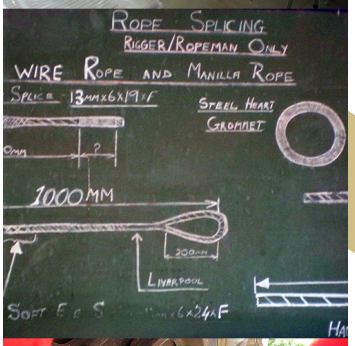
School



Theory

Practical

Workplace

Assessment

Expertise

Skills for and through SIPs

economic development
Economic Development Department
REPUBLIC OF SOUTH AFRICA

higher education & training
Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

SKILLS FOR AND THROUGH SIPS

What has been done and still needs to be done to Skill South Africans for SIPs and through SIPs

Pretoria

September 2014

This report outlines the processes that have been followed to identify the scarce skills for the SIPs and the steps that need to be taken if the projected scarcity is to be addressed. The views expressed are those of the Occupational Teams which the Minister of Higher Education and Training launched a year ago. The views expressed are therefore not necessarily those of the Minister or his Department although the expression of these views has been welcomed by both.

As a first step the Minister invites all who wish to comment on the recommendations made to do so, by sending comments to the portal https://sip-skills.onlinecf.net

The report is also a call to action. Chapter 14 identifies some of the ways in which this might be taken forward. All stakeholders are invited to engage with the recommendations made.

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CONTENTS

MESSAGE FROM MINISTER NZIMANDE

In 2012 our President, the Honourable Jacob Zuma, announced the commencement of our National Infrastructure Plan and at the time he stated that the massive investment in infrastructure must leave more than just power stations, rail lines, dams and roads. It must industrialise the country, generate skills and boost much needed job creation (9 February 2012). We have been working hard since then to ensure that skills are indeed generated both for the infrastructure projects as well as through them. This is a report of the work that has been done to date, and the work that still lies ahead. It is also a call to all stakeholders to assist us in this great task.

The work has of necessity progressed through a series of stages, the first of which was to establish what skills are needed for the infrastructure projects, known as the Strategic Integrated Projects or SIPs because of their interdependent nature. Of course we knew of the most urgent and initiatives in these areas began almost immediately, but to identify others, a more systematic research process was needed. We therefore established Occupational Teams, consisting of people who are deeply familiar with the occupations in question, drawn from professional bodies, trade associations and the like, to assist us to understand where the blockages are and what needs to be done if we are to meet the demand. They have recommended a wide range of interventions which need to be addressed if we are to ensure that we have the skills we need to roll out our infrastructure plans for the future.

The question now is what is to be done? The Sector Education and Training Authorities (SETAs) have been asked to help implement these recommendations and I salute them for committing nearly R1bn so far to this national endeavour. The universities and colleges are also being asked to address these recommendations, and I trust they will use the resources received from the state and other sources to do so. Certainly I invite them to take the advice in this report into account as they plan for 2015 and beyond. Some have already done so, and I commend them for doing so.

My department will also consider these recommendations when they enter into discussions on future plans – however I must not that not all will be able to be implemented as not all necessarily comply with our policy nor can be met by the resources available.

The preparation of this report has necessitated a great deal of collaborative working across government departments, between state-owned companies and with partners in the private sector. To all of these organisations, and to the individuals who have represented them, I would like to say thank you. Without your hard work the progress reflected in these pages would not have been possible.

And to those who are receiving this report – I invite you to celebrate with me the fact that we now have such an improved insight into the skills needed for our SIPs and such a better understanding of the work that must happen if we are to realise our President's injunction that the SIPs must leave more than physical infrastructure, they must also be a vehicle for skilling our nation. Of course the job is not yet done, but our sleeves are rolled up, the tools we need are to hand, and the first generation of skilling has begun. Let's all do what we can to accelerate the process.

Dr. BE Nzimande, MP

Minister of Higher Education and Training

2 September 2014

MESSAGE FROM MINISTER PATEL

Building infrastructure is central to South Africa realising inclusive economic growth and social development. Through the building of new energy facilities, piped water systems, broadband capability, roads, railway lines, houses, health centres as well as schools, colleges and universities not only will many new jobs be created but the foundation will be laid for further inclusive growth in future. After all, individuals, households, communities, businesses and government all need this infrastructure to be able to perform better and to enjoy the benefits that this will bring. The experience of successful industrialising economies elsewhere in the world has shown the importance of modern infrastructure. We are applying those insights to our Plan.

Central to the success of our plan is skills development as this is a vital element of creating a more productive and equitable society. This is recognised in the National Infrastructure Plan, the objects of which are set out in the recently gazetted Infrastructure Development Act (Act No. 23 of 2014). The Act states that we must promote *'practices and procedures which seek to ensure that infrastructure development is not undertaken merely in a transactional manner, but in a manner which seeks to advance national development goals, including local industrialisation,* ***skills development****, job creation, youth employment, small business and cooperatives development, broad-based economic empowerment and regional economic integration'.*
The Act also mandates the Presidential Infrastructure Coordinating Commission (PICC), the oversight body of the National Infrastructure Plan, to *'promote the creation of decent employment opportunities and* ***skills development, training and education****, especially for historically disadvantaged persons and communities, women and persons with disabilities, in so far as it relates to infrastructure and any strategic integrated project'.*

This report is an important contribution to this task, providing as it does the first comprehensive set of pointers to the specific occupational skills we need for the initial phase of implementation of our Plan and the tasks we must undertake to develop them.

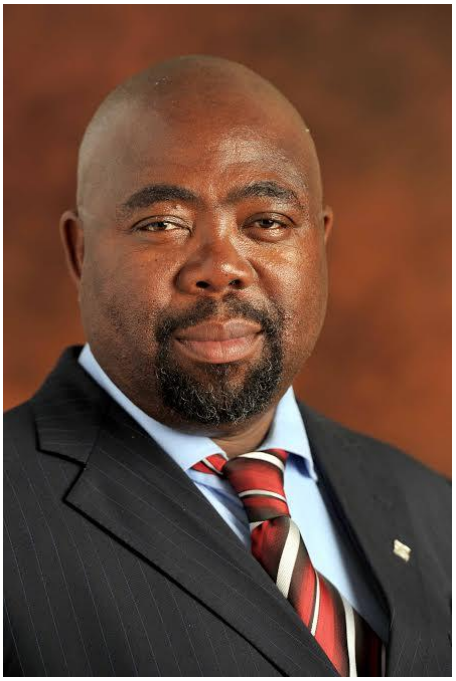
Without such signals our efforts could easily be poorly directed and wasteful. That this report is also the product of a way of working that the National Infrastructure Plan set out to advance, namely collaboration between many different government departments and agencies as well as between government and its social partners, makes it particularly valuable.

On behalf of the PICC Secretariat, I am delighted to acknowledge receipt of this report and wish to thank Minister Nzimande and all those who have contributed towards its completion. I will table the report to the PICC as an important milestone towards achieving the skills objective of the National Infrastructure Plan and invite all with the resources to do so, to partner us to take the work forward. Our country's future depends on it.

Mr. Ebrahim Patel
Minister of Economic Development
Chairperson: PICC Secretariat

MESSAGES TO THE MINISTERS

MINISTER OF PUBLIC WORKS, T. W. NXESI



A special thank you to Minister Nxesi and his Department for the strong support provided to this work, particularly through his agencies the Construction Industry Development Board (cidb) and the Council for the Built Environment that have each acted as Intermediate Bodies, the former for Elementary and Non-Trade Production Workers as reported in Chapter 9 and the latter for Professionals and Associate Professionals reported in Chapter 5. Thank you too for the leadership that Minister Nxesi has shown with regard to the cidb Standard for Developing Skills through Infrastructure Contracts outlined in Chapter 11 of this Report and provided in full in the appended CD. This is the primary vehicle for meeting the vision of 'Skilling South Africans through SIPs' and is strongly welcomed.

MINISTER OF PUBLIC SERVICE AND ADMINISTRATION, COLLINS CHABANE

A special thank you to Minister Chabane and his Department for the strong support provided to this work, particularly through the work of officials in his Department who acted as the Intermediate Body for the Manager Cluster of occupations outlined in Chapter 10 of this report.

Whilst it is acknowledged that this is but a small part of the work that Minister Chabane is leading to build a capable state, it is an important contribution towards building a state that is professionally equipped to lead and manage the SIP projects.

The focus and attention that has given is greatly appreciated.

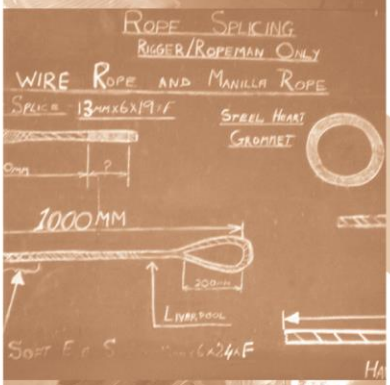
ACRONYMS

AA	Affirmative Action
AAB	Access Assessment Battery
ABET	Adult Basic Education and Training
ADRS	Applied Development Research Solution
AEF	Africa Engineers Forum
ANC	African National Congress
APP	Annual Performance Plan
APS	Admission Point Score
AQP	Assessment Quality Partner
ASIDI	Accelerated School Infrastructure Delivery Initiative
ASM	Assignment Square Metres
BBBEE	Broad-Based Black Economic Empowerment
BCEA	Basic Conditions of Employment Act
BE	Built Environment
BEP	Built Environment Professional
CAD	Computer Aided Draughting
CBE	Council for the Built Environment
CEO	Chief Executive Officer
CEP	Community of Expert Practitioners
CESM	Classification of Education Subject Matter
CETA	Construction Education and Training Authority
CHE	Council on Higher Education
CHS	Construction Health & Safety
CHSA	Construction Health & Safety Agent
CHSM	Construction Health & Safety Manager
CHSO	Construction Health & Safety Officer
CIDB	Construction Industry Development Board
CPD	Continuing Professional Development
CPM	Construction Project Manager
CSIR	Council for Scientific and Industrial Research
CTP	Committee Of Technikon Principals
DBE	Department of Basic Education
DBSA	Development Bank of Southern Africa Limited
DEA	Department of Environmental Affairs
DHET	Department of Higher Education and Training
DoD	Department of Defence
DoL	Department of Labour
DPE	Department of Public Enterprises
DPSA	Department of Public Services & Administration
DQP	Development Quality Partner
DST	Department of Science and Technology
DTI	Department of Trade and Industry
DUT	Durban University of Technology
ECSA	Engineering Council of South Africa
EDD	Economic Development Department
EPWP	Expanded Public Works Programme
Eskom	Electricity Supply Commission
ESSA	Employment Services of South Africa
EU	European Union
FET	Further Education and Training
FP&M	Fibre Processing and Manufacturing
FTE	Full Time Equivalent
GDP	Gross Domestic Product
GIS	Geographic Information Society of South Africa
GISSA	Geographic Information System
GNSS	Global Navigation Satellite System
GTPP	General Trade Preparation Programme
HEIs	Higher Education Institutions
HEQC	Higher Education Quality Committee
HEQF	Higher Education Qualifications Framework
HESA	Higher Education South Africa
HIV/Aids	Human Immunodeficiency Virus / Acquired Immunodeficiency Syndrome
HR	Human Resources
HRD	Human Resources Development
HRDC	Human Resource Development Council
HSRC	Human Sciences Research Council
ICT	Information and Communication Technology
ILO	International Labour Organisation

IMESA	The Institute of Municipal Engineering of Southern Africa
INDLELA	Institute for the National Development of Learnerships Employment Skills and Labour Assessment
ISCO	International Standard Classification of Occupations
JIPSA	Joint Initiative for Priority Skills Acquisition
KPI	Key Performance Indicator
KZN	KwaZulu-Natal
LED	Local Economic Development
LM-EM	Linked Macro-Educated Model.
LMIP	Labour Market Intelligence Project
LOSC	Labour Only Sub-contractors
MBSA	Master Builders South Africa
MIG	Municipal Infrastructure Grant
MTSF	Medium-Term Strategic Framework
NADSC	National Artisan Development Support Centre
NAMB	National Artisan Moderation Body
NBT	Nature Benchmark Test
NC(V)	National Certificate (Vocational)
NCAP	National Career Advice Portal
ND	National Diploma
NDP	National Development Plan
NEDLAC	National Economic Development and Labour Council
NEET	Not in Employment, Education or Training
NGO	Non-Governmental Organisation
NGP	New Growth Path
NHI	National Health Insurance
NIP	National Infrastructure Plan
NLRD	National Learners' Records Database
NQF	National Qualifications Framework
NSA	National Skills Authority
NSC	National Senior Certificate
NSDS III	National Skills Development Strategy 2011 - 2016
NSF	National Skills Fund
NSFAS	National Student Financial Aid Scheme
NYDA	National Youth Development Agency
OBE	Outcomes Based Education
OECD	Organisation for Economic Cooperation and Development
OFO	Organising Framework for Occupations
OSD	Occupation Specific Dispensation
OT	Occupational Team
PDI	Previously Disadvantaged Individual
PEDs	Provincial Education Department
PFMA	Public Finance Management Act
PICC	Presidential Infrastructure Coordinating Committee
PIVOTAL	Professional, Vocational, Technical and Academic Learning
PLATO	South African council for Professional & Technical Surveyours
POPS	Points of Presence
PPP	Public- Private Partnership
PR	Public Relations
PRASA	Passenger Rail Agency of South Africa
QCTO	Quality Council for Trades and Occupations
QLFS	Quarterly Labour Force Survey
QS	Quantity Surveyor
R & D	Research and Development
RPL	Recognition of Prior Learning
SACAP	South African Council for the Architectural Profession
SACE	South African Council of Educators
SACNSP	South African Council for Natural Scientific Professions
SACPCMP	South African Council for Project and Construction Management Professionals
SACPLAN	South African Council for Planners
SACPO	South African College Principals' Organisation
SACQSP	South African Council for the Quantity Surveying Profession
SADC	Southern African Development Community
SAFCEC	South African Federation of Civil Engineering Contractors
SAGDA	South African Graduates Development Association
SAGI	South African Geomatics Institute
SAICE	South African Institution of Civil Engineering
SAID	South African Institute of Draughting
SALGA	South African Local Government Association
SANBI	South African National Biodiversity Institute
SANRAL	South African National Roads Agency Limited

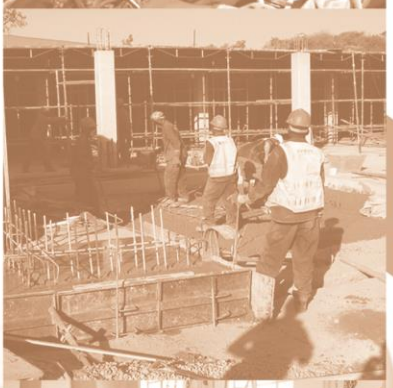
SAQA	South African Qualifications Authority
SATN	South African Technology Network
SDA	Skills Development Act
SET	Science, Engineering and Technology
SETA	Sector Education and Training Authority
SIPS	Strategic Infrastructure Projects
SKA	Square Kilometre Array
SMMEs	Small, Medium and Micro Enterprises
SOC	State-Owned Company
SOE	State- Owned Enterprise
SPLUMA	Spatial Planning and Land Use Management Act
SPU	Special Project Unit
SSETA	Services Sector Education and Training Authority
SSP	Sector Skills Plan
SSACI	Swiss-South African Cooperation on College Improvement
TETA	Transport Education and Training Authority
TTT	Technical Task Team
TUT	Tshwane University of Technology
TVET	Technical and Vocational Education and Training
UCT	University of Cape Town
UIF	Unemployment Insurance Fund
UJ	University of Johannesburg
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNISA	University of South Africa
UoT	University of Technology
UP	University of Pretoria
USA	United States of America
VA	Voluntary Associations
WBE	Workplace-Based Experience
WBEF	Workplace-Based Experience Framework
WIL	Work- Integrated Learning
WITS	University of the Witwatersrand
WP	White Paper for Post-School Education and Training: Building an Expanded, Effective and Integrated Post-School System
WSP	Workplace Skills Plan
www	World Wide Web

School



Theory

Practical



Workplace

Assessment

Expertise

SECTION 1: INTRODUCTION

Contents	Section 1 I
Executive Summary	
Chapter 1	The National Development Plan and the New Growth Path
	The National Infrastructure Plan
	The Strategic Integrated Projects (SIPs)
	The SIP Skills Plan
	Occupation: Language of the SIP Skills Plan
	The Organising Framework for Occupations
	This Purpose of this Report

Executive Summary

In 2012 when President Jacob Zuma announced the commencement of the National Infrastructure Plan in his State of the Nation Address, he stated that 'the massive investment in infrastructure must leave more than just power stations, rail lines, dams and roads. It must industrialise the country, generate skills and boost much needed job creation.' (9 February 2012).

The National Infrastructure Plan is made up of eighteen Strategic Integrated Projects (SIPs) each of which consists of a large number of projects drawn from a wide range of economic sectors and stretching across all nine provinces of the country. These projects are outlined in the first chapter of this report.

Minister Nzimande, Minister of Higher Education and Training, was given the task of ensuring that the skills demands of these projects were realised both in advance of (for), and on the site of (through), the Strategic Integrated Projects (SIPs). This report is the first public account of the work that has been done to date and that which still lies ahead. It is essentially a report to the Minister from its authors (outlined at the end of this executive summary) and it should therefore not be interpreted as consisting of policies or plans which the Minister has considered or endorsed. It is being publicly released at the Minister's request so that its messages can be considered and, where appropriate, used to support the work required for successful implementation of the SIPs.

The report has a number of purposes which are detailed in the Introduction and Overview Chapter they can be summarised as follows:

- To inform education and training planners of the occupations in demand for the SIPs
- To invite researchers and key partners to assist in improving the methodology that has been used to derive this list, so that it can be increasingly useful over time
- To direct the attention of education and training planners to specific interventions required to attend to projected scarcities in future, so that they can begin to attend to them now
- To encourage all those with the resources and expertise to support the interventions identified
- To report to South Africans about the work that has already been done and still needs to be done to gain the optimal benefits of the new infrastructure investment of government in terms of generating South African jobs and developing South African skills.

It needs to be emphasised that this report does not claim to be the final word on **Skills for and through SIPs**. It represents an important milestone on the journey of better understanding from a skills development perspective as to how to respond to major initiatives of the South African government in its role as a developmental state.

INTRODUCTION AND OVERVIEW

After giving an overview of the SIPs, the introductory section of this report, the vision, core principle and five focal areas of the SIP Skills Plan that have guided the team who have prepared this report. These are:

- **Vision** – Skilling South Africans for and through SIPs
- **Core Principle** – Skilling people is as critical as building physical assets
- **Focus One** – Identifying the skills in demand
- **Focus Two** – Addressing the skills in demand
- **Focus Three** - Building the capacity of the education and training institutions
- **Focus Four** – Ensuring access and equity

- **Focus Five** – Into the future

Following this outline, the introductory chapter explores the fundamental concept of occupation as used in this report.

It observes that occupation is the language used in the labour market – employers speak of the difficulty they experience when recruiting certain specific engineers or artisans i.e. certain occupational categories. Occupation is also a badge of identify for people looking for work (I am an electrician; I am an electrical engineer), suggesting that a competency is held which can be applied in a range of related contexts.

The chapter goes on to note that occupation is also useful for skills planning as it obviates the need for a one-to-one correspondence between the person trained and a project with a specific skills need. A person who is a qualified plumber, land surveyor or concreter can respond to any advertisement with that requirement; and an employer needing someone with these skills does not need to wait for a particular individual to complete their learning programme – they can recruit from the pool already available. The aim has therefore been to increase the pool of those with the requisite skills on the South African labour market – rather than seeking to map an individual to a job vacancy.

Given the centrality of the idea of occupation the chapter explains that a formal occupational language has been adopted, that of the Organising Framework for Occupations (the OFO), which is then explained.

However, the chapter goes on to note that education and training providers have their own language, that of qualifications which does not speak to the language of occupation in a linear fashion. Without a translation between the two languages, however, it is not possible to inform the supply-siders of messages from the demand-side. So the notion of a learning pathway was created to bridge the two – commencing with the underpinning knowledge or theory required, followed by simulated practice of some of the critical skills and procedures, followed by supervised practice in a real workplace and culminating in a formal assessment which might result in a professional designation, a trade certificate, a licence to practice or some other recognition that the practitioner is now competent to practice without supervision – with the qualification of providers being equivalent to the first one or two steps of this pathway. If there is a brand for this report, it is that of the learning pathway as depicted on the cover.

Having established these two fundamental building blocks (of occupation and learning pathway) the Report proceeds with its work:

SECTION TWO: METHODOLOGY

Section Two addresses the methodologies used, firstly to identify those occupations in short supply for the SIPs and secondly, to unpack the steps that should be taken to address this challenge. The section has three chapters:

- **Chapter Two** – Sets out the methodology that was used to determine the skills required for the different SIP projects and then to identify which of these positions are hard to fill from the experience of those responsible for project managing them.

  The methodology essentially consists of developing what are called skills prototypes for typical projects in each of the different sub-sectors and then using these prototypes to estimate the skill requirements of similar projects by scaling the prototype up or down. In this way an

estimation of the total skills required for all projects was developed.

Experienced technical project managers, responsible for the oversight of SIP projects, were approached to check the prototypes and the scaling factor used and to indicate, based on their own experience, which of these are hard to fill. Using these responses, a scarce skills list was produced – which is given at the end of the chapter.

- **Chapter Three** – Sets out to answer the question: how many people are currently employed in these occupational categories, how many are entering these categories from the universities or colleges and how many are likely to retire in the near future. The work of Dr. Asghar Adelzadeh (2014), using his Linked Macro-Education Model (LM-EM) of South Africa[1], is drawn on here together with input from the DHET and the South African Qualifications Authority (SAQA). These estimations are then used to calculate the probable scale of the shortfall of the skills identified. While undertaking this work, serious challenges in the quality of the data were encountered and the estimates are therefore approximations at best.
- **Chapter Four** – Explains Occupational Teams. These are the teams that were asked to advise the Minister on what should be done to address the gaps identified. The teams consist of people with expertise in the occupation itself and who care about it. They are broadly drawn from four constituencies: those who are familiar with the employment contexts in which qualified people must work (the employers); those engaged in providing the theoretical and practical foundation at a college or university (the lecturers); those who run practical training facilities where different from the previous category and finally those who hold the standard for the occupation (the assessors).

The Minister of Higher Education and Training first launched this idea on 6 August 2013 and the teams themselves were established at the end of September 2013. They provided first draft reports in 2013 and the reports contained in this compendium have been revised and improved.

SECTION THREE: OCCUPATIONAL TEAM REPORTS

Section Three is the substance of this Report. It contains six chapters – one on each of the major occupational clusters that were identified as scarce in the above section.

Each chapter begins with a broad analysis of the common problems that apply generally across the cluster, and then provides detail on each of the occupations individually. The problems differ per occupational cluster – although a common theme is the challenge to address throughput problems. The cost of carrying large numbers of drop-outs and failures is a serious drain on our scarce national resources.

In the individual occupational reports information is provided on the sectors in which the occupation is found and, where data permits, on the scale of the scarcity for that individual occupation. Each chapter includes a set of recommendations on what should be done to remedy the shortage – drawing on the learning pathway itself and an analysis of where the primary blockages fall.

- **Chapter Five** – Focuses on the professionals and the associate professional occupations
- **Chapter Six** – Focuses on service and clerical workers
- **Chapter Seven** – Focuses on the trades
- **Chapter Eight** – Focuses on Plant and Machine Operators
- **Chapter Nine** – Focuses on Elementary and Non-Trade Production Workers and
- **Chapter Ten** – Focuses on Managers.

These chapters contain recommendations to the Minister and his Department on what should be done to address the scarcity identified and should not be interpreted as policy or as having been endorsed by him.

SECTION FOUR: PLANNING AND RESOURCING

Section Four looks at the ways in which the above recommendations might be tackled.

- **Chapter Eleven** – Focuses exclusively on the Training Standard which the cidb has developed, together with input from the Departments of Higher Education and Training and the Economic Development Department, to require contractors engaged on infrastructure projects to train. In other words this Chapter focuses on **Skills through SIPs**. The Standard itself is briefly outlined and progress given.
- **Chapter Twelve** – Focuses more on **Skills for SIPs**. It looks at the planning and resourcing cycles of the universities, colleges and Sector Education and Training Authorities (SETAs) and how these can be tuned to promote skills development for the SIPs. Proposals are made on how this demand side signalling can be strengthened in the future. Potential sources of funds are also given.

Also outlined in Chapter Twelve is the progress that has already been made in this regard with the SETAs. It is reported that SETAs have already committed nearly R800 million to address the proposals of the Occupational Teams.

SECTION FIVE: EMPLOYMENT AND CAREER DEVELOPMENT SERVICES

Section Five looks at systems in place to support learners and jobseekers. It details career development initiatives that the Department of Higher Education and Training (DHET) has initiated in general and how these might be used to convey information pertaining to the SIPs to learners.

This chapter also highlights the work of the Department of Labour with regard to its Employment Services South Africa (ESSA) which seeks to match work seekers and employers. A strong recommendation emerging from this chapter is that all SIPs should register projects on the ESSA system so that there is a clear communication channel which communities can access to find out about the SIP-related opportunities. Stories of pioneering work already done are recounted in this chapter too.

SECTION SIX LOOK AHEAD: GOING FORWARD

Section Six ends the report with a call to all stakeholders to consider how best they might respond to the call made by the Occupational Teams.

SKILLS PORTAL

Developing a national SIP Skills Community for developing occupations in demand requires collaboration between individuals, groups and organisations. For this reason a collaboration portal was developed to enable the skills community to communicate effectively and efficiently. This portal offers access to documents, statistics and reports to plan and manage the development of occupations.

This portal is available for all in the community and will allow them to view the latest reports collated through the portal and approved by various SIPs skills structures.

The URL for the portal is https://sip-skills.onlinecf.net.

RESOURCES

This report has a Compact Disc (CD) attached to it which contains further resource material for planners, including:

- Financial commitments made by SETAs to the SIPs for 2014/15 and 2015/16

- A list of contact people at SETAs who can be approached to assist with accessing these resources
- A copy of the cidb Training Standard
- A copy of a report prepared for this Report entitled: **Estimating the underlying characteristics of South Africa's critical/scarce occupations: A proof-of-concept study**, prepared by Alexander Gloss and Lori Foster Thompson, IOTech4D Lab, North Carolina State University, 4 August, 2014.

THE CONTRIBUTORS

The report has been coordinated by the Special Projects Unit (SPU) of the Department of Higher Education and Training (DHET). The SPU has been assisted in this challenging task by a wide range of partners drawn from other government departments (in particular the Economic Development Department, the Department of Public Service and Administration, as well as two agencies that fall under the Department of Public Works – the Council for the Built Environment and the Construction Industry Development Board).

Information about the planned SIP projects was provided to the team by the Presidential Infrastructure Coordinating Committee (PICC) Technical Task Team housed in the Economic Development Department on a confidential basis and a wide range of technical specialists drawn from those responsible for the oversight of the projects helped the team to identify the skill required.

Once the priority skills in demand were identified and a scarce skills list was drawn, the Minister of Higher Education and Training again led the process by establishing, on 6 August 2013, the concept of Occupational Teams. These teams, described in detail in Chapter Four of this report, are the principal authors of the chapters in Section Three. They are people who are recognised within their communities of practice as having special occupational expertise. They have generously contributed to the advice contained in these pages. They are gratefully acknowledged in the Annexure to this report.

A second group of people, collectively called Intermediate Bodies, helped to identify and convene the people in the Occupational Teams (OTs) and manage the process per occupational cluster.

In conclusion, the purposes of this report need again to be highlighted, particularly those which invite planners and those with resources and expertise to engage with this report and to actively contribute to finding ways to support Skilling of South Africans for and through SIPs in the interests of the SIPs, in the interests of individuals and their communities and for the development and success of our nation.

CHAPTER 1

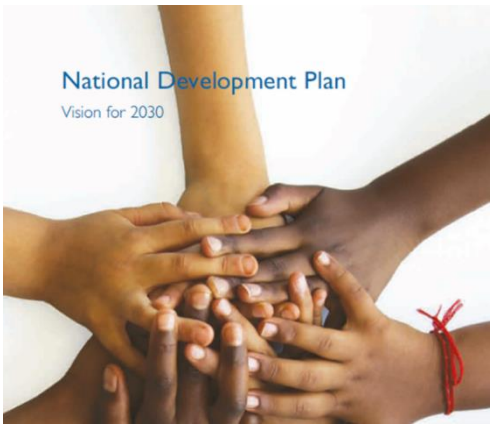
National Development Plan and the New Growth Path

THE PURPOSE OF THIS REPORT

The South African government has adopted the National Development Plan (NDP) as its framework for addressing the three key ills in the country – high unemployment, high inequality and high levels of poverty. The New Growth Path (NGP) sets out how the goals set out in the NDP are to be achieved in practice. As is evident from the brief summaries below, infrastructure is central to the achievement of these goals.

NATIONAL DEVELOPMENT PLAN

The National Development Plan (NDP) was developed by the National Planning Commission and adopted by government on 11 November 2011 as a means to create jobs and reduce poverty and inequality by 2030. It identifies the roles and responsibilities that must be played by different actors if the desired goals are to be achieved.



The overall targets of the plan are:

- By 2030, the number of households living below R418 a month per person (in 2009) should fall from 39% to zero.
- The level of inequality as measured by the Gini co-efficient should fall from 0.7 in 2009 to 0.6 in 2030.

The NDP document has 15 chapters namely:

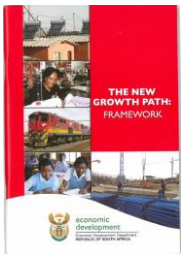
- **Chapter 1**: Key drivers of change
- **Chapter 2**: Demographic trends
- **Chapter 3**: Economy and employment
- **Chapter 4**: Economic infrastructure
- **Chapter 5**: Transitioning to a low-carbon economy
- **Chapter 6**: Inclusive rural economy
- **Chapter 7**: Positioning South Africa in the world
- **Chapter 8**: Human Settlement
- **Chapter 9**: Improving education, innovation and training
- **Chapter 10**: Promoting health
- **Chapter 11**: Social protection
- **Chapter 12**: Building safer communities
- **Chapter 13**: Building a capable state
- **Chapter 14**: Promoting accountability and fighting corruption
- **Chapter 15:** Transforming society and uniting the country

Chapter 4 discusses the status and backlogs of economic infrastructure in the country and presents actions that can be undertaken to address these. It emphasises capital investment in roads, rail, ports, electricity, water and sanitation, public transport and housing.

NEW GROWTH PATH

The New Growth Path was announced by government on 23 November 2010. It is intended to be the implementation arm of the

NDP. The NGP aims to increase the economic growth envisioned in the NDP to sustainable rates of between six and seven per cent per year in order to create five million jobs by 2020 which will reduce unemployment by 15%.



The NGP has 5 main job drivers that will aid in the implementation of the NDP. The job drivers are:

- Infrastructure
- Main economic sectors
- Seizing the potential of new economies
- Investing in social capital and public services
- Spatial development.

According to the NGP, public investment in infrastructure has the potential to create 250 000 jobs a year in energy, transport, water and sanitation, communications and housing by 2015.

NATIONAL INFRASTRUCTURE PLAN

Flowing from the above decisions, the government adopted a National Infrastructure Plan (NIP) in 2012 to transform our economic landscape while simultaneously creating significant numbers of new jobs, and to strengthen the delivery of basic services. The plan also supports the integration of African economies.

When launching the Plan in his State of the Nation Address on 9 February 2012 the President, the Honourable Mr Jacob Zuma, stated: 'As a developmental state that is located at the centre of a mixed economy, we see our role as being to lead and guide the economy and to intervene in the interest of the poor, given the history of our country.' He added 'The massive investment in infrastructure must leave more than just power stations, rail lines, dams and roads. It must industrialise the country, generate skills and boost much needed job creation'.

This report outlines the Skills Plan that was developed in 2012 to address the skills dimension of the National Infrastructure Plan. It provides an update on the progress achieved to date and outlines the next steps for its implementation. It concludes with a set of recommended measures that must be taken in support of this Plan.

STRATEGIC INTEGRATED PROJECTS (SIPS)

South Africa's National Infrastructure Plan is an integral part of its National Development Plan and its New Growth Path. It is intended to lay the foundation for job creation and poverty eradication by addressing infrastructure backlogs and exploiting economic growth opportunities.

The steps that were followed in its development, in terms of its central components are summarised in a publication prepared by the Presidential Infrastructure Coordinating Commission (PICC) which is readily available on the website http://www.economic.gov.za/communications/presidential-infrastructure-coordinating-commission.

The National Infrastructure Plan consists of eighteen Strategic Integrated Projects (SIPs), each of which is essentially a portfolio of projects integrated through a common purpose. A summary of each of the eighteen SIPs is provided on the following pages.

SIP 1: UNLOCKING THE NORTHERN MINERAL BELT WITH WATERBERG AS THE CATALYST

Investment in rail, water pipelines and energy generation and transmission infrastructure will catalyse unlocking of rich mineral resources in Limpopo resulting in thousands of direct jobs across the areas covered. Urban development in the Waterberg will be the first major post-apartheid new urban centre and will be a green development project.

Mining includes coal, platinum and other minerals for local use and export, hence rail capacity is being extended to Mpumalanga and for export via Richards Bay and in future Maputo (via the Swaziland link).

The additional rail capacity will transport coal from road to rail in Mpumalanga with positive environmental and social benefits. Supportive logistics corridors will help to strengthen Mpumalanga's economic development.

SIP 2: DURBAN – FREE STATE – GAUTENG LOGISTICS AND INDUSTRIAL CORRIDOR

Strengthen the logistics and transport corridor between South Africa's main industrial hubs; improve access to Durban's export and import facilities, raise efficiency along the corridor and integrate the Free State Industrial Strategy activities into the corridor and integrate the currently disconnected industrial and logistics activities as well as marginalised rural production centres surrounding the corridor that are currently isolated from the main logistics system.

SIP 3: SOUTH EASTERN NODE AND CORRIDOR DEVELOPMENT

Promote rural development through a new dam at Umzimvubu with irrigation systems and the N2 Wildcoast Highway which improves access into KZN and national supply chains; strengthen economic development in Port Elizabeth (PE) through a manganese rail capacity from Northen Cape (N. Cape), a manganese sinter (NC) and smelter (EC); possible Mthombo refinery (Coega) and transhipment hub at Ngqura and port and rail upgrades to improve industrial capacity and the performance of the automotive sector.

SIP 4: UNLOCKING THE ECONOMIC OPPORTUNITIES IN NORTH WEST PROVINCE

The acceleration of identified investments in roads, rail, bulk water and water treatment and transmission infrastructure will result in reliable supply, meet basic social needs and facilitate the further development of mining, agricultural activities and tourism opportunities and open up beneficiation opportunities in the North West Province.

SIP 5: SALDANHA – NORTHERN CAPE DEVELOPMENT CORRIDOR

Develop the Saldanha – Northern Cape linked region in an integrated manner through rail and port expansion, back-of-port industrial capacity (which may include an IDZ) and strengthening maritime support capacity to create economic opportunities from the gas and oil activities along the African West Coast. For the Northern Cape, expansion of iron ore mining production.

SIP 6: INTEGRATED MUNICIPAL INFRASTRUCTURE PROJECT

Develop a national capacity to assist the 23 least resourced districts (17 million people) to address all the maintenance backlogs and upgrades required in water, electricity and sanitation bulk infrastructure. The road maintenance programme will enhance the service delivery capacity and so impact positively on the population.

SIP 7: INTEGRATED URBAN SPACE AND PUBLIC TRANSPORT PROGRAMME

Coordinate planning and implementation of public transport, human settlement, economic and social infrastructure and location decisions into sustainable urban settlements connected by densified transport corridors.

SIP 8: GREEN ENERGY IN SUPPORT OF THE SOUTH AFRICAN ECONOMY

Support sustainable green energy initiatives on a national scale through a diverse range of clean energy options as envisaged in the IPR2010 and to support biofuel production facilities.

SIP 9: ELECTRICITY GENERATION TO SUPPORT SOCIO-ECONOMIC DEVELOPMENT

Accelerate the construction of new electricity generation capacity in accordance with the IRP2010 to meet the needs of the economy and address historical imbalances.

SIP 10: ELECTRICITY TRANSMISSION AND DISTRIBUTION FOR ALL

Expand the transmission and distribution network to address historical imbalances, provide access to electricity for all and support economic development.

Align the 10-year transmission plan, the services backlog, the national broadband roll-out and the freight rail line development to leverage off regulatory approvals, supply chain and project development capacity

SIP 11: AGRI-LOGISTICS AND RURAL INFRASTRUCTURE

Improve investment in agricultural and rural infrastructure that supports expansion of production and employment, small-scale farming and rural development, including facilities for storage (silos, fresh-produce facilities, packing houses); transport links to main networks (rural roads, branch train-line, ports), fencing of farms, irrigation schemes to poor areas, improved R&D on rural issues (including expansion of agricultural colleges), processing facilities (abattoirs, dairy infrastructure), aquaculture incubation schemes and rural tourism infrastructure.

SIP 12: REVITALISATION OF PUBLIC HOSPITALS AND OTHER HEALTH FACILITIES

Build and refurbish hospitals, other public health facilities and revamp 122 nursing colleges. Extensive capital expenditure to prepare the public health care system to meet the further requirements of National Health Insurance (NHI).

SIP 13: NATIONAL SCHOOL BUILD PROGRAMME

A national school build programme driven by uniformity in planning, procurement, contract management and provision of basic services. Replace inappropriate school structures and address basic service backlog and provision of basic services under the Accelerated School Infrastructure Delivery Initiative (ASIDI). In addition, address national backlogs in classrooms, libraries, computer laboratories and administration buildings. Improving the learning environment will go a long way in improving outcomes especially in the rural schools and also reduce overcrowding.

SIP 14: HIGHER EDUCATION INFRASTRUCTURE

Infrastructure development for higher education focusing on lecture rooms, student accommodation, libraries and laboratories as well as ICT connectivity. Development of university towns with a combination of facilities from residence, retail recreation and transport. Potential to ensure shared infrastructure such as libraries by universities, colleges and other educational institutions.

SIP 15: EXPANDING ACCESS TO COMMUNICATION TECHNOLOGY

Provide for 100% broadband coverage to all households by 2020 by establishing core Points of Presence (POPs) in district municipalities, extend new Infraco fibre networks across provinces linking districts, establish POPs and fibre connectivity at local level, and further expand the network into deep rural areas.

While the private sector will invest in ICT infrastructure for urban and corporate networks, government will co-invest for township and rural access as well as for e-government, school and health connectivity.

The school rollout until focus initially on the 125 Dinaledii (science and math focused) schools and 1525 district schools. Part of digital access to all South Africans includes TV migration nationally from analogue to digital broadcasting.

SIP 16: SKA AND MEERKAT

SKA build the global mega-science project, to develop an advanced radio-telescope facility linked to research infrastructure and high speed ICT capacity and provide an opportunity for Africa and South Africa to contribute towards the advancement of science.

SIP 17: REGIONAL INTEGRATION FOR AFRICAN COOPERATION AND DEVELOPMENT

Investment in mutually-beneficial projects in the Free Trade Area, encompassing east, central and southern Africa. The countries will need projected growth ranging between 3% and 10%.

SIP 18: BULK WATER SUPPLY AND DISTRIBUTION

Addressing backlogs in water and sanitation; maintenance of water and sanitation infrastructure, which are near collapse in some municipalities; construction of sewerage plants

BACKGROUND OF CHALLENGES

This bold vision and these pioneering first steps do however need to be seen against a background of challenges which must be addressed going forward, some of which are summarised below:

- Available funds for education and training are not always spent timeously
- Too many young people are ill prepared for post-school learning
- SETA Sector Skills Plans have historically not permitted occupation- and specialisation-level planning, and although this is changing now the process needs to be accelerated
- Quarterly Labour Force Survey data is misleading as occupations are not defined with the correct qualification level, resulting in people with lower than required qualifications being counted as being fully qualified and thereby skewing the numbers for planning purposes
- No specific Standard Industrial Classification code exists for environmental sector.

Industry concerns and Government responses

Industry has expressed general concerns about the SIPs, such as:

- Acquiring land timeously
- Raising appropriate funds
- Handling environmental impact assessments timeously
- Ensuring electricity, water, ICT connections are facilitated timeously
- Developing project and product specifications which favour the use of local resources
- Ensuring that there are no delays in the awarding of tenders, and ensuring the projects do not need to go out to tender a second time due to delays and changes in scope
- Ensuring that payments are made timeously for milestones achieved on projects
- Preventing a change to the labour laws which would make students into employees, which will have the likely effect of discouraging employers to take on interns and students.

Government has acknowledged many of these problems and sought to address them with the passing of the Infrastructure Development Act, 2014 (Act No. 23 of 2014, GG. 37712, 2 June 2014). Its implementation is being overseen by the Presidential Infrastructure Coordinating Commission (PICC) – headed by the President himself, signifying the determination that they will be resolved.

Industry has also highlighted the importance of addressing skills constraints within the state:

- Capacitating the public sector with the requisite skills to plan, manage procurement and sign off of the projects
- Ensuring appropriately trained supply chain practitioners are in place and there is capacity to operate and maintain the assets once completed.

Here too the PICC has acknowledged the problem and adopted for national rollout the Infrastructure Delivery Management System – this work began over a decade ago but is now being accelerated. However, rather than tackling the skills problems in a piecemeal fashion, a broad framework has been developed which is outlined below

Figure 1: The SIPs Skills Plan

THE SIPS SKILLS PLAN

When the National Infrastructure Plan was launched, the Minister of Higher Education and Training was mandated to address its skills dimension, under the umbrella of the PICC. As a first step, he established the Special Projects Unit and they developed a plan to frame their work. The SIPs Skills Plan is illustrated in Figure 1.

VISION OF THE SIPS SKILLS PLAN

SKILLING SOUTH AFRICANS FOR SIPS AND THROUGH SIPS

Skilling South Africans for SIPs

From the onset it was envisaged that there would be a shortage of certain critical skills for the implementation of the National Infrastructure Plan's Strategic Integrated Projects (SIPs). Addressing this shortage is a key objective of the SIPs Skills Plan, and requires training in advance of the projects to ensure that skills are available when needed.

Skilling South Africans through SIPs

It was also seen that the projects themselves would provide an ideal opportunity for workplace learning for thousands of citizens. This was therefore set as a complementary goal. (This is given special focus in Chapter Eleven).

CORE PRINCIPLE

BUILDING PEOPLE'S SKILLS IS AS CRITICAL AS BUILDING PHYSICAL ASSETS

This principle has infused the work of the PICC that could be taken for granted however as the imperative to deliver quickly and efficiently has sometimes meant that training has been under pressure.

TIMEFRAMES: SHORT, MEDIUM AND LONGER TERM STRATEGIES

The interventions in support of the SIPs Skills Plan have been planned with the short, medium and longer term needs of the National Infrastructure Plan in mind. All of the following five focus areas are envisaged to embrace interventions which span all three of these time frames:

- **Short term** – From the time when interventions began in late 2012/early 2013 to 2014
- **Medium term** – From the beginning to 2017
- **Longer term** – From the beginning to 2030 (the delivery time for the National Development Plan)

These timeframes are however not fixed, as with the passing of time what was medium term becomes short term and what was long term becomes medium term. What is shown here is how the timeframes were seen when the work began.

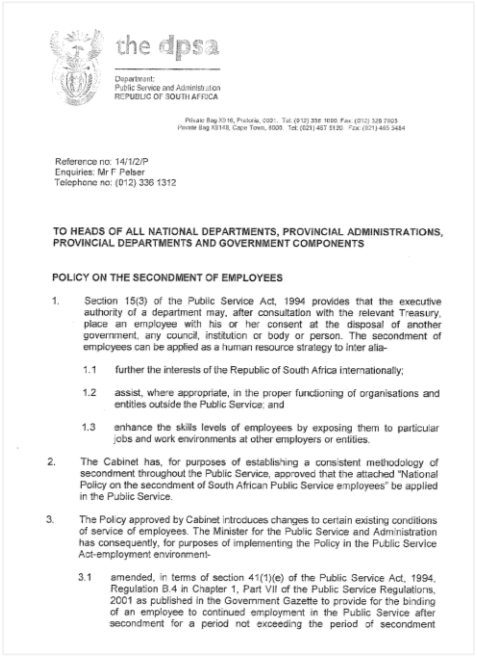
FOCUS ONE: INFORMATION (DEMAND, SUPPLY AND GAP)

Establishing what skills would be in short supply for the roll-out of the National Infrastructure Plan was a key priority. It proved to be challenging however as it soon became apparent that skills for the SIPs could not be seen in isolation from the broader demand for skills in the society at large – as there was no guarantee that a person trained for a SIP project would not be attracted to work in the public or private sector somewhere else locally or internationally. The challenge did not stop there. Working out the nature and extent of the scarcity was also difficult given the current state of labour market information in the country. A full description of how these challenges were tackled is outlined in the Methodology Chapter that follows this introduction.

In the time period covered by this report, however, two scarce skill lists were developed and circulated, the first in May 2013 and the second in October 2013. The list as update in July 2014 is to be found in Table 4 in Chapter 2.

FOCUS TWO: MEETING THE DEMAND

Having identified the skills in demand for the SIPs, the obvious question is: 'What is to be done?'



the dpsa

Department:
Public Service and Administration
REPUBLIC OF SOUTH AFRICA

Reference no: 14/1/2/P
Enquiries: Mr F Pelser
Telephone no: (012) 336 1312

TO HEADS OF ALL NATIONAL DEPARTMENTS, PROVINCIAL ADMINISTRATIONS, PROVINCIAL DEPARTMENTS AND GOVERNMENT COMPONENTS

POLICY ON THE SECONDMENT OF EMPLOYEES

1. Section 15(3) of the Public Service Act, 1994 provides that the executive authority of a department may, after consultation with the relevant Treasury, place an employee with his or her consent at the disposal of another government, any council, institution or body or person. The secondment of employees can be applied as a human resource strategy to inter alia-
   - 1.1 further the interests of the Republic of South Africa internationally;
   - 1.2 assist, where appropriate, in the proper functioning of organisations and entities outside the Public Service; and
   - 1.3 enhance the skills levels of employees by exposing them to particular jobs and work environments at other employers or entities.
2. The Cabinet has, for purposes of establishing a consistent methodology of secondment throughout the Public Service, approved that the attached "National Policy on the secondment of South African Public Service employees" be applied in the Public Service.
3. The Policy approved by Cabinet introduces changes to certain existing conditions of service of employees. The Minister for the Public Service and Administration has consequently, for purposes of implementing the Policy in the Public Service Act-employment environment-
   - 3.1 amended, in terms of section 41(1)(e) of the Public Service Act, 1994, Regulation B.4 in Chapter 1, Part VII of the Public Service Regulations, 2001 as published in the Government Gazette to provide for the binding of an employee to continued employment in the Public Service after secondment for a period not exceeding the period of secondment

In the **immediate to short term**, education and training is not a practical response, so three strategies have been put into place, as listed below. These are detailed in the Methodology section of this report:

- **Firstly** – where there are unemployed people (or retired people) with the requisite skills available, make recruitment as straightforward as possible
- **Secondly** – where one state agency has capacity and another does not, facilitate the transfer of skills from one to the other where necessary

- **Thirdly** – where the required skills are not available in South Africa, facilitate the immigration of people with the requisite skills without delays

In the **medium to longer term**, education and training is an appropriate response.

In general what has been developed is an understanding of the pathway that new entrants must follow in order to attain full competence – from school to a learning institution where theory is learnt, followed by or interspersed by time in a simulated workplace learning site where practical skills are acquired, followed by time in a workplace where the person moves from novice to competent worker under the mentorship of a qualified person. A point is reached where they can be formally assessed as being competent in their own right and capable of working independently – from which point they can proceed to enhance their expertise.

In the medium term, it is possible for those who have travelled part of the way to be assisted to complete the journey – such as, for example, university graduates who require the requisite workplace learning in order to attain professional registration or college graduates who need workplace learning to take their trade tests. In the medium term, those who have acquired skills informally can also be evaluated and assisted to become competent. In the longer term, the number of those who enter and successfully travel the full journey need to be increased. The methodology used to define and facilitate the needed interventions, with their financing, is given in the Methodology chapter.

FOCUS THREE: BUILDING EDUCATION AND TRAINING CAPACITY

In order to implement the strategies identified under Focus Two above, it is necessary to simultaneously address the education and training capacity of those who must induct others. In general, there is a so-called intervention menu from which to select, as follows:

- Ensure that the pathway from entry to competence (and on to expertise) is well defined and is clearly translated into appropriate qualifications and/or designations, and that these are supported by quality curricula and materials, adequate facilities and competent lecturers, and
- Ensure that the learners who travel along the learning pathway are optimally supported at each stage of the journey.

Putting in place measures to enable implementers to ensure these things also require committed attention. As is outlined in the Methodology section, Focus Three has been addressed concurrently with Focus Two. Together these two steps constitute the primary focus of this report.

In some areas dedicated training facilities have been built to meet the needs of the SIP projects in the areas.

FOCUS FOUR: ACCESS AND EQUITY AT THE LOCAL LEVEL

Central to the achievement of the local access is information. If people do not know of the employment and training opportunities in their area, they have no hope of their accessing them.

In order to make information available, the Department of Labour (DoL) has made its Employment Services South Africa (ESSA) services available for the SIPs. All SIP Coordinators have been informed about this service and have been encouraged to register job opportunities on the ESSA system. The DoL has committed itself to registering work seekers in these areas as a priority. It has also made available to the Special Projects Unit team information about the number of people registered on their database claiming to have the skills in demand for SIPs. This information has been incorporated into the information section outlined in the Methodology chapter.

Career guidance is another critical vehicle for expanding the number of learners entering needed occupations. Both employment and career development services are discussed in Chapter Thirteen.

FOCUS FIVE: FUTURE (LOOKING BEYOND THE BUILDING)

Looking ahead to a time when the infrastructure is built, it is necessary to anticipate the skills that will be needed in a range of downstream areas such as infrastructure maintenance. Even further downstream, the opportunity for local economic opportunities to expand using the outputs of the infrastructure needs also to be anticipated and promoted, and the necessary skills built, such as small business development occurring in the Saldanha area.

It is also critical to consider upstream opportunities that may emerge i.e. to prepare the skills required for those investment initiatives in the manufacturing sector where inputs required by and for the infrastructure could be locally manufactured. An excellent example is the contract issued to Alstom by the Passenger Rail Agency of South Africa (PRASA) to build new rail coaches – a contract worth over R51bn over ten years – with a manufacturing and training facility to be built in Ekurhuleni on the East Rand.

As Eskom has discovered to its cost, it is also necessary to consider what should be done when construction ends. In the case of Medupi Power Station some 17 000 workers' contracts will end when this power station comes on stream.

An initiative is also under way with the European Union's Social Dialogue Facility to explore what new skills might be needed to address the new jobs that will emerge with new technology and new form of work organisation.

OCCUPATION: LANGUAGE OF THE SIP SKILLS PLAN

In order to kick-start the development and implementation of the Skills Plan for SIPs it was necessary to address the terminology used in the plan.

For the reasons described below, it was decided to adopt the term **occupation**. Readers will see that this permeates through almost every chapter: occupations in demand; people with the identified occupational skills; learning pathways to attain occupational competence and so on.

OCCUPATIONS FROM THE PERSPECTIVE OF EMPLOYERS

All workplaces have their own job descriptions and job titles that flow from the nature of the work that is done. This is useful for them, but for planning at sectoral, provincial, national or international level if these titles were used it would be impossible to compare one workplace with another or to determine aggregate demand. To address this challenge, the International Labour Organisation developed the International Standard Classification of Occupations (ISCO). The DHET has adapted this classification system into one that is fully aligned to the ISCO but which enables the department to manage shifts and changes as needed. The DHET's system is called the Organising Framework for Occupations (OFO)[2]. This has required all project managers consulted to map their job descriptions to this standard language. This has sometimes been a challenge, as the map is not always obvious, nevertheless this mapping was done.

OCCUPATIONS FROM THE PERSPECTIVE OF LEARNERS

SIPs by their very nature, are large construction projects with a start, a middle and an end. Once built, the assets need to be operated and maintained. This normally requires far fewer people than those employed during the construction phase. This means that many will need to move on after the specific asset is built.

There are a number of issues that need to be considered: Training takes time – for example training an engineer can take ten years – will a person trained definitely work on a specific project when they qualify or might they choose to work elsewhere? And perhaps they will not have a choice as the employer may not wish to hire them. And even if they are employed, what will happen to those who are not employed once the construction phase is complete? Will there be another identical project for them to apply for? This is far from certain.

These issues led the Special Projects Unit to the conclusion that we must train for the labour market, so that learners can move from one project (or job in the public or private sectors more generally) to another with as much flexibility as possible. In other words, it meant that it would be better to train people with portable skills than train them for a specific job only. Occupation provides a type of mobility identity (an identity card) which people can carry when seeking employment anywhere. 'I am a qualified plumber', 'I am a designated professional chemical engineer'. These identity cards must be known, trusted and recognised by employers. This means recognised standards and recognised quality are critically important.

This does not mean that specialisation is not needed. Employment in one sector may require additional skills to those provided in a general foundational programme. For example, a plumber who installs solar water heaters may require some additional training and so would a plumber employed in local government where he or she will have to work on large water distribution systems. This does not detract from the need for a strong foundation, while also requiring additional specialist learning.

In order to ensure that Occupational Teams (see Chapter Four) address these issues of specialisation, a pie graph has been shown for most occupations to signal the range of sectors in which people may work when qualified. The only exception here is the

elementary and plant and machine operators who are primarily employed in the construction sector.

OCCUPATIONS FROM THE PERSPECTIVE OF EDUCATION AND TRAINING PROVIDERS

In general, education and training providers – universities and colleges – do not use the term of **occupation**. So the concept of **learning pathway** is used which begins with theory after school, which refers to the qualifications earned at universities or colleges, and is followed by workplace learning and finally occupational assessment. The mismatches relate to the following:

- The universities classify the programmes they offer using the Classification of Education Subject Matter (CESM) – which is essentially based on disciplines of knowledge
- The colleges have another system – which is captured under the areas of specialisation available under the National Certificate (Vocational) (NC(V)) and the different categories of NATED programmes (see Chapter Seven where these are described further).

The challenge is to map the qualifications offered under these headings to occupations. In some cases there is a one-on-one mapping and in others there is a many-to-one, a one-to-many and a many-to-many mapping.

The only practical solution to this problem has been to use the National Career Advice Portal (NCAP) which is described in Chapter Thirteen. The NCAP outlines the different learning pathways that lead to a single occupation. It is for this reason that the NCAP web address is appended to the description of each occupation in Part Three. The idea of a learning pathway is outlined in Chapter Four.

This does not detract from the necessity to use occupation as the key bridge from job to qualification – using the generic pathway shown here, it means that the theory and sometimes the practical component can be aligned to institutional qualifications and lay the foundation for workplace learning and final occupational assessment. This provides the bridge that is needed to help learners to progress from school to work – a vital journey if more and more people are to escape poverty and unemployment and find decent work that would benefit the economy.

WHAT IS THE OFO?

In essence, the OFO is a coded occupational classification system. It is the Department of Higher Education and Training's key tool for identifying, reporting and monitoring skills demand and supply in the South African labour market.

The OFO is constructed from the bottom-up by:

- Analysing jobs and identifying similarities in terms of a tasks and skills
- Categorising similar jobs into occupations
- Classifying these occupations into occupational groups at increasing levels of generality.

The OFO adds value to skills development planning and implementation purposes in that it:

- Provides a common language when talking about occupations
- Captures jobs in the form of occupations
- Groups occupations into successively broader categories and hierarchical levels based on similarity of tasks, skills and knowledge.

JOB AND OCCUPATION

For the purposes of identifying the OFO occupations, the following definitions of ISCO-2008 are applied and are adhered to when identifying new occupational titles:

- A job is a set of tasks and duties carried out or meant to be carried out, by one person for a particular employer, including self-employment
- An occupation is a set of jobs whose main tasks and duties are characterised by a high degree of similarity (skill specialisation).

The occupations identified in the OFO represent a category that encompasses a number of jobs. For example, the occupation General Accountant also covers the specialisation Debtors Manager. An occupation descriptor always either indicates the unique service the occupation renders or the unique product the occupation produces in executing some or all the related tasks in a specific context. Jobs in the workplace could either be related to occupations or specialisations on the OFO. The association depends on the level of uniqueness of the output of the job on the workplace.

SKILL

Skill is defined as the ability to carry out the tasks and duties of a given job. Two dimensions of skill are used to arrange occupations into groups. These are skill level and skill specialisation.

SKILL SPECIALISATION

Skill specialisation is considered in terms of four concepts:

- Field of knowledge required
- Tools and machinery used
- Materials worked on or with
- Kinds of goods and services produced.

This is particularly important for the SIPs as it was frequently found that different sectors and sub-sectors require slightly different expertise from a person with the same occupational title. This is frequently seen as an add-on for those with the generic occupational foundation, and not a different occupation. [This is explored a little further in Chapter 4.]

STRUCTURE

Occupations are grouped into eight Major Groups, which are:

1. Managers
2. Professionals
3. Technicians and Associate Professionals
4. Clerical and Support Workers
5. Service and Sales Workers
6. Skilled Agricultural, Forestry, Fishery, Craft and Related Trades Workers (Trades)
7. Plant and Machine Operators and Assemblers
8. Elementary Occupations

In this report the Chapters in Part Three have clustered the Major Groups of the OFO into five:

- Managers (Major Group 1)
- Professionals and Associate Professionals (Major Groups 2 and 3)
- Clerical and Support Workers (Major Group 4)
- Trades (essentially Major Group 6 although where occupations were not listed trades on the South African list they were managed under Group 8)
- Plant and Machine Operators (Group 7)
- Elementary and Non-trade production workers (Major Group 8 plus occupations from Group 6 that are not listed South African trades).

The OFO codes per occupation are shown in Table 4 in Chapter 2.

Each Major Occupational Group on the OFO sub-divides into Sub Major Groups, Minor Groups and Unit Groups primarily on the basis of aspects of skill specialisation.

Occupations (six digits) are subdivisions of the Unit Groups and are further detailed through specialisation and alternative occupation titles. The number of digits indicates the level

of detail of the classification system that is being used at any one time.

The digit levels of the Organising Framework for Occupations

- **Major Groups** (1 digit) – e.g. 3 Technicians and Associate Professionals) are: The broadest level of the classification: Distinguished from each other on the basis of skill level and the broadest concept of skill specialisation
- **Sub-Major Groups** (2 digits) – e.g. 31 Science and Engineering Associate Professionals are: Sub-divisions of Major Groups and are distinguished from other Sub Major groups in the same Major Group on the basis of broadly stated skill specialisation
- **Minor Groups** (3 digits) – e.g. 312 Mining, Manufacturing and Construction Supervisors are: sub-divisions of Sub Major Groups Distinguished from other Minor groups in the same Sub Major Group on the basis of a less broadly stated skill specialisation
- **Unit Groups** (4 digits) – e.g. 3121 Mining Production/Operations Supervisors are: Sub-divisions of the Minor Groups Distinguished from other Unit Groups in the same Minor Group on the basis of a finer degree of skill specialisation
- **Occupations** (6 digits) – e.g. 312101 Production/Operations Supervisor (Mining) are: Not identified as part of structure, but listed as sub-divisions of the Unit Groups through a consultation process, based on its relevance to the specific descriptor and tasks of the Unit Group. They are distinguished from other occupations in the same unit group on the basis of uniqueness of the output, usually due to specific application of skills and knowledge in a specific context. Occupations relate to a cluster of jobs which involve the performance of a common set of tasks.

THE PURPOSE OF THIS REPORT

The purpose of this report is to:

- Inform education and training planners of the occupations in demand for the SIPs
- Invite researchers and key partners to assist in improving the methology that has been used to derive this list, so that it can be improved over time
- Demonstrate the richness of the engagement with Occupational Teams and to promote this engagement more broadly
- Direct the attention of education and training planners to specific interventions required to address projected scarcities in future, so that they can begin to address to them now
- Encourage all those with the resources to use them to support the interventions identified
- Report to South Africans about the work that has already been done and still needs to be done to gain optimal benefits from the new infrastructure investment of government in terms of generating South African jobs and South African skills.

THE STRUCTURE OF THE REPORT

This report does not follow the Focus Area logic of the Skills Plan. Neither does this report fully address the Future Focus of the Plan – this is work that still lies ahead. The Sections that follow are:

- **Section Two: Methodology**
  - **Chapter Two** – Sets out the methodology that was used to determine the skills required for SIPs, which of these skills are hard to fill in the minds of those responsible for project managing them and concludes with a list of the skills that were identified as scarce in the first round of enquiry
  - **Chapter Three** – Tries to determine how many of these skills we already have and the size of the gap both now and projected into the future
  - **Chapter Four** – Outlines the strategy that was adopted to address the scarcity identified.
- **Section Three: Occupations in demand**
  This is the substance of this Report. It contains six chapters – one each on the major occupational clusters that were identified as

scarce in the above section. These chapters outline general issues pertaining to all the occupations in the cluster, and then proceed to explore specific factors as to why there are scarcities and what could be done about them. These are recommendations to the Minister and his Department on what should be done to address the scarcity identified. They do not bind the Minister and his Department – they are recommendations to them

- **Section Four: Planning and resourcing**
  Looks at the ways in which the supply side – the universities, the colleges and the Sector Education and Training Authorities (SETAs) in the main (although other agencies are also listed briefly) – can be, and have been, guided and incentivised to address these proposals. This section also looks at the proposed Training Standard prepared by the Construction Industry Development Board (cidb) which aims to make quality assured training on SIP projects (indeed all infrastructure projects) compulsory.
- **Section Five: Informing the learners**
  Moves the focus to the learners and details strategies that the Department of Higher Education and Training (DHET) has initiated to keep learners informed about the opportunities that may unfold as a result of the SIPs. This is embedded within the Department's broader initiatives. This section also highlights the work of the Department of Labour with regard to its Employment Services South Arica (ESSA) which seeks to match work seekers and employers. The SIPs are all being encouraged to register projects on this system so that there is a clear communication channel which communities can access to find out about the SIP projects.
- **Section 6: Going forward**
  Calls everyone to action to ensure that skills are developed for SIPs and the nations.

Note: Should readers or partners have ideas, suggestions or corrections which will help to improve the quality of the next report you are warmly invited to send them to:

Special Projects Unit,
Department of Higher Education and Training
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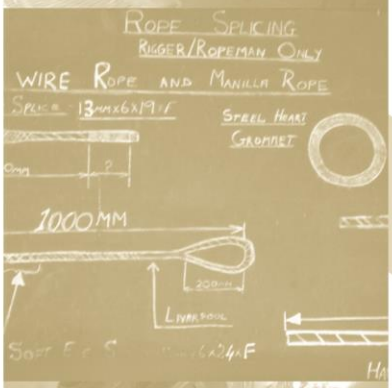
School



Theory

Practical

Workplace

Assessment

Expertise

SECTION II: METHODOLOGY

Contents	Section II
Chapter 2	**Estimating the skills required for the SIPs**
	Determine the occupations
Chapter 3	**Where are the gaps**
	Overall demand
	Current workforce
	Expansion demand
	Replacement demand
	Numbers qualifying
	Identifying the gap
Chapter 4	**Occupational Teams**
	The people who care

CHAPTER 2

Estimating the skills required for the SIPs

DETERMINING THE OCCUPATIONS

As outlined in the first chapter, when the work began in 2012 the broad framework shown in Figure 4 was adopted.

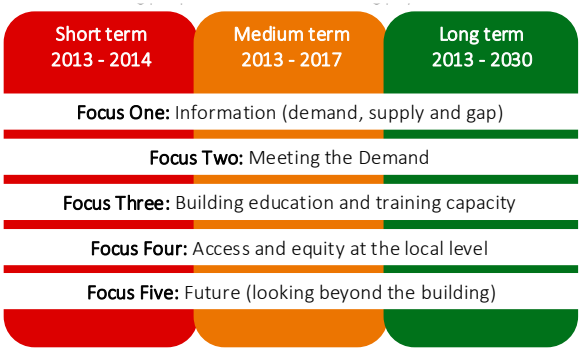


Figure 4: The SIPs skills plan

This chapter focuses on the identification of the occupations in demand for the SIPs.

Eight steps were followed to identify these occupations:

- **Step One**: Determining sectors and sub-sectors
- **Step Two**: Determining occupations for typical projects in sub-sectors
- **Step Three**: Generating the project list
- **Step Four**: Identification of skills prototypes
- **Step Five**: Customisation of prototypes
- **Step Six**: Estimating scarcity
- **Step Seven**: From prototype to real project
- **Step Eight**: Scarce skills from real projects

Each of these steps is described in the following sections.

STEP ONE: SECTORS AND SUB-SECTORS

The first step taken was to analyse the projects in the 18 SIPs to determine in which sectors the SIP projects fell. This exercise can be understood by looking at the matrix in **Error! Reference source not found.**.

Table 1: A typical matrix of sectors per SIP

Road	Rail	Ports	Water	Energy	ICT	Ind	Social
SIP 1 (Eskom)							
Road projects in SIP 1	Rail projects in SIP 1	Ports projects in SIP 1	Water projects in SIP 1	Energy projects in SIP 1	ICT projects in SIP 1	Ind projects in SIP 1	Social projects in SIP 1
SIP 2 (Transnet)							
Road projects in SIP 2	Rail projects in SIP 2	Ports projects in SIP 2	Water projects in SIP 2	Energy projects in SIP 2	ICT projects in SIP 2	Ind projects in SIP 2	Social projects in SIP 2
SIP 3 (TCTA) etc.							
Road projects in SIP 3	Rail projects in SIP 3	Ports projects in SIP 3	Water projects in SIP 3	Energy projects in SIP 3	ICT projects in SIP 3	Ind projects in SIP 3	Social projects in SIP 3

Once the projects were categorised under sectoral headings, they were further grouped into sub-sectors. It was recognised that a different prototype may be required per sector and in some instance per sub-sector.

For instance the skills required to develop a coal-fired power station would be very different from the skills required to develop a wind farm, although both projects are categorised under energy as the sector and generation as the sub-sector.

Conversely, the same profile may be used for developing and constructing a university, which falls under higher education as a sector, and a court, which falls under justice.

The sectors and sub-sectors identified are listed in Table 2.

Table 2: Sectors and sub-sectors

Sector	Sub-sector
Energy	Distribution
	Generation (biomass)
	Generation (fossil fuel (gas/coal))
	Generation (nuclear)
	Generation (solar)
	Generation (wind)
	Generation (water)
	Transmission
Ports, Rail and Pipelines	Pipelines
	Ports
	Rail
	Rolling stock (imported)
	Rolling stock (locally built)
Roads	New roads (excluding maintenance)
	Developments & improvements (excluding maintenance)
	Periodic maintenance
	Routine road maintenance
	Special projects (e.g. Road markings, emergency bridge repairs)
	Un-surfaced roads (new & maintenance)
Basic Education	School build and services
Commercial and Office Buildings	Facility plus services
Communication	School connectivity
	Telkom input
Square Kilometre Array (SKA)	Piled foundation for antennae
	RFI shielded bunker
	Raised platform
	Ops & Maintenance of Dishes
Correctional Services	Prisons (including security) built
Crime Prevention (SAPS)	Facility build, services and security
Health	Health buildings and services
	Health technology
Higher Education and Training	Learning Centre and services
Human Settlements	Home building and services
Justice	Courts (constitutional)
Manufacturing	Smelter
	Sinter plant
Mining	Fixed - regulation
	Fixed - promotion
	Fixed - inspection
Other (e.g. Public Works)	Facility build, services and security
Public Transport	Passenger rail based
	Rail based rolling stock
	Road based buses
Social Services	Facilities and services
Tourism	Accommodation
	Tour operators
Water and Sanitation	Storage dams medium
	Storage xams large
	Bulk conveyance
	Potable water treatment
	Reticulation
	Sewage collector system
	Waste water treatment
	On- site sanitation
Agriculture, Forestry and Fisheries	Animal health
	Animal production and processing
	Crop production and processing
	Fisheries projects
	Forestry
	Fresh produce products
	Revitilisation of Irrigation schemes
	Roads

STEP TWO: SKILLS FOR TYPICAL PROJECTS IN SUB-SECTORS

Expert project managers in each sub-sectoral area were asked to indicate the size of a typical project to be built in that space. In some cases this was expressed in financial terms and in other cases physical characteristics were cited such as 20 km of road, 40 km of railway line, the square area of a building, the height of a dam wall, the number of megawatts or megalitres in the case of a power station or reservoir, or the number of learners to be taught. Using this typical size of project, project managers were then asked to describe the time it would take to implement such a typical project. They were also asked to outline, in detail using OFO level 6 categories, the occupational skill sets that would typically be required to take such a project from conception, and the planning stage, through design to construction. The profile so generated was called a prototype. Going forward, it is anticipated that operations and maintenance will be added to each prototype.

In this way a typical skills profile for each typical project in each of the SIP sub-sectors was developed. To date sixty four prototypes have been developed. Once completed, the prototypes can be graphically presented, such as illustrated in Figure 5 (with obvious variations per sector).

The coloured bands each represent a major category of the OFO, and the width of the band indicates the number of skills in that band that will be required through each phase of the project. The operation and maintenance aspects require further research with the various operating bodies. This will be developed in the next phase.

Several prototypes have been finalised, while others are still in draft form. Approved prototypes may be found on the Skills Portal at https://sip-skills.onlinecf.net.

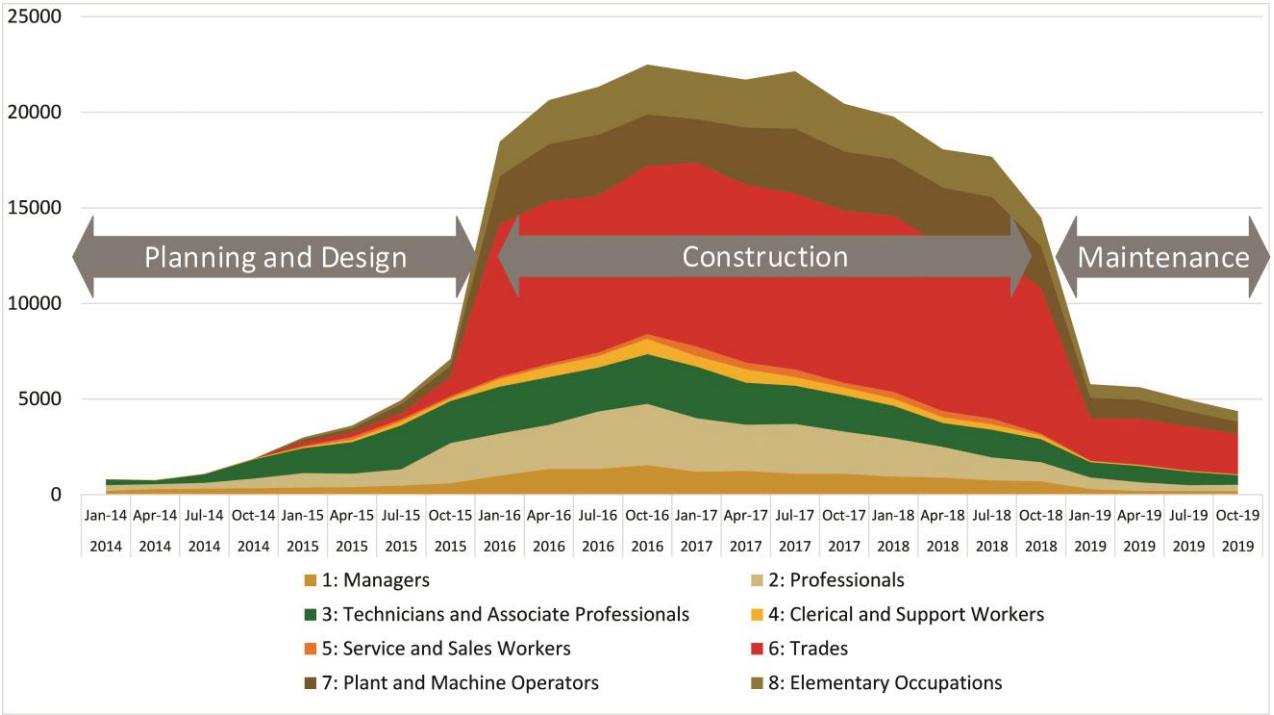


Figure 5: A typical prototype

STEP THREE: GENERATING THE PROJECT LIST

Credibility of the results will only be achieved if the input of all planned projects in each SIP is collected from the relevant SIP owner with all critical identifying data (such as scope, size, budgeted cost, start and end date of each phase). Working closely with the PICC, this needs to be collated for short-term, medium term and long-term scenarios (i.e. to 2030) with the realisation that longer term scenarios require judgment calls.

This stage of input collation represented the most critical aspect of data collection and involved a number of meetings with the identified bodies such as Eskom, Transnet, PRASA, IDC, Department of Basic Education, Department of Health, Department of Public Works, Department of Agriculture, TCTA, SANRAL, various municipalities and so on. Where projects were part of wider programmes, these programmes were taken into the database where the identifying data could be summarised in a format acceptable to the database.

Certain projects were not categorised due to the fact that they had been identified as a need but did not as yet have a detailed project plan. Other projects were considered to be below the project value cut-off (held to be R1bn in the initial runs). The initial objective was the identification of skills demand, based on the major project requirements, with allowance for the smaller projects as programmes or allowances.

STEP FOUR: IDENTIFICATION OF SKILLS PROTOTYPES

The initial set-up development had identified 64 prototypes across the project definition in all 18 SIPs. These were established based on actual projects from reliable sources; but the scheduled use of the occupations has been simplified for universal usage. It is accepted that different implementers will use a variety of skills prototypes driven by such factors as availability of skills, schedule pressure encouraging mechanisation, specifics of the project and working conditions. The prototypes ranged across the sectors of agriculture, building, services infrastructure (piping reticulation, roads, electrification, and telecommunication), manufacturing, health, mining, energy, education and the SKA. The relevant prototype was chosen for each project by assessing the skills requirement of the project and matching it with a prototype. This may have been from another sector if the skills envelope was a match.

Each project was viewed simply as having three distinct phases being:

- Planning and design
- Implementation
- Operation and maintenance.

The project cost was proportioned among planning and design, and implementation; while an allowance over twenty years was taken for operation and maintenance. This served as an additional cross-check, as an estimate could be developed on man-hour cost per phase to verify the Skills Model output.

Initially, a total of 450 projects were identified to meet the skills demand criteria within the total project list of approximately 3 000 SIP projects. These required discussion with the individual SIP owners to ensure valid input data for each project. Mutual agreement of critical identifying input data was a hurdle for medium-term and long-term project horizons. However subjective assessment was considered a better option than the omission of major skills-demand project data.

STEP FIVE: CUSTOMISATION OF PROTOTYPES

The prototype chosen to represent a particular project serves as a base evaluation of the occupations in demand for a particular base project. The procedure to customise the base prototype to the actual project makes use of multipliers as the broad skills envelope is considered to be valid.

Each prototype has an identifier such as project cost, kilometres, kilowatts. Thus the first step was to adjust the skills prototype to the actual project by a scaling factor. Projects tend to be of mixed discipline (such as rail laying, electrification, signalling and station building in one Transnet project).

Equally, a project cost identifier does not allow for the skills requirement in materials and equipment procurement or other set-up aspects. A manpower multiplier was used to allow for varying skills demand compared to the prototype. Lastly, it was necessary to take account of the skills efficiency in a large project as opposed to skills inefficiency in a smaller project. Multipliers were allocated to these three aspects in the Skills Model input to create a skills prototype that better represents the actual project requirements.

These multipliers are critical to the use of the Skills Model and involve an understanding of the scope of the project and implication of choice of prototype. They can be 'reverse-engineered' against known projects within a portfolio.

STEP SIX: ESTIMATING SCARCITY

The output from the Skills Model gives an indication of individual skills demand per project amalgamated over a sector. It was then necessary to consider the scarcity.

Scarce skills, according to the definition of the Department of Labour, refer to occupations in which there is a scarcity of qualified and experienced people, currently or in the future, either because such people are not available (absolute scarcity), or because they are available but do not meet the employment criteria (relative scarcity).

Critical skills refer to specific skills within an occupation, and include generic skills (e.g. problem solving, report writing etc.), and particular occupational skills (e.g. using GIS). (See ESSP Working Document No. 5.)

The complexity of the various definitions of scarcity led the team to decide on a simplified scale. The originators of the base prototypes were asked to evaluate which occupations are difficult to fill using a four point system:

- Adequate supply
- Shortage (0-20%)
- Significant shortage (20-50%)
- Critical shortage (50-100%)

This enables an estimate (although subjective) of skills positions that may be difficult to fill and gives an early warning on critical areas that may require solutions that look at sourcing of skills from similar occupations, or fast-track training, or review of the proposed implementation technique (such as more automated equipment).

It is clear that the aspect of skills scarcity is critical to the practicality of the Skills Model output. The view of the team is that this aspect will require detailed industry workshops based on the projects identified as a problem relating to skills scarcity.

STEP SEVEN: FROM PROTOTYPE TO REAL PROJECT

Working closely with the PICC, the list of real SIP projects already under construction were

identified, while details of others that were at different stages of preparation were determined. The projects were clustered into the different sub-sector categories and an exercise was undertaken of comparing each project to its relevant Skills Model output. Where actual skills information was available from projects in the project cycle, the model output was collated and allowance was made in the relevant skills efficiency multiplier. This enabled a reconciliation of output data against actual project data.

All projects currently in the project cycle were analysed in greater detail to validate the multipliers to be used in that sub-sector. For example, the skills demand was relatively low in dam construction as opposed to factory development. Analysis of actual projects enabled a multiplier to be developed based on actual project data.

In passing, it can be noted that the skills requirement multiplier is critical – and was difficult to estimate accurately as the real project often had variations which had not been taken into account in the prototype e.g. a real road project often required a bridge or a tunnel which was not factored into the prototype.

Going forward two refinements will take place:

- The prototypes will be expanded e.g. not only will there be a prototype for a road, there will also be a prototype for a bridge across a road and a prototype for a tunnel and so on
- Real project data will be used to inform the scaling factor for each major occupational category as managers and professionals do not usually escalate at the same rate as tradespeople and elementary workers.

In general, the estimated commencement date for each project was known (from SIP Coordinators) and so the same comparative method was used to estimate the duration of each project. This has also emphasised the importance of sequencing of projects so as to avoid spikes of demand followed by troughs of no or little demand.

OPERATIONS AND MAINTENANCE

A problem was experienced in acquiring valid staffing allowances for the Operation and Maintenance of the completed projects due to limited records available. An estimate can be made based of typical team or additional research can be developed. This was not included in the final profile.

THE ESTIMATED DEMAND

The estimated skill requirements for each project across a timeline were combined and a picture of the total demand for different occupations was then estimated for all SIPs across a timeline as illustrated in Figure 6.

It was found that 249 occupations, totalling some 205 329 workers would be required at the peak of the current known development.

Projections

It should be noted that although figure xxx shows a drop off in demand, this will not be the case. The model simply reflects the actual development details and demands which are known at present. These are largely linked to the Medium-Term Expenditure Framework (MTEF).

The dotted demand line represents overall projections using the factors suggested by the Linked Macro-Education Model, which is discussed in detail in the next chapter. It can be seen that the projection closely follows the demands determined for the first three years.

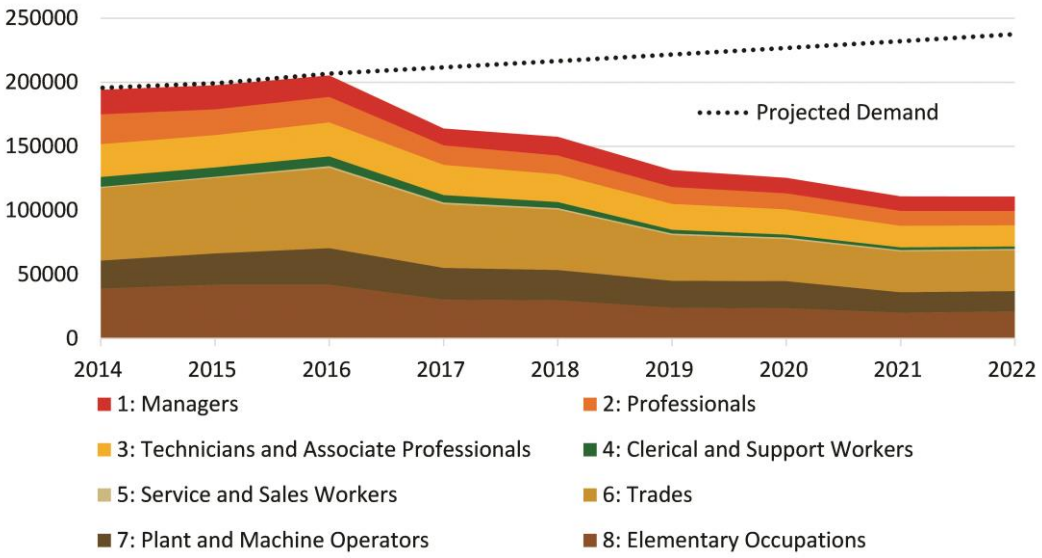


Figure 6 :The SIP skills demand from 2014 to 2022

STEP EIGHT: SCARCE SKILLS FROM REAL PROJECTS

The occupations that had been identified as being difficult to fill at prototype level were extracted to produce the scarce skills list. The actual number of all scarce skills required across the life of the projects is shown in Figure 7.

Using the scarcity ratings that were assigned to each occupation, the system estimated the scale of the scarcity in each case. This was done with some caution as the skills planners share the concern of others (e.g. Carmel Marock at the HRDC Summit, 3-4 March 2014) that such estimations are tentative at best and misleading at worst given the 'unknowability' of the future. However, if supply side responses are to be scaled in any way, there is a need for indications, wherever possible.

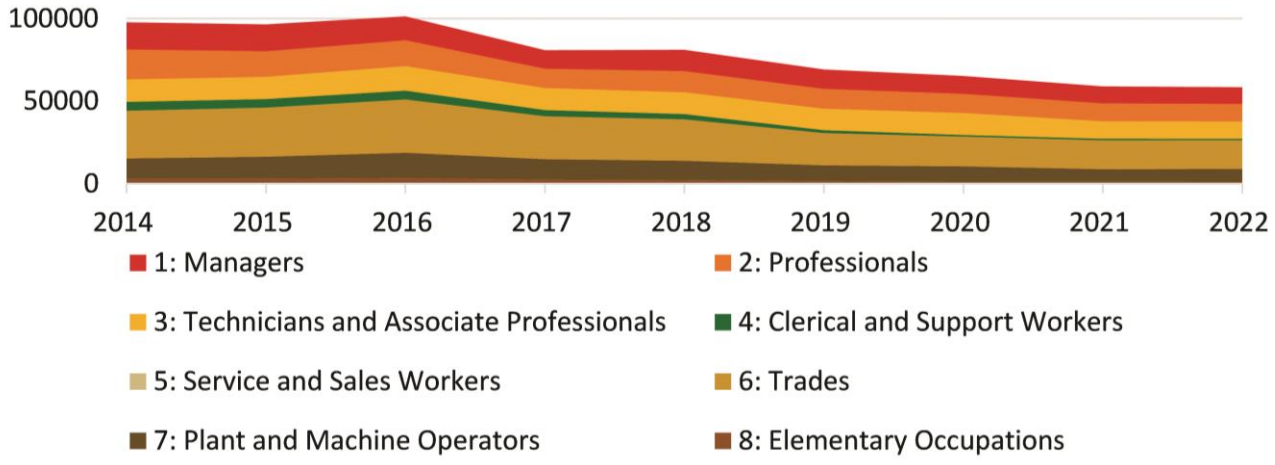


Figure 7: The SIP scarce skills demand from 2014 to 2022

The initial scarce skills list contained 58 occupations. On further investigation it was found that in many cases several specialisations were needed rather than the actual occupation which was selected from the OFO list. In other cases it was found that those completing the prototype tool had only selected the first in a suite of occupations that they considered scarce rather than selecting each occupation. For instance, they may have selected health and safety officer, but may have in fact required the entire team of health and safety agent, manager and officer to attend to health and safety issues on a site.

After deliberations with owners and industry, the list was expanded to include a more comprehensive list of occupations for development.

The final totals relating to skills required and scarcity per occupation and numbers per major OFO group are shown in Table 3. It can we seen that the shortage is considered to be of the order of 25% of the skills which are considered to be scarce. On interrogation, industry generally indicated that this scarcity related to inadequate numbers with the requisite experience (i.e. relative scarcity) rather than a general shortage of numbers in most of the so-called scarce skills. The final scarce skills list is shown in Table 4.

With this list of occupations in demand, it was necessary to determine the general scarcity beyond that of the SIPs with respect to these occupations and from there the strategies needed to address them.

The next chapter discusses the basis for determining the overall scarcity.

Table 3: The number of skills in demand and those which are scarce

Major OFO	Number of occupations in total	Number of skills in total	Number of scarce occupations	Number of scarce skills in total	Possible shortage
1: Managers	33	16 799	5	14 486	1 100
2: Professionals	57	19 917	30	15 697	5 300
3: Technicians and Associate Professionals	45	26 433	14	14 804	3 300
4: Clerical and Support Workers	16	76 11	2	5 370	450
5: Service and Sales Workers	5	1 353	0	0	0
6: Trades	51	62 642	16	32 254	7 250
7: Plant and Machine Operators	20	28 654	7	15 368	1 250
8: Elementary Occupations	22	41 919	16	3 400	6 400
Totals	**249**	**205 329**	**90**	**101 379**	**25 050**

Table 4: Occupations in demand for the SIPs (Version: October 2013)

Management			
121101	Management accountant	212908	Quality manager
134901	Environmental manager	121905	Programme/project manager
121904	Contract manager		
Professionals and associate professionals			
214403	Aeronautical engineer	314301	Forester
211101	Astronomer	214201	Industrial engineer
214501	Chemical engineer	214102	Industrial engineering technologist
214502	Chemical engineering technologist	311905	Industrial engineering technician
311601	Chemical engineering technician	216502	Land surveyor
214201	Civil engineer	216502	Engineering surveyor
214202	Civil engineering technologist	311202	Geomatician
311201	Civil engineering technician	216201	Landscape architect
351301	Computer network technician	214907	Materials engineer
226302	Construction health and safety	311201	Materials engineering technician
132301	Construction and project manager	214401	Mechanical engineer
311801	Draughtsperson	214402	Mechanical engineering technologist
215101	Electrical engineer	311501	Mechanical engineering technician
215102	Electrical engineering technologist	211101	Physicist
311301	Electrical engineering technician	214904	Quantity surveyor
215201	Electronic engineer	214601	Mining engineer
215201	Electronic engineering technologist	214602	Mining engineering technologist
311401	Electronic engineering technician	311701	Mining engineering technician
214301	Environmental engineering	216401	Planners
Service and clerical workers			
441903	Programme/project administrator	833402	Storeperson
Trades			
641201	Bricklayer	651101	Moulder
671101	Electrician	651404	Structural plater
671202	Millwright	653301	Industrial machinery mechanic
651302	Boilermaker	643101	Painter
641501 641502	Joiner Carpenter	642607 642601	Pipe fitter Plumber
651202	Welder	642302	Plasterer
651501	Rigger	651301	Sheet metal worker
Plant and machine operators			
734205	Grader operator	734301	Crane or hoist operator
734204	Excavator operator	733201	Truck driver

734203	Dozer operator	734213	Road roller operator
734202	Backhoe operator	711405	Concrete batching plant operator
734201	Earthmoving plant operator		
Elementary and Non-Trade Production Workers			
312303	Construction supervisor	134916	Operations foremen
312301	Construction supervisor /clerk of works	611302	Landscape gardener
831302	Drainage, sewerage and stormwater worker	831312	Sign erector
831303	Earthmoving worker	641902	Scaffold erector
831305	Concrete plant worker		Scaffold inspector
641401	Concrete hand	831310	Surveyor's assistant
862202	Handyperson	641502	Shutter hand
831302	Road Marker and sign erector	311702	Materials tester - roads
214908	Materials non-destructive testing operators	671102	Electrical installation inspector

CHAPTER 3

Where are the gaps?

PROJECTION METHODOLGY

THE FLOW

It is often assumed that self-regulation mechanisms in a market economy ensure the necessary supply to the labour market, but there is evidence of this not being the case at present, as significant numbers of scarce and critical skills have been identified.

To address the skills gaps, overall data on demand and supply is required. Adequate data on the demand for skills and supply of skills in South Africa is not available and a combination of approaches is required to obtain the required information. Market signals (e.g. occupational employment trends, job advertisements, unemployment rates, wages, and enrolment data) can help identify skills requirements when individual available data sources are inadequate.[3]

The exercise described in Chapter 2 was used to determine the skills which were considered to be in short supply for delivering the SIPs. Many of the problem areas which emerged were confirmed by employment agencies and employers who complained of increasing difficulty in sourcing such skills and the higher wages that they must pay to source them.

On further investigation many systemic failures were identified in relation to some of the occupations, such as the discontinuation of courses, or the withdrawal of funding by SETAs as the particular occupations had not been included in their targets.

Recognising the need to ensure the supply of priority skills for the SIPs, it was necessary to estimate the national demand to ensure that those trained for SIPs would not be poached for other purposes. This is the reason why SIP skills planning cannot be done in isolation from national skills planning.

Having established the overall demand it was necessary to determine the current workforce per occupation and how many people are entering or leaving each occupation to establish whether there would be sufficient capacity per occupation. These movements are also shown in Figure 8.

Where gaps between the number required and the possible numbers available were identified, it was necessary to determine what interventions would be required to address the gap. This could include increased training, RPL, immigration and encouraging retirees to return to the industry.

Figure 8: Flow of staff per occupation

Determining the quantum of each of these factors is discussed in this chapter. How to address the blockages will be discussed in the occupations' chapters (Chapters 5 to 10).

OVERALL DEMAND

Figure 9 shows the typical overall demand that may be required for an occupation when considering the SIPs demand, plus the balance of the public sector demand and private sector demand.

The relative proportion of public sector to private sector demand will vary per sector.

For instance, in civil engineering, some 60% of development is public sector related, while in mechanical engineering, possibly only 20% to 30% of development and products will be for the public sector. When considering mining activities, only a small percentage will relate to the public sector and the balance will be largely private sector.

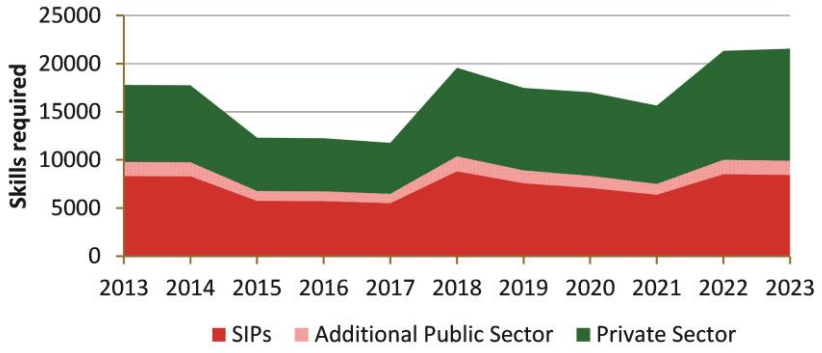


Figure 9: Typical total demand projected for an occupation considering SIPs, additional public and private sector requirements

THE LINKED MACROECONOMIC-EDUCATION MODEL

The Linked Macroeconomic-Education Model (LM-EM), a forecasting model designed by Dr Adelzadeh of Applied Development Research Solutions (ADRS) for South Africa, as part of the DHET's Labour Market Intelligence Programme (LMIP), was used to obtain percentages for new occupational positions required for the 2014 to 2030 period as well as estimations of the rate at which people are leaving.

On the one side the model is a comprehensive macroeconomic model designed to assist South Africa to devise policies to minimise imbalances in the labour market by more accurately being able to forecast future economic trends, based on industrial and economic policies and the likely effects of key external drivers. The LM-EM simulates the future outlook for the South African economy using such variables as:

- Investments
- Employment
- Remuneration rates
- Outputs
- Exports
- Imports
- Pricing
- Consumption
- Income and expenditure in relation to the government, private sector and households

The model ultimately translates the macroeconomic model's annual sector employment forecast to generate parallel forecasts for occupations.

On the other hand the LM-EM model considers the supply of skills graduating from the education and training system and begins to identify gaps.

The model is currently being refined as part of the LMIP and DHET plans to introduce a user-friendly web-version of LM-EM to the public in due course. It will then be possible to generate projections of workforce skills required under alternative economic and education scenarios.

Dr Adelzadeh was requested to use the LM-EM to generate predictions on the probable demand for each of the SIP occupations in demand. The model included an examination of the following:

- **The stock of skills** The number of people employed in a specific occupational category i.e. the current workforce as shown in Figure 8
- **Expansion demand** The anticipated number of new occupational positions forecast for the period. The compound average annual growth rate (CAAGR) over the five year period (2009 to 2013) for each of the occupational categories was calculated to represent expansion demand and was translated into a percentage of the total number of people likely to be employed during the projected period
- **Replacement Demand** The anticipated number of people in this occupational category that are likely to retire, migrate, change jobs or die during the period and this was translated into a percentage of the total number of employed likely to need to be replaced over the projected period.

PROJECTED GROWTH

The model created by Dr Adelzadeh was based on past trends as indicated in Figure 10.

Considering all the parameters outlined above, a future model has been proposed as shown in Figure 11. The model forecasts an average growth of 2.52% to 2030 based on past trends. This could be an under-projection if the SIPs impact on growth as planned in which case the skills gap may be larger.

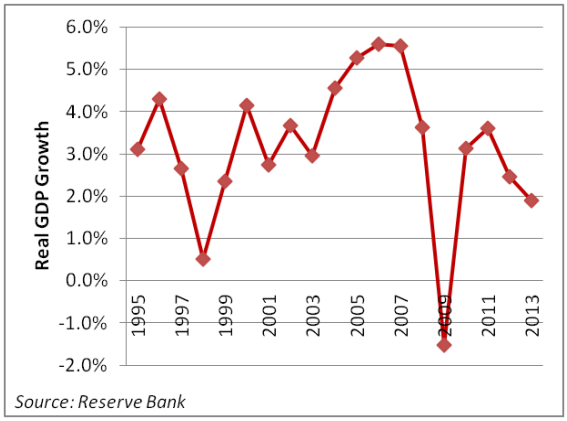


Figure 10 : GDP Growth 1995 - 2013

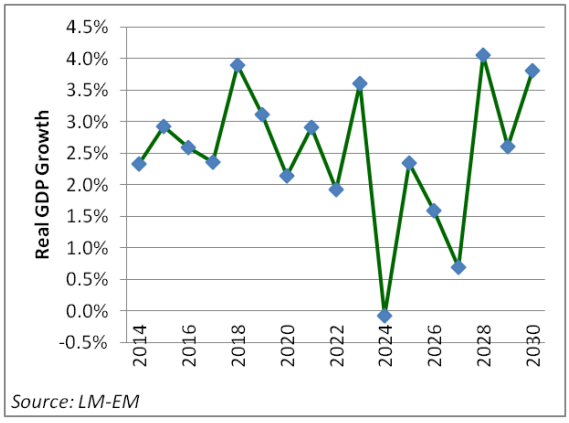


Figure 11 : GDP Growth Forecast 2014 - 2030

Since the longer-term detail of the SIPs projects are currently tentative, and developing skills cannot be a stop-start exercise, the average expansion demand percentages have been used to determine growth required relative to the current stock for the duration of the period in question.

STOCK/CURRENT WORKFORCE

QUARTERLY LABOUR FORCE SURVEY

The South African government's national statistics agency, Statistics South Africa's (Stats SA's) Quarterly Labour Force Survey (QLFS) of 2009-2013 was used to obtain the stock of skills. Assumptions which had to be made when using the QLFS included the following:

- **Required qualification** Attention had to be paid not only to the occupation but also to the required qualification for occupational competence, since the OFO level used in the QLFS does not exclude those with lower level qualifications.
- When considering the professions, only those with NQF 6 and above were counted.
- When considering the trades, NQF 4 was used to determine the numbers in the workforce who have completed comprehensive training and passed their trade tests, since those with much lower levels of education and training are likely to be under-qualified.
- **Fluctuation in responses** - A challenge arising from the QLFS data is the high annual fluctuations in the number of counts for the occupational categories under discussion.
- These fluctuations are as a result of extrapolating raw data obtained from a sample to approximate national parameters. To smooth out the effects of the fluctuations:
    - An average for the four quarters for each year was calculated for each occupational category
    - An average per occupational category was generated for the 2009-2013 period.
- **Insufficient qualification levels** - In many cases there were insufficient qualification levels for the occupations in question in the QLFS dataset. For example several categories of technologists were not captured.
- **Mapping of the Organising Framework for Occupations (OFO) codes** Mapping of the OFO codes used by DHET with the South African Standard Classification of Occupations (SASCO) codes used in QLFS datasets presented a problem. There is not always an exact fit between the OFO codes and SASCO codes, as the OFO occupational descriptions are at the six digit level, while the SASCO codes are used at a four digit level only. Carpenters and shutterhands would for instance count under the same SASCO code in the QLFS dataset, while having separate OFO codes.

OTHER DATA

Where more accurate data was available from professional bodies, stakeholders and recent surveys, these figures were used instead.

SOURCES OF DATA

The sources of each data set are captured as part of the caption of each graphic.

EXPANSION DEMAND

Expansion demand percentages for the anticipated average 2.52% growth of the South African economy are shown in Table 5.

Table 5 : Expansion demand percentages

Occupation group	Expansion %
Senior officials and managers	1.94%
Professionals	1.87%
Technicians and associate professionals	2.05%
Clerks	2.44%
Service workers	2.42%
Trades workers	3.07%
Plant and machine operators	2.45%
Elementary occupations	1.73%

The above factors were used to calculate the overall demand required per occupation and were used to increase graduation figures annually.

REPLACEMENT DEMAND

As outlined above, replacement demand relates to retirement, leaving the industry, migration, injury or mortality.

RETIREMENT

Retirement can be calculated from QLFS data by considering the fraction of the occupational class that is aged 55 to 65 in a given year and then assuming that some fraction of this group would retire each year.[4]

Retirement figures could also be estimated from the comprehensive registration statistics of the Engineering Council of South Africa (ECSA). From their model it would appear that approximately 1.8% retire annually. This figure has been used for the retirement of professionals whilst the LM-EM percentages were used for others.

MIGRATION

Net migration is the difference between the number of persons entering and leaving a country during the year per 1000 persons (based on midyear population). An excess of persons entering the country is referred to as net immigration. An excess of persons leaving the country is referred to as net emigration.[5]. Currently South Africa is said to be experiencing net migration of high level skills of the order of 0.6%[6]

MORTALITY

Mortality rates are contained in the Actuarial Society of South Africa's (ASSA) aids demographic model developed for Census data.[7]

LEAVING THE INDUSTRY

Alumni research at a number of universities, and anecdotal evidence from 30 and 40 year graduate reunions suggest that at least 0.5% on average per annum have left their original field and have moved into other industries.

A MORE COMPREHENSIVE MODEL

It is readily accepted that the sources of information used are limited. Where it was not possible to determine the size of the current workforce, the percentage scarcity figures were used to determine the shortage relative to the SIP demand. Where more detailed information was available, demand, workforce and supply could be used to determine the gaps.

Going forward, additional information on wage trends, immigration/emigration data, vacancies, job opportunity index data, and detailed research per occupation is needed. The establishment of Occupational Teams, as detailed in the following chapter will contribute to the longer term refinement of the datasets.

NUMBER QUALIFYING/SUPPLY

The White Paper states that 'the post-school system … consists of all the institutions, public and private, for which the DHET is responsible'. The education institutions include:

- 25 public universities (with one more coming on stream in 2015)
- 50 public technical and vocational education and training (TVET) colleges
- Public adult learning centres (soon to become the new community colleges)
- Private post-school institutions

They offer a range of courses and qualifications from skills programmes for elementary workers to PhDs in the case of managers, professionals and associate professionals.

To determine the number of learners entering the labour market with a specified

occupation, it is necessary to understand the pathway that they followed. An approach has been taken based on a generic understanding of the pathways that have to be followed to attain occupational competence as outlined in chapter 4.

LEARNERS COMPLETING OCCUPATIONAL PATHWAYS

The most useful tool currently available to determine the different pathways to occupational competence is the National Career Advice Portal (NCAP).[8] However NCAP does not provide data on how many learners have entered or completed each step on the pathway. It transpires that there are data challenges in this regard:

- **Data on final assessments** i.e. designations issued for professionals, trade tests passed for artisans or licences issued for operators. These datasets are very incomplete. It has therefore not been possible, in most instances, to count those qualifying at the final step.
- **Data on workplace learning** e.g. candidacy for professionals or apprenticeships for trade workers. Similarly data is scarce and uneven for this stage of learning. The SIPs project has used the SAQA's NLRD information regarding learners who have completed learnerships registered by the SETAs historically as a proxy for this kind of learning. However, in general, only numbers for lower NQF level occupations are available.
- **Data on theoretical learning** In the light of the above constraints it has been necessary to use the more comprehensive data available on those who complete the theory step of the pathway.
- NCAP has been used to identify the different qualifications that a person might complete if they wish to proceed to a particular occupation. The graduation data for these qualifications has then been used to estimate supply. This is somewhat misleading in the case of some occupations as only a percentage of those who graduate proceed to attain full occupational competence in the specified occupation. Nevertheless in the context this information has had to be used.
- Data on graduations for each of the qualifications that might lead to occupational competence has been secured from the South African Qualifications Authority's (SAQA) National Learners' Records Database (NLRD) and has been checked and completed using the information on university and college enrolments and graduations kept by the DHET.

THOSE RETURNING

Provision has also been made for inflow over and above those who are qualifying and entering the workforce. Those considered are as follows:

- **Returning from other industries** It is common cause that when the construction industry is quiet, unemployment in the sector increases, or those who are multi-skilled move into other industries. When construction picks up they return to the industry
- **Returning South Africans** As with those returning from other industries, many South African accept projects abroad when the construction industry is quiet and return when development picks up
- **Retirees** Replacement demand made allowance for normal retirement, but in some cases retirees are encouraged to stay on or return to the workforce for a period
- **Re-employment** Supply data has also been gained from the **Department of Labour's ESSA system**, although a caveat has to be raised here, namely that the ESSA system currently is not able to establish whether a person who is registered on the ESSA system has subsequently secured employment. The Department of Labour is nevertheless willing to establish availability if an employer requests candidates for a vacancy.

IDENTIFYING THE GAP

Determining skills requirements is not a once-off exercise, but rather requires ongoing

attention to the needs. Figure 12 shows the philosophy adopted for determining actions that need to be taken to ensure long-term supply of each occupation in question.

- **2013 workforce** The workforce in place at the end of 2013 is shown as the orange bar and will reduce over the years as people leave
- **LM-EM expansion projection** Using the LM-EM expansion percentage per occupation group as listed in Table 5, the black dotted line suggests the increase that should take place over the next 15 years to support the growth of the economy
- **Accumulated losses** Losses from the current workforce are shown in red below the axis. These take retirement, mortality, those leaving the industry and net migration into account.
- **Qualifying** The inflows above the current workforce represent those graduating or completing their trade tests who are able to enter and make a contribution in the workplace. In the case of professions, the inflow from both degree courses and national diplomas is shown. Those completing BTech or other postgraduate qualifications are not included here as they do not represent additional entrants into the workforce, but rather existing capacity with enhanced knowledge.
- **Accumulated gains** An allowance has been made for those returning to the industry from retirement, unemployment or having been out of the industry for a period.
- **OT projection** Where occupational teams felt that the numbers were far too low and needed to be developed beyond the LM-EM suggested expansion demand percentage, they suggested a percentage growth as shown by the red dotted line. This generally applied to smaller and newer occupations, but in instances where changes in technology, approaches or compliance demands required increased in skills higher percentages were also suggested.

Addressing the gap between the LM-EM or OT projections and the numbers available will require attention. These include increasing graduations, RPL, encouraging immigration, retirees to return and many other innovative solutions (not all of which are education and training related). Those which do relate to education and training will be introduced broadly in the next chapter and detailed per occupational cluster thereafter.

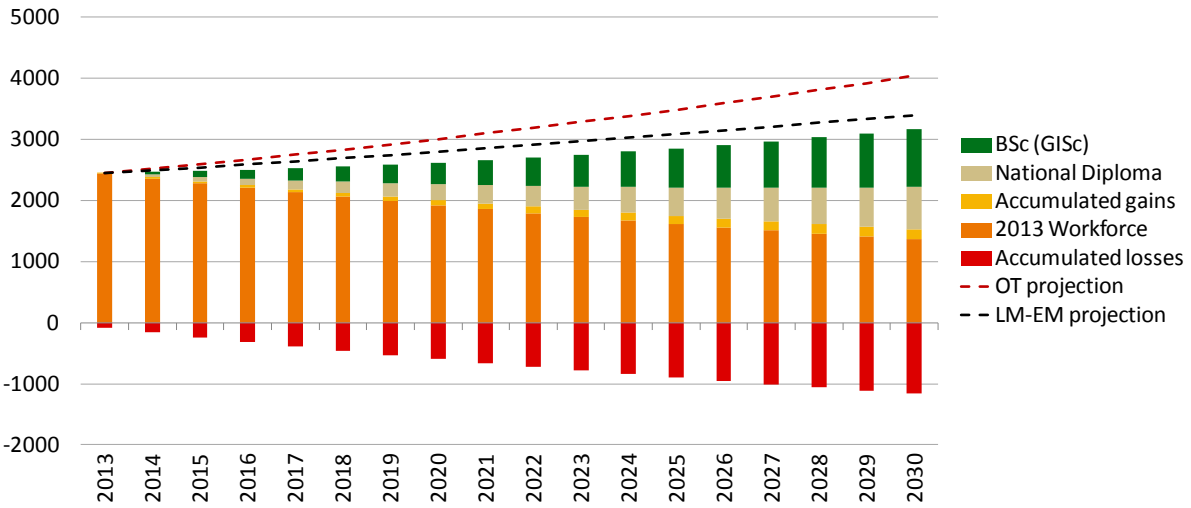


Figure 12 : Projected demand for and supply of an occupation

CHAPTER 4

Occupational Teams

THE PEOPLE WHO CARE

FROM GAP TO GO

Having identified the occupations in demand for the SIPs, the obvious next question was: what should be done to remedy the anticipated shortfall?

FROM LEARNING PATHWAY TO OCCUPATIONAL TEAM

FIRST STEP

Figure 13: The Skills pipeline

The starting point for the SIPs Teams was to identify a generic learning pathway that needs to be followed by those preparing to enter these occupations. The result is shown in Figure 13:

SCHOOL

All learning pathways start at school, with information about the choices on offer and the entry requirements that need to be met to embark on the journey.

THEORY

Once a decision has been made, a pathway chosen and entry requirements met, for most (not all occupations) a foundational theoretical qualification has to be acquired e.g. a Bachelor of Science (Engineering) for engineers. Depending on the occupation in question, this theoretical foundation may be at a college or a university.

PRACTICAL TRAINING

Either as part of the theoretical programme or after it is completed, a period of learning is frequently (not always) needed where the practical skills associated with the occupation are acquired in a simulated environment. This may be in a laboratory for professions, in a training workshop for artisans or in a simulator for grader operators. It is however NOT subject to the time, quality and cost pressures of real production or service delivery.

WORKPLACE-BASE LEARNING

Once basic competence has been acquired, learners usually progress to a time in a workplace, where they are mentored and coached by experienced and qualified practitioners. The learners begin as novices and progress through rotation and guidance to attain the confidence and experience they need to operate increasingly independently.

ASSESSMENT

Once a learner has completed their structured learning programme in a workplace, they are subjected to an assessment by those who are able to judge whether the person is ready to function independently. This may be a test (such as a trade test), it may be an assessment by peers (such as a professional body) or it may be a licensing process undertaken by an authorised body (such as the Department of Transport for truck drivers).

EXPERTISE

A newly qualified person is not yet ready to take responsibility for complex, high cost activities with significant risk elements. They

must begin on straightforward tasks for which their training prepared them, and over time build up their capacity to address increasingly complex and challenging tasks.

THE NEXT STEP

The next step was to identify why there is a shortage and what can be done about it.

This led the SIP Skills team to ask: who can answer these questions? The answer was clear: those who understand each step along the pathway:

- lecturers who teach the theory
- employers who employ graduates
- those who assess the occupation
- where appropriate
- those who run the simulated training centres

The idea of Occupational Teams was born.

An Occupational Team comprises of at least one person from each step along the learning pathway for an occupation.

While each step might be represented by an individual, they should network with all those in their constituency who share their interest. In other words we should have a Convener from each constituency – such as was the case in the past with Technikon Advisory Committees:

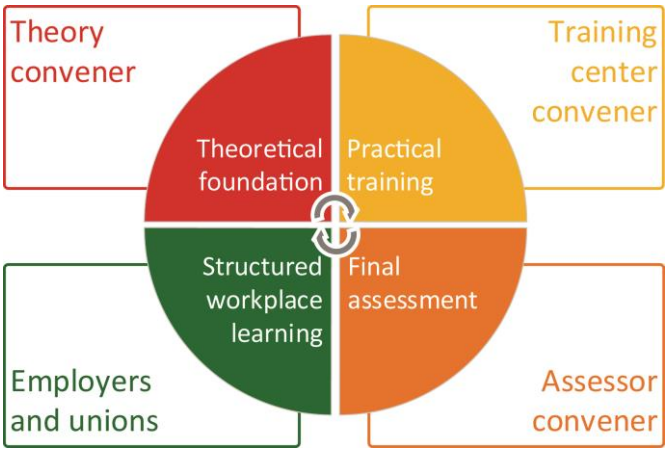


Figure 14: Components of occupational teams

The recently published **White Paper for Post-School Education and Training: Building an Expanded, Effective and Integrated Post-School System** endorses this approach:

'An important development in the management of the Strategic Infrastructure Projects is the establishment of Occupational Teams. These teams will bring together representatives of employers, education and training providers, professional bodies and others such as trade testers and licence issuers. Their purpose is to address problems of curriculum relevance and alignment between institutional (theoretical) and workplace (practical) learning as well as work placement problems at a systemic, national level. The implementation of this concept in the Strategic Infrastructure Projects will be evaluated and extended across vocational and professional training generally wherever possible.' (White Paper: 65/6)

HISTORICAL ROOTS: ADVISORY BODIES

Occupational Teams are not a new idea. The core idea grew out of the old Apprenticeship Committees where employers, unions and college lecturers met to discuss not only contractual issues, but also issues pertaining to the content of learning required per trade.

When the complexity of work performed by certain artisans grew, and the new occupation of technician was born after World War II, a new qualification was born – the diploma – providing the expanded theoretical foundation needed by this new class of worker. However the diploma retained a key artisanal feature: the combination of theoretical and workplace learning. To keep the training up to date and relevant, the notion of Advisory Committees was born.

Advisory Committees were national structures that were formally coordinated by the Committee of Technikon Principals (CTP). The CTP nominated one faculty of one Technikon to be the Convener of all Technikons for a particular technical area (e.g. electrical engineering) and it became the responsibility of that Convener to establish a committee that met at agreed intervals with leading business people with an interest in the occupation, to ensure that the programme remained relevant and up to date. It was the responsibility of the Convener Technikon to keep all Technikon lecturers informed about the outcomes of these discussions with business so that all could benefit.

These Advisory Committees continue today under the South African Technology Network (SATN), although their status has reduced somewhat since Universities of Technology (UoTs) (the new name for Technikons) are now permitted to generate their own unique qualifications within national guidelines set by the Council on Higher Education (CHE). In other words, there is no longer one National Qualification and curriculum to which all institutions must adhere. Some UoTs have Advisory Committees at institution level now i.e. meetings with business to inform their own career curriculum and learner placement.

CONVENERS AND NETWORKS: STILL WORK TO BE DONE

Much work still lies ahead when it comes to building occupational networks. In this first generation report, only the direct members of the Occupational Teams have, in general, been involved in the preparation of reports (although individuals were frequently drawn from organisations, such as professional councils, voluntary associations or trade associations, such as the plant hire association, which have consulted more broadly). In future the Portal will be a critical tool for the dispersed communities of practice to engage with draft reports prepared by the core team and to comment on and contribute to them. The goal will be:

- **Theory** – For OTs to link relevant lecturers engaged in teaching the foundational programmes across all institutions (universities or colleges)
- **Workplace** – For OTs to identify key employers drawn from each of the sectors where the occupation is practised to be consulted on draft reports. As a step towards this goal, this report identifies the SIP sectors which require the specific
- **Assessment** – For the organisations with the statutory or socially accepted responsibility for assessment of final competence to ensure that reports support the achievement of standards (and ethical practice).

OCCUPATIONAL TEAMS AND SECTORAL SPECIALISATION

Specialisation is commonly raised in the SIP community. It is argued that specialist skills

are required for a particular scope of work and that this is not routinely covered in the broad foundational programmes for individual occupations. This is an important issue for the Occupational Teams and speaks directly to the networks they must establish if they are to serve national objectives and to provide learners with optimal mobility across all the sectors where their skills might be applied. Figure 15 tries to capture the way in which networks must be established to deal with this issue.

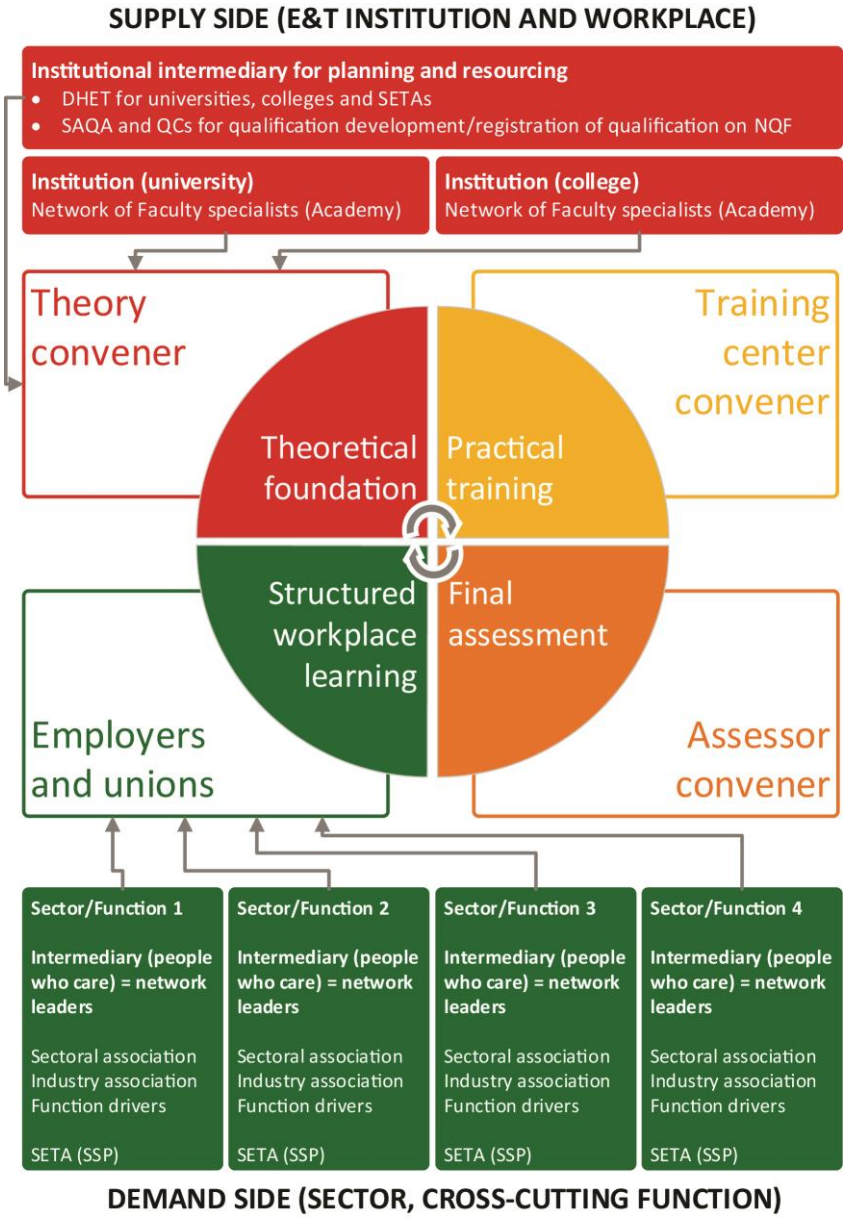


Figure 15: Developing networks between employers, theory providers and other role players

Not all networks are yet in place, but if such a system were nationally applied, then SETAs could play a central role. For example, all SETAs could be asked to interrogate their grant databases and determine which

employers have sought and received grants to train a particular occupation on a regular basis. These employers could be invited to participate in the electronic network of a particular occupational team. This model needs to be further explored.

THE CORE FUNCTION OF OCCUPATIONAL TEAMS

- Determine why there is a shortage?
- Determine where are the major challenges?
- Recommend solutions for challenges at each step along the learning pathway i.e. for theory, practical, workplace and assessment
- Prepare reports to feed into mainstream planning and resourcing

ESTABLISHING OCCUPATIONAL TEAMS

On 6 August 2013 the Minister of Higher Education and Training, Dr Blade Nzimande, launched the concept of Occupational Teams (OTs) to assist the SIPs Team to formulate appropriate strategies to address the scarcities identified.

The partners shown in Table 6 were asked to assist with the establishment and oversight of these Occupational Teams.

The partners were called Intermediate Bodies. A meeting was held at the end of September 2013 where a wide range of carefully selected stakeholders were asked to become OT members and to prepare reports following a given template for their occupation. There were about ninety occupations to be addressed in this way.

Table 6: Intermediate bodies responsible for Occupational cluster

Occupational Clusters	Intermediate Bodies
Managers (public sector prioritised)	Department of Public Service and Administration
Professionals and Associate Professionals	Council for the Built Environment
Service and Clerical Workers	Services SETA
Trades	INDLELA, DHET
Plant and Machine Operators	Transport SETA and the Plant Hire Association
Elementary and Non-Trade Production Workers	Construction Industry Development Board

In addition to assisting to establish the Occupational Teams, the Intermediate Bodies were charged with the responsibility of identifying common challenges across all of the occupations in their cluster and to identify generic solutions to address them. It has therefore been the Intermediate Bodies that have written the extensive introductory sections for Chapters 5 to 10.

OCCUPATIONAL TEAM REPORTS AND RECOMMENDATIONS

Following their identification of challenges, Occupational Teams were asked to make recommendations under three broad headings. The first two relate to proposals with regard to direct learners, the third relates to a broader range of interventions aimed to improve the capacity of the institutions and workplaces to produce more successful graduates.

THEORY

This refers to the number of individual learners for whom additional support is required to attain a foundational qualification needed for the occupation. In the main this refers to bursaries or loans provided for learners attending a university or college course. OTs were also to report on:

- Number of learners per year who needed support
- The unit cost of providing support to an individual learner

WORKPLACE

This refers to the number of workplace incentive grants required for employers who are in a position to provide structured workplace learning (i.e. for employers who have the capacity to provide the training required for learners to attain full occupational competence). OTs were also to report on:

- Number of workplace incentive grants required per year
- The cost of providing one incentive to one per employee for the required workplace training

OTHER

This refers to the supporting measures required to assist providers or workplaces to deliver the required training. OTs were asked to quantify and determine costs of support needed. A range of support measures emerged:

- **Career guidance** – It is often the case that previously disadvantaged learners simply do not know of the range of occupations for which there is a demand and towards which they could study. This results in too few students enrolling in critical areas. This needs attention
- **Qualifications** – In some instances the qualifications need to be updated or developed from scratch to ensure they are relevant and up-to-date. There is also frequently a problem with the alignment between theory and workplace learning requirements
- **Curriculum** – The curriculum needs to be regularly updated. For many universities this is an institutional affair (although some professional bodies do accredit these institutions using national criteria). For colleges, curricula are national.
- **Learning materials and open learning** – The materials that support the curriculum similarly need to be up-to-date and relevant to the needs of the labour market. Increasingly there is the need to develop complementary open learning materials.
- **Staff** – Under this heading there are a range of issues:
  - Some institutions do not have the requisite departments so new Chairs at universities or Departmental Heads at colleges need to be appointed;
  - There are not be enough people to lecture the growing student body;
  - Lecturers may themselves require education, training and workplace exposure
- **Learner support strategies** – Learners from poor school backgrounds find it difficult to adjust to the more independent learning expectations of post-school learning and therefore too often drop out or fail. They need support interventions to assist them to succeed such as tutorials, senior students supporting junior students, peer learning groups.
- **Equipment** – A great deal of equipment is needed to ensure that buildings are learning spaces. In many instances the paucity of equipment constrains the ability of learners to succeed in their studies. It is vital that this is remedied.
- **Workplace supervision and mentorship programme** – Some workplaces have insufficient capacity to provide quality, structured learning. In some instances this can be addressed by providing support to workplace supervisors and in other cases external mentors are required. These arrangements need to be put in place to optimise learners' prospects of progressing successfully to full competence.
- **Assessment issues** – While it is usually the case that there are clear qualifying criteria for final competence assessment, there are issues that often need to be addressed such as recognition of prior learning, access, scheduling.

- **Research** – In some cases there is a need to conduct further research to establish what precisely the problems are in relation to a particular occupation. In other cases research is required to build the cohort of lecturers (who themselves require higher degrees to qualify for lecturing posts). These both need to be supported.

The above items do not, in the main, take into account the physical infrastructure required for the occupations identified. Issues such as student accommodation, lecture halls, laboratories and the like have largely been addressed under SIP 14 (see Chapter 12).

Note: The heading Other addresses Focus Three of the SIP Skills Plan: Building Capacity of Institutions.

OCTOBER 2013

The first generation reports from Occupational Teams were prepared in a highly summarised format to facilitate the handover to agencies responsible for planning and resourcing. OTs were simply asked to advise whether increased enrolments were required in 2014, what support was needed in the workplace and to list any other items which required attention in the short term.

An example of the first generation reports is shown in Table 7 outlining the support required for Land Surveyors.

JULY 2014

Chapters 5 to 10 are the second generation reports from the Occupational Teams. They provide more detail and recommendations from each OT and are based on the detailed request for data as outlined in the previous section.

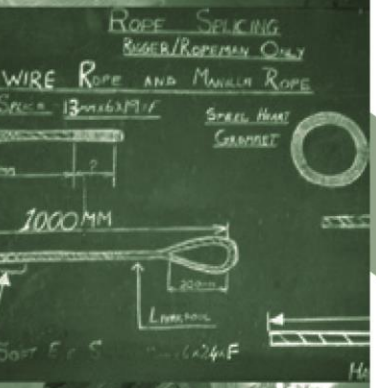
Table 7: October 2013 report on surveyors

OFO	Occupation	Theory	Workplace	Other
Surveying and mapping				
216502	Land surveyors *Land and engineering surveyors are in short supply. To increase the numbers, more equipment and the development of more academics is essential.*	MSc Scholarship for 10 @ R 100 000 per post graduate p.a. PhD Scholarship for 5 @ R 150 000 per postgraduate p.a. *(These are to develop the next generation of lecturers.)*	R180 000 per candidate over three years. A total of 40 new candidates to be taken on annually *(These are to ensure that graduates get the necessary structured workplace learning.)*	Increase enrolment, in all degrees through marketing and career guidance: R 100 000 p.a. Equipment required for increased enrolment UCT – R 2 755 000 UKZN – R 1 182 136

STATUS OF RECOMMENDATIONS MADE BY OCCUPATIONAL TEAMS

The recommendations that have been made by the Occupational Teams are not automatically endorsed by the Department, institutions or other planning and resourcing agencies. These recommendations must be considered, measured against disbursement criteria and competing claims and where accepted or not accepted. However, it is important that they are carefully considered and they are submitted in this report for just such a purpose.

School



Theory

Practical

Workplace

Assessment

Expertise

SECTION III: THE OCCUPATIONS

Contents	Section III
Chapter 5	**Professionals and Associate Professionals**
	Overview
	Challenges in detail
	Increasing roles expected of councils
	Built environmental and planning professionals
	Construction professionals
	Engineering professionals
	Scientists
Chapter 6	**Service and Support Workers**
Chapter 7	**Trades**
	Historical Overview
	The Artisan Programme
	Trades
Chapter 8	**Operators**
Chapter 9	**Elementary Workers**
Chapter 10	**Managers**
	Public sector competency framework
	Managers
	IDMS

CHAPTER 5

Professionals and Associate Professionals

OVERVIEW

Most professions identified as priority professions for delivering the SIPs are associated with the planning, design, development, operations and maintenance of projects, products, systems or processes. They are required to solve problems, exercise professional judgement and make sound decisions with respect to planning, designing, building, operating and maintaining infrastructure.

Most of these professionals are regulated by the various Acts falling under the Departments of Public Works and Rural Development and Land Reform. The purpose of these regulations are to protect the public in terms of health, safety and well-being. This is necessary due to the responsibility that professionals carry.

STATUTORY COUNCILS AND PROFESSIONAL REGISTRATION

The councils are as follows:

- South African Council for the Architectural Profession (SACAP), established by the Architectural Profession Act of 2000 (Act No. 44 of 2000)
- South African Council for the Project and Construction Management Professions (SACPCMP), established by the Project and Construction Management Professions Act of 2000 (Act No. 48 of 2000)
- Engineering Council of South Africa (ECSA), established by the Engineering Profession Act of 2000 (Act No. 46 of 2000)
- South African Council for the Landscape Architectural Profession (SACLAP), established by the Landscape Architectural Profession Act of 2000 (Act No. 45 of 2000)
- South African Council for the Quantity Surveying Profession (SACQSP), established by the Quantity Surveying Profession Act of 2000 (Act No. 49 of 2000)
- South African Council for Professional and Technical Surveyors (PLATO), established by the Professional and Technical Surveyors Act of 1984 (Act No. 40 of 1984)
- South African Council for Natural Scientific Professions (SACNSP), established by the Natural Scientific Professions Act of 2003 (Act No. 27 of 2003)
- South African Council for Planners (SACPLAN), established by the Planning Profession Act of 2002 (Act No. 36 of 2002)

Two professional bodies which were not established by an Act, but which encourage the development of professionals are:

- Institute of Information Technology Professionals South Africa (IITPSA)
- South African Institute of Draughting (SAID)

SAID is recognised by both SACAP and ECSA as a Voluntary Association relevant in the architectural and engineering fields respectively.

The professions and categories of registration recognised under each of the Acts are shown in Figure 16. It should be noted that although specific categories of registration were listed as scarce, for example chemical engineering technicians, professional teams are required to deliver infrastructure. More detailed investigations highlighted the need to address challenges associated with delivering each team of professionals, so most reports cover all team members.

Table 8: Professions associated with the SIPs

Profession	Council	Category of registration	Designation
Architecture	SOUTH AFRICAN COUNCIL for the ARCHITECTURAL PROFESSION	▪ Architect ▪ Senior Architectural Technologist ▪ Architectural Technologist ▪ Architectural Draughtsperson	Pr Arch Pr S Arch T Pr Arch T Pr Arch Draught
Construction	SACPCMP South African Council for the Project and Construction Management Professions	▪ Construction Project Manager ▪ Construction Manager ▪ Construction Mentor ▪ Professional Construction Mentor ▪ Construction Health and Safety Agent ▪ Construction Health and Safety Manager ▪ Construction Health and Safety Officer	Pr CPM Pr CM CMentor Pr CMentor Pr CHSA CHSM CHSO
Engineering	ECSA	▪ Engineer ▪ Engineering Technologist ▪ Certificated Engineer ▪ Engineering Technician	Pr Eng Pr Tech Eng Pr Cert Eng Pr Techni Eng
Landscape Architecture		▪ Landscape Architect ▪ Landscape Technologist ▪ Landscape Technician ▪ Landscape Assistant	Pr LArch Pr LA Techno Pr LA Techni Pr LA Assist
Quantity Survey	THE SOUTH AFRICAN COUNCIL for the QUANTITY SURVEYING PROFESSION	▪ Quantity Surveyor	Pr QS
Natural Science	SACNASP South African Council for Natural Scientific Professions	▪ Natural Scientist ▪ Certified Natural Scientist	Pr Nat Sci Cert Sci Nat
Survey/ Geomatics	PLATO	▪ Land Surveyor ▪ Engineering Surveyor ▪ Technician Engineering Surveyor ▪ Professional GIS Practitioner ▪ GIS Technologist ▪ GIS Technician	Pr L Pr S S GISc Pr GISc T GISc Techn
Town and Regional Planning	The South African Council for Planners SACPLAN	▪ Professional Planner ▪ Technical Planner	Pr Pln Tch Pln
Information Technology	IITPSA Institute of Information Technology Professionals South Africa	▪ Associate Member ▪ Full Member ▪ Professional ▪ Fellow	AMIITPSA MIITPSA PMIITPSA FIITPSA
Draughting		▪ Associate Member ▪ Full Member	

DEVELOPMENT PATHWAY

Prospective professionals follow a protracted development pathway of at least 8 to 10 years after matriculating before they are able to operate independently. The requirements are as follows:

- **Schooling** – demonstrate an aptitude for mathematics and science as required by each programme in higher education
- **Theory** – complete an accredited professional degree or diploma through a University or University of Technology
- **Workplace** – complete a workplace training phase usually over three or more years under supervision and mentorship. In terms of the various Acts, during this phase the professional in training is known as a candidate practitioner and the phase is usually referred to as the Candidacy Phase. Candidates are required to:
  - Follow a prescribed range of activities and complete logbooks or follow best practice guidelines as issued by their professional body, and develop a portfolio of evidence
  - Be exposed to an adequate range of activities, increasingly complex work and increasing responsibility, until they have reached the level where they can perform as independent professionals
  - Submit logbooks, portfolios of evidence, reports as required, either during the course of their development, or when ready for assessment for the purpose of registration
- **Assessment** – be assessed through examination or peer review or both to determine whether the required level of competence required has been achieved
- **Registration** – be awarded designations commensurate with their education, training and experience
- **Expertise** – once registered, a professional will continue to work towards becoming an expert and must:
  - Adhere to the Code of Conduct prescribed by the relevant Statutory Council and must work within the practice area for which their education, training and experience has rendered them competent
  - Continue to develop and keep up to date by actively engaging in Continuing Professional Development (CPD).

The development pathway is shown in Figure 16.

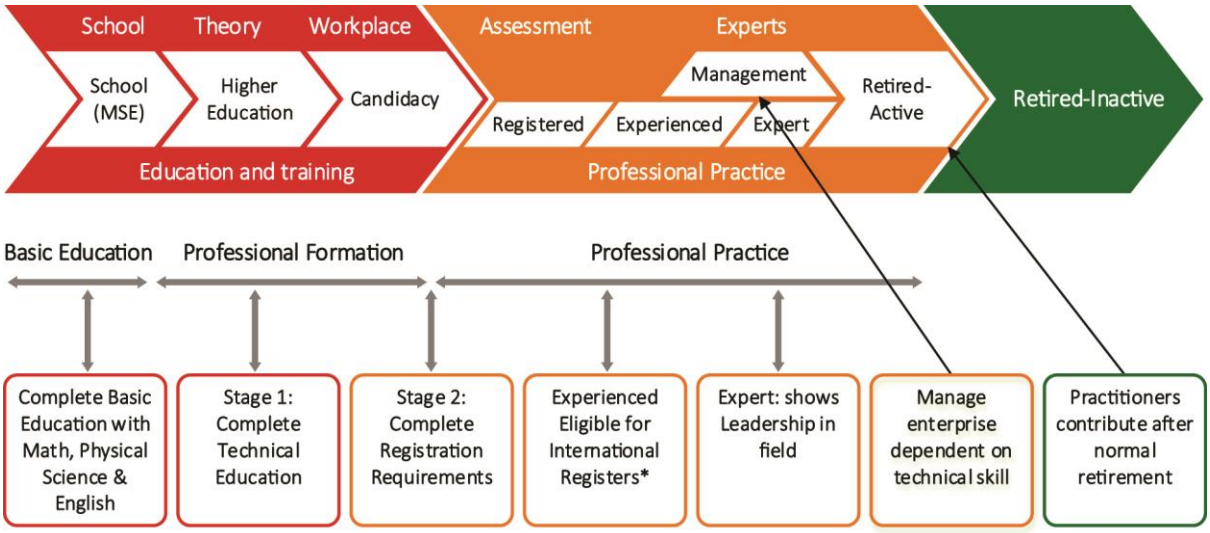


Figure 16: The professional pipeline

SAQA AND THE PROFESSIONS

Recognising that development towards professional registration is indeed a learning pathway, and that it contributes to the development of a professional, the National Qualifications Framework Act (2008) has extended the scope of the SAQA, to permit it to register a professional designations on the NQF.

The importance of taking this step was to promote public understanding of, and trust in, professions through the establishment of a nationally regulated system for the recognition of professional bodies and of professional designations. The requirements for registering a designation on the NQF are that a professional body, among other things, must:

- Be legally constituted and represent or regulate a community of expert practitioners
- Protect the public interest (including health, safety and the environment) in relation to services provided by its members and must be cognisant of the associated risks
- Develop, award, monitor and revoke its professional designations in terms of its own rules, legislation and/or international conventions
- Set criteria for, promote and monitor continuing professional development (CPD) for its members to meet the relevant professional designation requirements
- Publish a code of conduct and operate a mechanism for the reporting of, and investigating of members who are alleged to have contravened the code

To date, ECSA, SACAP and SACPCMP have been registered by SAQA, representing by far the majority of all professional groupings associated with the SIPs. The applications of SACQSP, SACNSP and IITPSA are in the pipeline.

SUMMARY OF CROSS-CUTTING CHALLENGES

The professions face a number of common cross-cutting challenges which will be discussed in detail below. In summary they are:

SCHOOL

Inadequate career guidance and consequently in some instances inadequate numbers enrolling appears to be the problem in some occupations. Too few applicants with the requisite entrance requirements appears to be another problem which limits enrolment in highly specialised and complex courses.

The overriding challenge though, appears to be the poor maths, science, literacy and problem solving ability of matriculants, who struggle with the transition to higher education. This then puts a load on HEIs who find it necessary to give much attention to underprepared students.

THEORY

The overriding top three priorities expressed by most theory providers were:

- The need for more teaching and support staff
- The expansion of facilities and updating and/or increasing the range of equipment required in laboratories
- The need to provide more student support

WORKPLACE-BASED LEARNING

Placement opportunities and funding for structured workplace training, mentoring and coaching was the overriding request from employers. Access to sufficient capacity for coaching and mentoring is also a problem.

ASSESSMENT

In some instances, the size of statutory councils is such that they are unable to offer the level of support required in terms of assessment, CPD and the development of expertise. Support to

expand assessment capacity, particularly in terms of RPL is required in several instances.

EXPERTISE

Limited recognition of the value of professionals and how they can contribute to service delivery in the public sector is considered a problem. The OTs expressed the view that South Africa should harness all experts in the short term while developing future skills.

Finalisation of the Identification of Work, to ensure that all professionals appointed are competent, registered professionals requires urgent attention.

CHALLENGES IN DETAIL

Cross-cutting challenges and solutions are outlined in detail in this section, and specific challenges and support required will be outlined where relevant per occupation.

Whenever concern is expressed about the lack of a certain skill, the temptation is to increase the number of entrants into the appropriate programme. This does not produce the quantum or level of expertise required.

In terms of quantum, throughput rates are a challenge and, in terms of expertise, employers are generally seeking applicants with years of experience.

The challenges associated with throughput are legion. Failure and dropouts are costly to the nation and demoralising for students and their families. In a bid to understand higher education challenges, the Engineering Council of South Africa (ECSA) commissioned a study on the levers for change in 2012 and published detailed findings entitled **Improving Throughput in the Engineering Bachelor's Degree.**[9]

The levers for change were identified as:

1. The school pipeline
2. Student selection
3. Student support
4. Curriculum
5. Teaching and learning
6. Staffing
7. Funding

Engineering Departments at universities and universities of technology were asked to give their input on what support was required under each of the headings above. The findings were echoed by research carried out by the physics community.[10]

In debating what the numbers should be, one needs to be mindful of the analysis carried out by Prof Hall many years ago. He explained to his MBA classes that in apartheid South Africa the ratio of white professionals to the white population, at the time, matched the ratio of professionals to population in Western countries. Since the only professionals in South Africa at the time were white this meant that not enough professionals were being trained to support the entire population and this would one day be a problem. How right he was!

Research carried out by the Production of Professionals Technical Task Team of the Human Resource Development Council of South Africa indicates that South Africa has on average less than one tenth of the number of professionals in many professions from engineers to financial and medical professionals when compared with a range of countries.[11] Substantial increases in the numbers of professionals, are required.

In terms of Built Environment Professionals the number of graduates has almost doubled since the dip of the early 2000s. The White Paper on Post-School Education and Training suggests that enrolments should increase by 70% by 2030 i.e. an increase of 3% on average per

annum.[12] It is essential that these increases translate into successful graduations.

The following sections cover proposed support to address the bottlenecks and to grow the number of professionals.

SCHOOL

There are many areas relating to the primary and secondary school stages of the pipeline which need to be addressed.

THE RIGHT SUBJECTS AND RESULTS

Table 9 indicates the subjects required for entry into a number of the professions. It can be seen that most professions require matriculants to have attained at least 60+ in English, mathematics and, in some instances, physical science, while several universities require 70+ for some of these subjects. There are only some 37 000 matriculants who achieve 60+ for mathematics and of those only 5 000 to 6 000 currently are African. This severely limits the numbers who can enter many professions required for the delivery of the SIPs and is a challenge in terms of transformation of the professions. There are many other occupations competing for these learners, including all the other science degrees, accounting, actuarial science and medicine.

At universities of technology, the requirements are less demanding, but they also stipulate maths and not maths literacy. The number of technicians required is substantially more than professionals, so in some cases there are not enough applicants who satisfy their entry criteria. Where learners with lower results are selected they are seldom successful.

For those with an interest in pursuing any technical or scientific career, guidance early on in high school is essential to ensure that they take the correct subjects to be able to enter their chosen field of study.

UNDERPREPAREDNESS

Universities lament the underpreparedness of students entering higher education.

Communication skills

Communication skills are a fundamental requirement for effective teaching and learning as all knowledge, skills and attributes must be attained via effective communication. Many students entering higher education have very poor communication skills which exacerbates the difficulty in comprehending new learning material and producing reports, projects, assignments and presentations. Well-structured compulsory language preparedness tests in the language of tuition must form part of the admission procedure.

Numeracy and literacy

The introduction of Outcomes Based Education, though believed to produce learners who are better at team work and doing project work, has resulted in a reduction in numeracy and literacy levels of matriculants. Even those who satisfied the entrance criteria for higher education have been found wanting in mathematics and only 47% were found to be proficient in English.[13] This negatively affects throughput rates at higher education institutions (HEIs).[14]

Numeracy skills have also been tested by DUT.[15] It was found that only 22% of the first year engineering class scored more than 50% on simple multiplication tables. They introduced NumberWise, an online numeracy programme and found that once students were numerate, they achieved a 20% improvement in results for all engineering subjects.

Table 9: Entrance criteria for professional occupations

Discipline	University						University of Technology					
	Maths		Science		English		Maths		Science		English	
Aeronautical engineering	60+	70+	60+	70+	60+							
Chemical engineering	60+	70+	60+	70+	50+	60+	50+	60+	50+	60+	50+	60+
Civil engineering	60+	70+	60+	70+	50+	60+	50+	60+	50+	60+	50+	60+
Electrical engineering	60+	70+	60+	70+	50+	60+	50+	60+	50+	60+	50+	60+
Industrial engineering	60+	70+	60+	70+	60+		50+	60+	50+	60+	50+	60+
Mechanical engineering	60+	70+	60+	70+	50+	60+	50+	60+	50+	60+	50+	60+
Mining engineering	60+	70+	60+	70+	50+	60+						
Architecture	50+	60+	50+		50+	60+	40+	50+	50+		50+	
Astronomy	60+		60+		50+							
Building Science	50+		50+		60+		40+	50+	40+	50+	50+	
Construction management	50+	70+	50+	60+	60+		50+		50+		50+	
Forestry	50+		50+		50+		40+				40+	
Land survey	70+		60+	70+	50+		50+		40+	50+	50+	
Landscape architecture	50+		50+		50+	60+	40+				40+	
Physics	60+		60+		50+	60+						
Quantity survey	50+		50+		50+	60+	50+				50+	
Town planning	50+	60+	50+		50+	60+		50+			50+	

Source: University and UOT websites

PROBLEM SOLVING

Bridging the gap between school and university is recognised to be a huge challenge. Over recent years the complexity of subjects at school is thought to have reduced[16], with learners generally learning by rote and preparing to pass matric by doing past exam papers ad nauseam. The move to learning process rather than principle has impacted on the success rates of first year students at universities as they are particularly challenged by:

- The intensity of the work
- The rapid progression from one set of concepts or procedures to another
- The independence which is expected of them at university with respect to their own learning

A return to developing analytical and thinking skills, problem solving skills, enhancing language and communication skills, both oral and written, and encouraging independent learning in schools is essential, along with much dedicated support in the early months of higher education.

Universities suggest that a major review of the school curriculum and teaching practices is required, as university admissions data indicate that fewer than 10% of secondary schools in South Africa account for almost all successful admissions, even with preferential policies in place for applicants from disadvantaged backgrounds.[17]

CAREER GUIDANCE

Awareness of many occupations is lacking amongst learners at school level. Major effort needs to be expended to create awareness of the many opportunities which exist, not only in the professions, but across all occupations.

Chapter 13 outlines career guidance support available through DHET and must be strengthened in the case of the smaller or newer occupations such as aeronautical engineering, landscape architecture, construction health and safety, industrial

engineering, land and engineering surveying, geographic information science and forestry science. Engaging with learners on the established professions is equally important to ensure a continuous inflow of high calibre applicants.

In terms of the traditionally white male image of many of the professions, emphasis needs to be placed on attracting female and black students into the professions.

STUDYING FOR THE RIGHT REASONS

Career guidance is important not only in terms of attracting entrants into professional occupations, but ensuring that students enter these occupations for the right reasons. It is quite common to find students following a particular course because they were able to get funding, only to find once they have commenced their studies that they did not like the career that they had chosen.

SELECTION

The old syllabus was demanding, and the matric results were a fairly accurate predictor of success, but currently it is quite common for students with straight A's to drop out of university, and average students to make it.

Since senior certificate symbols are no longer considered to be an accurate indicator of student ability, a range of entrance assessments are carried out by various universities. These include the Admissions Point Score (APS)[18] and the National Benchmark Test (NBT). The NBT was commissioned by Higher Education South African (HESA) to assess academic readiness as a supplement to secondary school reports.[19]

Specific assessments have been developed by various institutions such as the Access Assessment Battery (AAB) at Nelson Mandela Metropolitan University, ASPECT at UCT, INCITE at UKZN etc. They are designed to measure the learner's ability to reason and solve problems.

It is suggested that the NBT results be made available to all HEIs through a central system.

Several universities reported that they were able to select the cream of the crop, whilst others lamented the unsuitability of some of their students and suggested that interviews or a rigorous test battery be introduced to identify top applicants and channel others to learning programmes such as Higher Certificates etc. Clearly research and more comprehensive solutions to the selection process is required.

REVIEW OF THE SCHOOL SYSTEM

Support from early on

Before moving off the schooling bottleneck, it needs to be recognised that improved teaching and learning needs to be addressed from grade 1. The size of classes, ability and number of teachers, methods of teaching and keeping learners engaged and excited about asking questions and learning needs to be addressed across the entire system.

Matric outcomes to address HE needs

It appears that the outcomes measured in matric are misaligned with respect to the requirements of higher education. The Department of Basic Education should be encouraged to consider HE requirements when reviewing the matric curriculum.

OT RECOMMENDATIONS

The OT recommendations with respect to schooling should be considered to start addressing the challenge of underprepared entrants wishing to enter higher education.

OCCUPATIONAL TEAM RECOMMENDATIONS FOR SCHOOLING

Numeracy and literacy

- Consideration should be given to reintroducing the equivalent of Higher/Standard Grade for Mathematics in preference to Maths Literacy
- Mathematics and science should be given top priority by ensuring that teachers undergo teacher training in their subjects and are rewarded for successful output
- Senior Certificate results, in particular for Mathematics and Physical Science, must not be adjusted to achieve a higher pass rate
- Schools achieving good results in advanced programme mathematics (AP maths) should be funded to accept learners from neighbouring schools without AP maths to participate in their classes
- Significant development and refurbishment of physics laboratories for grades 10 to 12 is required
- Improve communication and literacy skills
- NumberWise or equivalent numeracy programmes should be introduced to all primary schools to ensure that secondary school entrants have the basic numeracy skills in place
- Review matric outcomes to better align with higher education requirements

Career guidance

- Professions should engage with NCAP to enhance the information on the portal and elevate their occupations by participating in radio broadcasts and career fairs

Selection

- NBT should be centrally available for selection purposes by October each year
- A national review of current approaches to selection, together with open debate about what is being done, what has been learnt, and how selection processes could be improved, should be convened

THEORY

In the short term, only a small number of professions indicated the need to increase enrolment with immediate effect. In the long term however, it is recognised that numbers of all professions should increase not only to address expansion demand, but also address replacement demand.

The most concerning challenge highlighted by respondents and captured in many research papers is the throughput challenge. In their report, Scott, Yeld and Henry[20] noted how the 2000 cohort study conducted by the DHET revealed that, five years after entering their course of study (i.e. in 2004), only 30% of the total first-time-entering student intake had graduated, 14% were still in the system and 56% had left without graduating. Only 54% of the students who enrolled for a four-year professional bachelor's degree in engineering in 2000, had graduated within a five-year period, while 19% were still in the system.

Although disturbing overall, the picture for engineering students at Universities of Technology (UoTs) was much worse. Nationally, a mere 17% of students who enrolled for a three year National Diploma in Engineering in 2000, at residential educational institutions graduated within a five-year period while 14% were still in the system. Based on these findings, fundamental, targeted interventions are clearly long overdue and urgently required.

In the mid – 2000s universities received funds to extend engineering and built environment facilities. This was however largely for redress especially for those universities that were already stressed with student enrolments and lack of space. Required growth in terms of current projections was not sufficiently catered for.

The following section discusses a significant range of actions required, largely to address throughput. Although these are costly, the cost of not addressing them is more costly to the nation, as underprepared students lead to extensive dropout rates, which in turn leads to economic loss and a shortage of high-level skills nationally not to mention the human cost for the individual concerned.

Considering only the drop outs from engineering degree courses this amounts to some R40m to R50m per annum. The additional cost of those who take five and more years to complete would mean that the cost of slow progress for engineering degrees alone amounts to hundreds of millions of Rands, a cost which could be reduced with improved selection and higher education capacity.

INFRASTRUCTURE

Facilities limited

Where facilities and teaching space is limited, enrolling more students is not an option. Assignable square metres (ASM) dictate the number of students who can actually be accommodated per square metre. Universities such as Wits which is constrained by the size of the campus would be hard pushed to increase numbers. Many others need to expand their infrastructure to cope with existing students, while others who physically have space are willing to develop and expand their facilities, if funding can be raised.

Expansion would need to include space for teaching, tutorials, practical's, libraries, administrative and student facilities.

It must be noted that lecture venues built in the 60s – 90s were in most cases designed to accommodate classes of up to 60 students. Breaking out walls (which is currently being done) to accommodate 120 students leaves venues which are audio-visually compromised as the distance from rear placed seats to the lecturer's podium and whiteboard/screen is too big. Comprehensive redesign is required for current teaching methods and engagement with students.

Too few institutions offering the course

In terms of more recent qualifications, or lesser known occupations, the demand is such that the qualification cannot be offered nationwide. In some instances there is a need to offer the qualifications at more universities and, in other cases, simply to expand capacity in the current institutions.

The decision on whether to offer courses more widely will largely be based on the regional spread of the demand and the viability of establishing new departments.

Equipment inadequate

When increasing numbers, laboratory equipment, including computer laboratory capacity generally becomes a bottleneck. The use of ICT and carrying out experiments in the various sub-disciplines plays a key role in developing technical competence, critical and lateral thinking. Many universities report having antiquated equipment, some dating back to the seventies, and many state that they simply do not have the number of sets of equipment required for the large student groups currently enrolled. This is particularly problematic in senior classes, as these have

more than doubled and the equipment required at that level is normally cost intensive.

It is suggested that DHET work with institutions to determine optimum equipment configurations and assist universities to leverage funding to achieve the level required.

STAFFING

Staffing is at the core of what it takes to make a meaningful impact to ensure the success of students. Staffing shortages, high vacancy rates, unsatisfactory staff-student ratios and staff attrition are evident across the system. The demands for more research, consulting to earn third stream income, and increasing levels of reporting and administration, detract from the business of teaching. The JIPSA study of 2008 should be consulted for a comprehensive range of challenges and solutions relating to staffing.[21]

Vacancies

Substantial vacancies exist in terms of lecturing posts, and institutions repeatedly advertise and get few if any applications. The main reason for lecturing staff leaving the sector or not wanting to enter is the heavy load due to the large number of students, and lack of competitive packages.

The JIPSA report of 2008[22] identified that salaries of lecturing staff in the engineering sector needed to increase by at least 25 – 30% to make the career more attractive. Paying an additional non pensionable allowance would not necessarily resolve the problem as lecturing staff also look to protect their retirement benefits and any increases in salary need to be pensionable.

Working conditions have deteriorated significantly since the overall student numbers from 2005 onwards have steadily increased – the staff to student ratio in some cases exceeds 120 which is considerably above the current DHET Academic: FTE staff norm (for engineering this is 1:20). The ability to supply the necessary support to individual students is severely compromised.

Too few lecturers

It is suggested that the DHET determine an appropriate Academic: FTE ratio and provide additional resources to ensure that additional posts can be created at competitive salaries.

FUNDING FOR FORESTRY EQUIPMENT AND BURSARIES

There are several avenues for accessing funds for equipment. Budgets, ear-marked funding, SETAs, contributions from industry and donations of equipment from suppliers are typical sources.

The FP&M SETA for instance has responded to SIPs research which identified a significant shortage of Foresters. They have committed to give the Forestry Departments of Stellenbosch and Venda Universities funding for four years to cover 30 bursaries and the upgrading of laboratory equipment. The bursaries should be primarily for students from disadvantage backgrounds and should cover registration, tuition and accommodation fees and industrial training in the workplace.

Picture taken at FP&M Seta offices, shows (left to right): Mr PK Naicker – FP&M Seta COO; Thuba Sithole – DHET; Ms F Yende – FP&M Seta CEO; Sinah Ndala – Council for the Built Environment; Mr Anton Kunneke, Stellenbosch University; Dr Allyson Lawless – DHET; Prof JJ Odhiambo – University of Venda

Recruitment of postgraduates into the academic profession remains a challenge, and the recruitment of black graduates, in particular, is constrained by their market value in industry and the uncompetitive salaries and working conditions of academic life. Conversely, equity and transformation requirements stand in the way of employing and developing white engineering graduates.

Most professional disciplines include several fields of study. For instance in civil engineering students study structures and water while electrical engineering students study power engineering and electronics and quantity surveyors cover building and civil engineering projects. This means that when there are too few lecturers to cope with class sizes, it is necessary to double the number of lecturers to ensure that there are enough specialists per study area. Where enrolment needs to be increased, a substantial increase in lecturing capacity is generally required.

A further complication is that existing lecture venues are not designed to accommodate large classes. They are then split which doubles the teaching load.

It is believed that increasing the number of academics to reduce class sizes in the first and second years will possibly make the most significant contribution to student success.

Higher qualifications and research

The demand at UoTs for all lecturing staff to have a minimum of a Master's degree to lecture, and for university lecturing staff to have a minimum of a PhD, is also proving to be a serious disadvantage to attracting potential staff. In UoTs it is also important to have staff with practical experience. It is suggested that a trade-off should be considered between professional registration and postgraduate qualifications in some instances.

Furthermore, lecturing staff are now expected to undertake research and supervise postgraduate students without a decrease in their lecturing load thereby placing further pressure on lecturing staff and contributing to increased stress levels.

Consulting

In addition to lecturing and research, academics are also expected to take on consulting work to earn third stream funding.

Given the above range of competing demands it is hardly surprising to hear lecturers saying 'We need to put the money into getting the foundations right, not on all of the extras!'

Developing young academics and researchers

There is a need to provide substantial bursaries to encourage students to continue with postgraduate studies and follow an academic or research career path. Not only are bursaries for PhDs necessary, but it is essential that adequate supervision is in place, and that scholars have sufficient funds to remain in the system and not be forced to withdraw due to socio-economic pressures. All too often they leave close to the end of their studies due to financial challenges. Universities try where possible to top up postgraduate allowances to retain them and appeal for contributions to their investment funds, set up for this purpose.

Developing existing staff

There is concern that few academics have had practical experience and cannot adequately contextualise the theory they are teaching. It is suggested that academics be given the opportunity when required to ensure that they gain sufficient practical experience through consulting, relevant research and being

seconded to industry to work towards professional registration.

Universities should also budget for covering professional registration fees and for academics to belong to at least one Voluntary Association, so that they can share their knowledge and benefit from being part of a knowledge network.

Laboratory and administrative staff

Laboratories play a key role in teaching and learning. The effective utilisation of laboratory equipment is subject not only to the availability but accuracy of the equipment.

Dedicated laboratory technicians are required to ensure equipment is adequately set up, calibrated, operated and maintained and to assist with practical sessions to achieve optimum results. Technicians should be well qualified and remunerated at rates which are attractive.

Administrative staff is required to remove the burden of routine paperwork and reporting from overstretched academics.

Few departments have adequate laboratory or administrative staff.

Retired capacity

Given the difficulty in attracting staff, universities believe that retired staff could contribute to selected lectures, practicals and projects such as in the field of design.

The practice of compulsory retirement should also be relaxed as such senior staff have excellent experience and knowledge to transfer to the students as well as to junior staff members.

THE CURRICULUM

Course load and academic support

There is concern that the course load of professional qualifications is too high, particularly in engineering. Over the years foundation programmes or extended programmes have been introduced to offer support for marginal students, but with limited success.

It is felt that students would be better served if the mainstream programmes were better resourced. Some universities are currently attempting to develop flexible curricula to allow students to progress at a rate that suits them rather than drop back when they fail key subjects. The jury is still out as to whether this will improve throughput results.

Of importance is the need for the curriculum to be uncluttered and for the regular repetition of certain concepts to be eliminated and rationalised across the curriculum.

Relevance of curricula and capacity to deliver

The Numbers and Needs[23] study identified weaknesses in civil engineering curricula and a re-curriculation exercise took place in 2006, but was never implemented, due to the emergence of the new HEQF.

The current three qualifications of national diploma, BTech and professional degree will be replaced by seven levels of qualifications, namely:

- Higher Certificate
- Advanced Certificate
- Diploma
- Advanced Diploma
- Bachelor of Technology
- Bachelor of Technology Honours
- Professional Bachelor's Degree

Concerns with the new model relate to whether institutions will have the necessary infrastructure and resources to offer the range

of qualifications, and whether the qualifications address industry needs.

A summit per discipline needs to be convened to determine industry needs, both in terms of qualifications required and content. Furthermore, the system of convenor universities and universities of technology building on the Occupational Team concept needs to be re-introduced to ensure consistency of offerings nationwide.

A directive needs to be issued to all institutions outlining the fact that no new qualifications will be approved unless they are accompanied by comprehensive documentation indicating industry support and the need for the qualification. Funding for the strengthening of the convenor model working with OTs needs to be made available.

Re-curriculation

In response to the HEQF, discipline-specific curriculum teams need to be established to develop reworked qualifications to replace existing qualifications. In many instances re-curriculation will mean developing completely new course content.

This process in itself adds a huge burden to academic staff.

New qualifications

In a small number of instances, the need for qualifications in new disciplines or sub-disciplines was identified. In these cases, it will be necessary to follow one of two paths:

- Modify an existing qualification in which case the qualification can be constituted and promoted within a 12 to 18 month period and can commence by January 2016
- Develop an entirely new qualification. This process requires institutions to follow the whole process of development, accreditation, approval, adoption and resourcing and the earliest such a qualification can commence will be January 2019.

In both instances, career guidance material will need to be developed and distributed through the various networks identified in Chapter 3.

TEACHING AND LEARNING

Traditionally, lecturers were selected based on expertise in their field, and there was no requirement for them to have formal teaching qualifications. With the increasing load, changing student profile, and generational learning differences, higher education needs to be able to engage today's students in new and contemporary ways.

Teaching expertise

Lecturing staff require knowledge in areas of didactics, pedagogy and andragogy, as most do not have teaching qualifications. They need to learn how to ensure total engagement of their students. Once better trained, lecturers should also be made accountable for outcomes in their subject(s) and should be rewarded for good results.

Teaching methods

There are a range of teaching methods which can be employed to enhance student involvement and interest including e-learning, simulations and modelling. Research needs to be carried out on the most cost effective methods, and implementation and training in the use of alternative methods to supplement current approaches must urgently take place.

Course material

Course material requires updating in many instances, and additional material which is easier to grasp is required for underprepared students to be able to catch up.

In terms of the HEQF, the new curricula will not be a repackaging of the old contents. It will be a

comprehensive re-think of the learning programmes so as to meet the exit level outcomes specified by the professional bodies as well as cover the contents needed by industry.

STUDENT SUPPORT

Student support is a complex topic which in short requires that the training of professionals is appropriately funded and resourced, and that all students, including those on foundation and extended programmes, receive the academic, financial and social support they need.

Enrolment

Where insufficient applicants meet the entrance criteria, the current strict adherence to equity requirements must be reviewed, as simply accepting students who do not meet the academic entrance requirements in order to achieve the targets is counterproductive for the students themselves, others in the class, and the lecturing staff. A more systematic solution is required.

Academic support

- Tutoring

South African universities lament the different learning approaches between black and white students, citing the fact that black students are less likely to ask for help and seldom study with peers.

This is not unique to South Africa and was identified by Professor Treisman[24] at Harvard as far back at 1983. In the USA, Asian students perform the best, as they spend more hours studying, at least 50% of which is in home groups where older siblings with matching qualifications are called upon to assist where students are struggling. In contrast Afro-American and Latino students spent less than half the time studying, always worked on their own and never asked questions. In response to this finding, the university introduced group learning in the form of regular workshops facilitated by graduate instructors allowing students to develop better study habits, share and learn from each other, and deepen their understanding of concepts. When this happened, Afro-American and Latino students produced comparable, if not better grades than their white and Asian peers.

The tutoring system, using postgraduate students and junior lecturers, who are trained to manage group sessions needs to be dramatically expanded and requires commensurate funding. Tutoring is particularly important in the early years of study where classes are very large and lecturers cannot possibly get to know all students and identify where they are struggling. Institutions which have introduced extensive tutoring support report improved throughput.

- Offer selected courses twice a year

One of the suggestions in terms of support students on so-called killer courses is to offer these courses in both the first and second semester, so that students failing the first semester still have a chance of completing the subject in the same academic year. As some subjects are prerequisites to proceeding to more advanced courses or the next academic year, this could assist throughput to some extent. Additional lecturing staff will be needed to cope with the additional load.

- Summer and winter school

Summer and winter schools have been introduced with success by some institutions to assist at-risk students with developing better foundation knowledge prior to tackling complex semester courses. These too can be delivered by postgraduate students who offer more sympathetic support to struggling students. Summer and winter schools can also

be considered to supplement tuition in so-called killer subjects.

- Numeracy

The considerable improvement in throughput achieved by DUT[25] through the use of NumberWise suggests that NumberWise should be implemented in all BE departments in UoTs.

- Create living learning environments

Over and above tutoring, there should be support after classes in residences to create living learning environments. Where possible, BE professionals should be housed in the same residences, so that they can get support from senior students and form peer groups for purposes of support and studying together. Such programmes should be formally established and rigorously implemented.

Work-integrated learning (WIL)

Many national diploma students have been unable to complete their qualifications due to lack of opportunities for work-integrated learning. At best their graduation may be delayed due to the time it takes to secure WIL. Some institutions report a three month delay but most suggest that taking a year or more to find WIL opportunities has become the norm.[26]

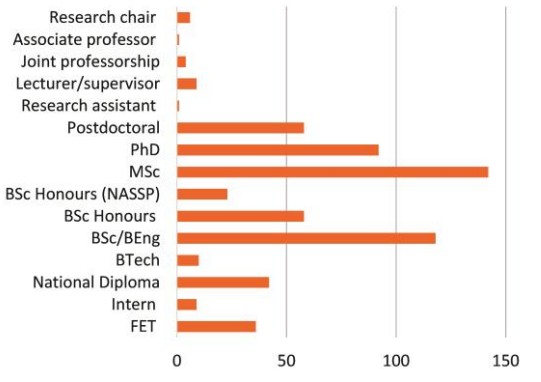
SETAs may pay grants for this phase of training, but the administrative burden when employing one or two students is a deterrent for most companies[27]. It is suggested that agreements be entered into between the SETAs and the UoTs, and the UoTs handle the placement, payment and monitoring of progress.

SKA BURSARY AND ACADEMIC SUPPORT PROGRAMME

When South Africa submitted its initial expression of interest to host the SKA in 2003, there were fewer than ten individuals in Southern Africa with experience in radio astronomy, science or engineering relative to the task at hand. To deliver and use the next generation of radio telescopes, and submit a competitive bid, the South African SKA Project leaders took the decision to initiate a capacity development programme which commenced in 2005.

Skills required to design, construct and operate the SKA and MeerKAT telescopes and to make optimal use of these radio telescopes for research, once commissioned, were identified and bursaries have been awarded to several hundred students since inception of the programme.

The bar diagram shows the number of grants awarded per academic level from 2005 to 2014, including support for developing academics and academic support personnel.



The photograph shows a proud team of SKA graduates who recently graduated from UCT at the same time that the leader of the project, Dr Bernie Fanaroff was awarded an Honorary Doctorate for his contribution to the programme and South Africa at large.

An annual allocation of R4 000 to R5 000 a month should be considered to cover stipends for the students and the overall cost of managing such programmes. (The current stipend is R3 000 and the placement and administration fee provided is 10%. This is not enough to cover identifying workplaces, handling placements, payments, supervision and monitoring progress). Providing mentorship should be a precondition for taking on students funded in this manner.

Financial

Bursaries and loans represent the main sources of funding for students. There are however several challenges associated with disbursement.

- Quantum

Student funding needs to be adequate to cover all their needs. It is undesirable for students to go hungry, or to be compelled to find employment to supplement their income and this detracts from their studies.

Where funds are inadequate, universities try to assist students with top-up funding to retain them. They appeal to industry to assist them with investment funds which they hold to disburse to needy students.

- Timing

When dealing with state funders such as NSFAS, and bursaries from SETAs, funds are often paid late, resulting in students having to miss many lectures. It is imperative that the timing of payments be reviewed and aligned with the academic calendar.

- Commencement and conditions

The practice of only offering bursaries from second year and withdrawing funding if a subject is failed is also limiting. Many deserving students with the aptitude and passion cannot commence studies without funding. Organisations need to fund students from the outset. To limit their risks, students should be selected through a rigorous assessment and interview process and should be offered support throughout their studies.

As indicated in preceding sections, few candidates complete their studies in the specified time. Bursary conditions should allow for failure of a small percentage of subjects, to prevent students dropping out prematurely.

- Priority skills

Preferential funding should be offered to students studying towards priority qualifications.

Social

At-risk students are generally those who face many more socio-economic challenges relating to family problems, crime, health and the like. They need substantially more support than affluent students. Counselling and peer groups should be set up for this purpose and residence committees should be tasked with seeking out students who do not participate in social events. They are often ill-equipped and unwilling to get involved in case they are exposed as being inadequate.

Buddy systems, pairing of first year students with senior students to introduce them to campus life, have been successful on some campuses and should be implemented widely.

Studies not completed

Many students get close to the end of their studies, but are unable to complete them because of personal or financial problems, lack of WIL opportunities, or having been unable to pass one or more of the so-called killer subjects.

Of particular importance is the need to re-consider the mix of subjects which must be completed in the institution from which a student graduates. The current 50% rule precludes many from completing their studies.

Typically if students drop out for personal or financial reasons, and must return home or eventually find employment in another centre, it is almost impossible to complete their qualifications at either the original institution due to locality or an institution in the new centre due to the need to repeat several subjects.

A major national campaign should be mounted to attract those with fewer than 120 credits to complete, to return to their studies, fully funded. The reasons for dropping out need to be included in their application, so that the need for additional support can be flagged where necessary.

FUNDING

Funding on higher education, as a percentage of GDP has been reducing over the years, to the point where South Africa even lags behind several African countries. Against this background, HESA has recently called for an increase in higher education spending to at least 1% of GDP, as against the current level of about 0,68%.[28]

While an increase in spending in the sector is desperately needed, other challenges also need to be addressed:

- A significant disparity exists between teaching input subsidy (a capitation subsidy based on enrolments) and teaching output subsidy, which is based on the numbers of graduates. The consequence of this is to reward growth in enrolments rather than graduate output. A more targeted and nuanced funding approach will be needed if funding is to provide stronger encouragement and support for improvements in throughput rates and graduate outputs
- Since the combined effect of admitting increasing numbers of underprepared students in an effort to meet targets for providing access to previously disadvantaged students is having a detrimental effect on retention, admission policies should be revised to correlate access and enrolment targets with retention targets
- There is a two-year time lag between increases in enrolments and increased funding reaching the institutions. This impacts negatively on institutions which are growing and needs to be addressed
- Due to the inadequacies of the structuring of NSFAS funding, it is contributing to increasing participation but not to increasing successful participation and improving student outcomes

In the context, the findings of the Ministerial Task Team on Higher Education funding are eagerly awaited.

Allocations and ring-fencing funds

Departments expressed frustration with the limited funding which made its way to them, explaining that in some cases less than 40% of the funds generated by them or allocated to them from DHET and external sponsors made its way to their departments, with the balance going to university overheads. It has been suggested that guidelines or even regulations be put in place to ensure that more income reaches the departments and programmes for which it was intended.

Chairs

The concept of organisations funding a Chair, i.e. a full professor or associate professor, as part of their social investment or responsibility should be encouraged. The current investment required is of the order of R 23m, which offers sufficient funds to be invested to ensure a Chair in perpetuity. The value is based on the current salary level of a professor, allowing some 30 – 40% for overheads and administration, investing the balance to give increasing returns

to cover increasing annual costs. These funds must of course be ring-fenced and managed by the accepting department.

Subvention

Where organisations cannot afford to sponsor a full Chair, they should still be encouraged to subvent individual salaries to bring them up to market related levels and ensure that departments are able to retain experienced academic staff.

Investment fund

Where organisations are not specific about the sub-discipline or post they wish to sponsor, it is suggested that they contribute towards an investment fund. Departments have suggested that they would like to build investment funds of the order of R50m in the short to medium term, so that they have annual income to use for subventing salaries and for assisting students whose funding is inadequate to fully support them.

OT RECOMMENDATIONS

The following recommendations should be considered to address throughput challenges and the need to increase enrolments in some occupations.

OCCUPATIONAL TEAM RECOMMENDATIONS ON THEORY

Infrastructure

- Raise funding to continue to develop more lecture theatres, offices, laboratories to accommodate increased enrolment in the future
- Determine the optimal equipment requirements for each laboratory and raise funding through DHET earmarked funding, from SETAs and industry to expand laboratories and bring them up to date
- Raise funding for effective and continuous maintenance of laboratory equipment

Staffing

- Make funding available to increase the salary packages of lecturing staff associated with SIPs professions by at least 25 – 30%
- Determine optimal staff/student ratio in order to determine the number of additional posts required and fund and appoint additional staff
- Relax the minimum qualification requirement for lecturing staff at UoTs to Bachelor or BTech whilst developing capacity at postgraduate level
- Expand the number of dedicated developmental posts per annum for the next five years with capacity to mentor future lecturing staff to obtain Master's degree qualifications to ensure that a pool of lecturing staff grows to fill current and future vacant posts due to ageing lecturing staff
- Increase the number of scholarships for existing lecturing staff to enhance their qualifications
- Support academics to gain practical experience where required
- Remove the compulsory retirement age of 65 for lecturing staff and allow those willing and able to continue working as long as they can without compromising their pensionable packages, even if on fixed term contracts
- Ensure that adequate support and administrative staff are in place
- Approve use of retired professionals to supplement the teaching load and act as mentors and raise funding for acceptable rewarding of such contracts

Curriculum

- Convene major workshops with industry on the HEQF and determine qualifications, courses required and graduate attributes most sought after
- Convene re-curriculation workshops per discipline where required

OCCUPATIONAL TEAM RECOMMENDATIONS ON THEORY (CONT)

- Encourage institutions needing to roll out new courses to commence work with industry on content and start working with the DHET
- Issue a directive to all Vice Chancellors (VCs) that no new qualifications will be approved without a defined vision of sustainability and employability for the intended learning programme and comprehensive evidence of industry and/or the relevant professional body support
- Portability of new learning programmes within the broader industrial community should be mandatory

Teaching and learning

- Ensure that all academics are masters of their subjects and are well versed in appropriate teaching and learning methods and arrange for those not up to speed to attend training. Ensure funding for lecturer replacements to facilitate staff development
- Research and determine most effective teaching supports and methods and introduce nationally
- Review and update course and supplementary material where necessary

Student support

- Expand tutoring support
- Implement summer, winter schools and repeating of so-called killer subjects in each semester
- Roll out NumberWise or an equivalent numeracy programme in UoTs
- Create living learning environments in residences by linking senior students with junior students to convene after class study sessions and offer support - ITand WiFi facilities must be available
- Expand WIL opportunities by making SETA funding available to UoTs to manage WIL programmes
- Expand the number of bursaries for SIP professions and ensure that they are of adequate value and commence at first year
- Ensure that NSFAS bursaries and loans are given to SIP professions as a priority
- Encourage the development of a buddy system in residences to offer social support to junior students
- Mount a campaign to identify all students with fewer than 120 credits to complete to return to an institution convenient to their locality to complete their studies

Funding

- Funding to be offered to be made available to departments to implement measures to address throughput challenges. Departments to submit business plans and targets and be given a two or three year period in which to demonstrate progress
- The funding formula to reward output and input in such a way as to facilitate and stimulate quality learning
- Admissions policies, assessment methods and targets to be reviewed with a view to improving throughput
- Encourage industry to fund chairs, subvent salaries or contribute to investment funds
- Funding given to universities for priority skills must be ring-fenced to ensure it finds its way to the departments in question

Industry wide

- The Convenor/Occupational Team model to be formalised and funded to ensure that universities and UoTs respond to industry needs

WORKPLACE-BASED LEARNING

As outlined in the pipeline discussion above, once graduated, prospective professionals require workplace experience to develop towards professional registration, while employers generally seek personnel with experience. When they do employ graduates, most employers' expectations are too high, as they do not distinguish between the education outcomes and the candidacy outcomes, and assume that recent graduates should already have achieved the outcomes required for professional registration. Much support is needed to create conducive environments for developing graduates to the level of competence required for professional registration.

PLACEMENTS

Many practices are small and cannot afford to take on graduates, or in the case of the public sector, many departments do not have experienced staff available to coach and mentor candidates. Public sector tenders should all be issued with the Training Standard, Gazette 36760 of 23 August 2013 to ensure that service providers who are awarded state projects can be harnessed to train public sector candidates or unemployed graduates.

Companies with established training programmes should be encouraged and funded to over-train for the nation.

STRUCTURED WORKPLACE TRAINING

Structured workplace training was commonplace until the early nineties. The extent of structured training then reduced dramatically due to:

- The withdrawal of the tax benefit that employers could claim for training
- Declining industry activity in the nineties and early 2000s, and tighter margins due to the introduction of competitive bidding
- Outsourcing in the private sector and privatisation in the public sector which has had the effect of dismantling communities of practice, and closing large functional areas which previously offered rotation opportunities for comprehensive overall training. This has dramatically reduced the capacity of the state to offer training.

Industry has lost many experienced people, and many who have assumed middle management roles are insufficiently experienced to provide adequate guidance to graduates. As a result, organisations have tried to pass the responsibility to universities to create career-ready graduates which is not appropriate or practicable.

Providing structured training should offer candidates:

- Exposure to a range of activities in their field
- Work of an increasingly complex nature
- Increasing responsibility
- The opportunity to work under supervision until such time as they are able to operate independently
- Access to a mentor to guide them in their practice area

Candidates who are trained in a structured manner generally achieve professional status much sooner than peers who find it necessary to job hop to gain the range of experience required.

It is essential that all statutory councils, working with their Voluntary Associations (VAs), develop training programmes and encourage all member organisations to participate in structured training of candidates. Where councils do not have the resources for such development work, funding should be made available by their custodian department.

SYSTEMS

Some councils have implemented a system of logbooks to monitor progress, while others

expect candidates to develop portfolios of evidence and/or reports which are only submitted when they are ready for assessment. For companies to effectively manage groups of candidates through structured training, ongoing recording and monitoring of progress is essential.

Councils should be provided once-off funding to set up systems with their VAs which enable companies to better manage, monitor and report on progress of their candidates.

MENTORSHIP AND COACHING

Without interaction with more knowledgeable people, it is impossible to learn. Statutory councils call on mentors to be in place to plan an adequate range of activities in the workplace and monitor progress. They also recognise the need for adequate supervision, which may be performed by the mentor or a designated line manager who would generally also perform as a coach, as developing skills does not occur by chance. Skills transfer requires support from knowledgeable others to assist with contextualising theory, offering support in the development of solutions, overseeing the implementation of projects and offering feedback.

The support roles performed by mentors and supervisors are time consuming. In small or busy organisations, senior personnel rarely have sufficient time to adequately perform these roles. Statutory councils do recognise this challenge and also allow for external capacity to be harnessed to play the mentoring and/or coaching role. The challenge is to find mentors and to cover the costs of their services.

The Engineering Council of South Africa (ECSA) will soon launch an imaginative solution to this challenge, known as Mentor-Connector. Recognising that databases of professionals available to mentor are difficult to build and maintain, they will be launching a website which will allow companies to publish their mentoring needs and for mentors in the required locality with the requisite skills to respond. The site will include mentoring contracts, guidelines on mentoring and coaching, guidelines on fees to be charged and links to engineering mentoring training courses. This model should be adopted nationwide by all professions to increase the access to potential mentors and coaches.

NATIONAL RECOGNITION

A national understanding of the need for candidate training must be developed and all legislation relating to learning pathways needs to be updated to include candidate phase training. Changes which should be considered include:

- Setting strategic objectives, performance indicators and annual targets for candidate programmes in the DHET's Annual Performance Plan
- Refocusing Service Level Agreements of SETAs to incorporate targets for candidate programmes
- Ensuring that Sector Skills Plans incorporate strategies and targets for candidacy programmes towards professional registration
- Developing national policies for candidate training with guidance from the Professional Bodies
- Including 'candidate training towards NQF registered designations' in the definition for 'learning programmes' in the new Learning Programme Regulations
- Changing the definition of PIVOTAL Programmes in the SETA Grant Regulations to 'professional, vocational, technical and academic programmes resulting in NQF registered designations, qualifications or part qualifications registered on the National Qualification Framework...'
- Amending Annex 400A and 400B of the Revised BEEE Codes of Good Practice to include 'Candidate Programmes'

- Expanding the clause in Commitment 2 of the National Skills Accord, 'To make internship and placement opportunities available within workplaces' to include Candidate Programmes and targets.

FUNDING

From the above it is evident that the training of candidates is a costly process. The candidacy phase is no different from an apprenticeship for artisans or the workplace component of a learnership, both of which are often funded by SETAs.

Recognition needs to be given to the candidacy phase as a learning pathway nationally, as outlined under National Recognition above, and all SETAs need to be called upon to fund candidate training towards relevant professional registration. National guidelines, milestones, report formats need to be agreed per discipline to streamline the process.

Candidate development costs

It is estimated that it costs some R100 000 to R130 000 a year excluding salary, to develop a professional in terms of the input from knowledgeable others, attending courses and workshops. It is suggested that this be funded on a 50/50 basis, with the SETAs providing R60 000 per annum for a three year period. Given that the Grant Regulations require that the final 20% only be paid on the attainment of the qualification, or in this case, designation, it is suggested that R60 000 be disbursed in the first year, R42 000 in the following two years, and the final R36 000 upon registration.

Role of Voluntary Associations (VAs)

As the paperwork associated with grant funding is onerous, and small companies cannot afford to take on more than one or two graduates, it is suggested that VAs be encouraged to take on the role of coordinating candidate training for smaller organisations within their discipline, and helping the larger organisations that have not in the past offered structured training to develop programmes.

Not only will this reduce the number of companies each SETA needs to engage with, but it will offer opportunities for cooperation and possibly secondments between companies, which will enhance the training of candidates.

UNEMPLOYED GRADUATES

The phenomenon of unemployed graduates is well known and deserves dedicated effort to resolve. Graduates essentially require a workplace to undertake a period of practical training under suitable supervision and mentorship. In this period they will not add an immediate return of value to the employer. Employers generally see this as a cost rather than an investment in future skilled resources.

Employers who do not have active training policies poach resources from those who do. This practice then discourages many employers from undertaking training. Two instruments which have now been put in place are:

- Providing funding through the SETAs for training and mentorship
- Making training towards professional registration one of the training requirements on all public sector projects.

Graduates should also:

- Be made aware of the South African Graduate Development Agency (SAGDA) for assistance with finding employment
- Advertise their availability on ESSA.

OT RECOMMENDATIONS

The following recommendations should be considered to ensure improved workplace-based training support. Once implemented, it is more likely that companies would be prepared to take on candidates which will increase the number of placements and reduce the number of unemployed amongst young graduates.

OCCUPATIONAL TEAM RECOMMENDATIONS ON WORKPLACE-BASED LEARNING

Placement

- Encourage all public sector structures to issue Gazette 36760 with all infrastructure tenders to ensure training and create opportunities for their staff to be seconded to service providers where necessary

Structured training

- VAs and Statutory Councils to assist companies with the development of structured training programmes
- Encourage all professions to adopt a Mentor-Connector model to connect companies and candidates with mentors
- Fund statutory councils and/or VAs to develop workplace training reporting and monitoring systems
- Recognise the candidacy phase as a learning pathway towards a designation
- Update all national training documents, as listed under National Recognition, to include the Candidacy Phase as a recognised step in the learning pathway

Funding

- Set targets for SETAs to fund candidate training, where SETA funding covers mentorship and coaching and the employer covers the candidate stipend or salary
- Encourage SETAs to work with VAs to manage candidate programmes on their behalf

ASSESSMENT

In the case of professions, the process of assessing competence is carried out by each of the Statutory Councils listed in Table 8.

Where experience is fairly uniform, passing of modules or exams is used to assess competence. Where the range of possible work is extensive, candidates need to be assessed by experts in their field to verify that they are indeed competent to operate in their chosen area of specialisation. The Code of Conduct issued by each council is designed to ensure that registered professionals work only in the field for which their education, training and experience has rendered them competent.

The system of reviewing applications is well established in most councils. Criteria for assessing newer professions are still being developed.

FUNDING FOR REVIEWS

Councils cannot afford to pay more than an honorarium at best for experts to mark exams or handle peer reviews. This is not a major problem where capacity of retired people can be harnessed.

New councils

In newer councils, where few registered practitioners have reached retirement age, access to reviewers presents a problem, as capacity must be drawn from those involved in productive work.

Small councils

In small councils the pool available to handle reviews is limited and they rely on one or two people to handle all applications which is totally unsustainable.

Transformation

In councils where demands are being made for transformation at all levels, including reviews, younger, more demographically representative professionals are under pressure to deliver in the workplace and need to be paid for the time spent doing council work.

Access to funding for assessments and to support transformation needs to be considered.

NEW DESIGNATIONS

As the nature of development and challenges change, the need arises to develop new occupations and associated designations. Currently there is a need to develop a specific hierarchy of construction health and safety officials, and further categories of registration associated with landscape architecture. When creating new designations, there is not a current income stream to cover development work, and support from custodian departments is required for this work.

A system of motivating and applying for funds to develop new categories for registration needs to be put in place.

REGISTRATION SUPPORT

There are many potential candidates who require support towards professional registration. These include:

- Graduates who have not been able to find employment
- Those in workplaces where experience or support has been inadequate and who require external support
- Those who have left the industry for various reasons and who should be encouraged to return
- Those who do not have the prescribed theoretical foundation but have qualified by experience

A major national initiative needs to be embarked upon to identify those who need support and attract those who have left to return to the industry. It is known that when the economy is not doing well many professionals are either laid off or cannot find work for a period of time and consequently leave the profession.

ECSA, when carrying out research on the distribution of engineering practitioners in 2013, called on all needing assistance with registration support to supply their contact details. Just over 10% of all respondents asked for support. A major campaign to support these potential candidates is being embarked upon with the VAs associated with ECSA.

Another such initiative has been launched by the South African Institute of Architectural Technologists (SAIAT) who are focusing their support on equity candidates who have been forced to leave the industry for various reasons to return. They are offering training and mentorship primarily by BBBEE colleagues under the guidance of SAIAT.

RPL

Due to the lack of structured training in the past, many potential professionals have chartered their own course in terms of experience. The application process of some councils allows all experience to be considered, while others only consider experience gained under mentorship and in structured programmes. Methods of recognising prior training of any form need to be developed by each of the councils.

THE OFO

In developing new categories for registration, there is also a need to engage with the OFO to accommodate new occupations and to update the descriptions of professions in accordance with contemporary needs and developments. A

more formal link between professional bodies and the OFO committee needs to be established and guidelines need to be published on how to go about applying for new OFO entries.

OT RECOMMENDATIONS

The following recommendations should be considered to support registration and ensure an increase in the number of registered professionals in South Africa.

OCCUPATIONAL TEAM RECOMMENDATIONS FOR ASSESSMENT

Increase capacity

- Subsidise the review process for small and emerging councils and to support transformation

New designations

- Offer seed funding to statutory councils when there is a need to introduce new designations
- Link statutory councils with the OFO committee to allow additional occupations to be accommodated when new designations are required

RPL

- Support all statutory councils to implement RPL systems if not currently in place

EXPERTISE

Expertise is developed over time as professionals gain more and more experience and continue with formal and informal education. The lack of skills indicated in many cases relates to experience rather than numbers.

To ensure that an adequate supply of experienced professionals is in place, CPD and postgraduate development must be supported, and consideration needs to be given to immigration and the use of retired engineers.

CPD

For professionals to keep up to date with the latest technology, methodologies, best practice, legislation, codes and standards, it is necessary to participate in continuing professional development. This requires that professionals attend various accredited courses, carry out self-study, and continue to tackle projects in their field to develop further expertise, serve as mentors and contribute to industry by way of participating in VA activities among other things.

CPD requirements and systems are in various stages of development in the statutory councils. A sharing of best practice and the development of robust systems for logging and monitoring CPD should be considered.

Support for CPD

It is necessary for professionals to be supported in their CPD activities. Companies need to provide for opportunities for them to attend courses and workshops and should include such development activities in their annual training budgets. This is often overlooked and professionals at times need to take unpaid leave to attend courses, workshops and conferences and pay the course fees themselves.

SUPPORT OF REGISTRATION

As it is in the organisation's interests to employ competent, registered professionals, allowance should also be made to pay professional registration fees for registered staff and to cover the cost of belonging to the VA most relevant to their area of specialisation.

In return, organisations should prescribe that lessons learned from courses, involvement in VA activities, should be shared with all technical staff.

Many companies use registration as a milestone towards the next band in the HR scales, or even promotion. This is a practice which should be encouraged.

SUPPORT FOR POSTGRADUATE STUDIES

The Numbers and Needs[29] study in 2004 and the 2013 ECSA[30] study showed that 42% of civil engineering practitioners and 40% of all engineering respondents respectively have postgraduate qualifications. Several studies over the years on graduate retention have also indicated that candidates desire to continue with postgraduate studies and they should be encouraged and funded to do so.

SPECIALISATION

Scarcity often relates to specialisation which should not be confused with expertise. Experience cannot be taught but develops with time, while specialisation relates to knowledge in a narrow field.

New specialist needs

There are many areas where specialisation could form a base technical qualification rather than follow a general qualification. The new HEQF lends itself to developing dedicated certificate qualifications in narrow fields where the foundation learning would cover only the building blocks relevant to the field of specialisation. (In terms of the earlier challenges outlined under theory, adopting this approach to developing a range of specialists would reduce numbers in large generalist classes and to some extent relieve the burden on the system).

Identifying specialist scarcity

The identification of scarcity is best located at the interface between the skills marketplace and the employer i.e. in the recruitment function. The most appropriate method of determining such demand is by developing an integrated vacancy and resource database.

The development of such a database has been proposed by facilitating the collective data housed in fragmented recruitment systems with a view to providing the outputs to the industry and any government institutions on a dynamic and on-going basis.

With such information at hand, short-term gaps may be easier to fill and insight will be gained on what specialist training is required.

INTERNATIONAL RESOURCES

Where specialist skills are simply not available, provision should be made for immigration. Attention needs to be paid to the degree of localisation relevant to the specialist areas. Where local knowledge of materials, processes and codes is required, foreign specialists may not be able to contribute meaningfully.

Local staff aware of the local requirements and conventions will be able to add value sooner and more effectively than immigrants. However, to maximise this resource, equity and empowerment considerations will of necessity have to be relaxed.

USE OF RETIRED CAPACITY

During the boom years of the late sixties and early seventies, large numbers of professionals were trained. Many have now retired but have extensive experience to share. Contracts should be developed for harnessing retired personnel with the proviso that they are paired with candidates for purposes of mentoring and coaching.

RECOGNISING THE VALUE OF EXPERTISE

In terms of expertise, the reality is that the majority of experienced senior personnel able to assume strategic and leadership roles are still largely white males. A study of the engineering profession in South Africa confirms this pattern as can be seen in Figure 17.

While the country needs to celebrate the dramatic transformation that has taken place in the younger age group, it would be naive to think that recently graduated practitioners could turn departments around and make significant contributions to building a capable state with the same effectiveness as their experienced counterparts. While younger transformed groups of professionals are being developed, international resources and experienced white males should be harnessed to lead the re-development of many public sector structures, while at the same time mentoring those who will follow them.

OT RECOMMENDATIONS

The following recommendations should be considered to develop and harness expertise.

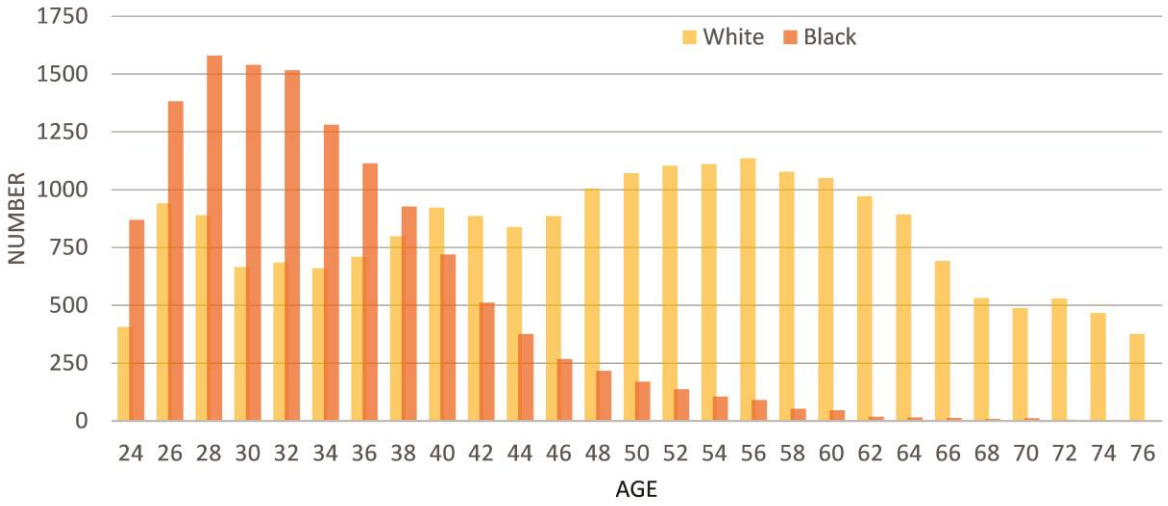


Figure 17: Age and racial distribution of all categories of registration with ECSA 2012

Source: ECSA 2012

OCCUPATIONAL TEAM RECOMMENDATIONS ON EXPERTISE

Development of expertise

- Support all registered personnel to participate in CPD
- Encourage and fund postgraduate studies

Harnessing expertise

- Harness international and retired professionals
- Relax equity considerations where specialists or senior personnel are required to rebuild departments, structures and systems

EMPLOYMENT AND RELATED ISSUES

IDENTIFICATION OF WORK

In each of the Acts governing infrastructure professionals there is a clause which states that the Council must consult with parties that may be affected by any laws regulating built environment professionals regarding the identification of the type of work which should be performed exclusively by persons deemed competent and subsequently registered in the various categories.

The definition of the type of work which is restricted to each of the professions has never been finalised, so the use of registered professionals for specific types of work cannot be enforced.

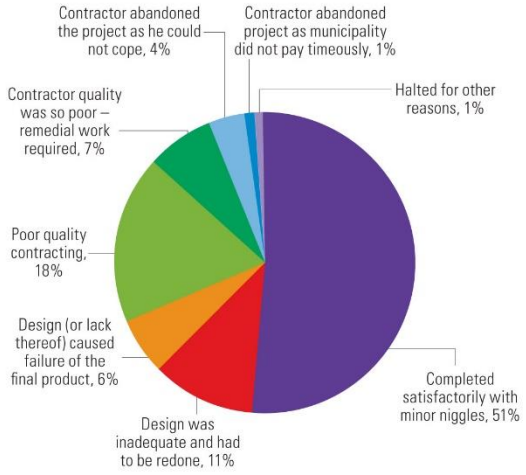


Figure 18: Success at completing projects

Source: Numbers and Needs in Local Government 2007

This has had a detrimental effect on the quality of services provided as can be seen in Figure 18. The figure represents a study carried out on projects in some 70 municipalities in 2007. It was found that only 51% of the projects were completed with the normal contractual niggles, and the rest needed to be abandoned or have remedial work carried out due to the inadequacy of the service providers.

To ensure that 49% of the investment planned for the SIPs does not go to waste, it is critical that the Identification of Work definitions be finalised for all professions, and that is be legislated and enforced in all spheres of government.

The process is under way for some professions at present and requires full government backing. Once the Identification of Work definitions have been finalised and adopted, practitioners will need to be registered and there will be an increased demand for registered professionals.

LABOUR LEGISLATION

The International Labour Organisation (ILO) has suggested that best practice in terms of training is for learners to be taken on as employees.

Adoption of such a policy would threaten the implementation of large scale development projects as employers will be reluctant to take on more graduates than are actually needed for their organisations.[31]

BUILDING A CAPABLE STATE

South Africa, like many countries, has dramatically reduced the number of technical professionals employed in the public sector, to the detriment of service delivery. Not only should South Africa be training for expansion and replacement demand, it should also be training to fill the actual and latent gaps which are so prevalent in the public sector. Latent gaps are those unrecognised skills gaps where organisations have operated without the necessary skills, the effects of which are evident in the breakdown of systems, processes, training and service delivery as a whole.

Developing public sector capacity

Career paths need to be redeveloped and technical structures need to be repopulated through a multi-faceted approach of:

- **Secondments** – Identifying experienced personnel in private sector companies and technically-rich public sector structures, and seconding them to senior positions to re-establish technical leadership
- **Developing tomorrow's leadership** – Assessing existing staff and developing career paths for them to work towards assuming senior management posts
- **Developing middle management** – Assessing existing junior staff and developing training programmes for them to work towards professional registration and ultimately assume management posts
- **Developing graduates** – Selecting and appointing graduates to be trained towards professional registration
- **Producing graduates** – Offering bursaries and work-integrated learning experience to students
- **Harnessing retired capacity** – Appointing retired engineers to bolster the secondment capacity and to mentor and coach junior staff and trainees as outlined above.

Training contracts should be entered into for each of the above developmental categories to ensure that once trained, technical personnel remain in public sector positions.

Graduates should be appointed to training posts rather than fixed posts to allow them to be rotated to various departments and to be seconded to external organisations where necessary in order to gain the all-round experience required for development towards professional registration.

Career paths should be developed considering both technical and managerial paths. This will allow those who wish to remain technical to be recognised and rewarded for their specialist work, and will ensure that technical managers, who are critical to the success of technical departments, are developed.

Referring to Figure 17, until such time as the demographics of the land is represented in all professions, employment equity criteria for senior posts should be relaxed.

Occupation Specific Dispensation (OSD)

In recognition of the scarcity of certain professionals in the public sector, the Occupation Specific Dispensation offers an increase in salary to those who are professionally registered in various occupations. The intention was to encourage public sector officials to work towards the level of competence required for registration.

Existing registered professionals in technical posts have benefited from the dispensation, but many unregistered and not yet competent staff have tried to pressure statutory councils to introduce new categories of registration to accommodate their lack of overall development towards registration. Unfortunately, the OSD is being paid to those who are registered as candidates with professional bodies, which defeats the initial intention of rewarding those who are competent.

Another weakness of OSD is the fact that it only rewards staff in technical positions. Once registered personnel reach management positions, OSD is no longer applicable. As argued above, technical personnel should be leading the development of infrastructure, so it is critical that senior management in infrastructure departments are highly experienced, registered professionals. Figure 19 demonstrates the progression of a professional from graduation to various leadership levels.

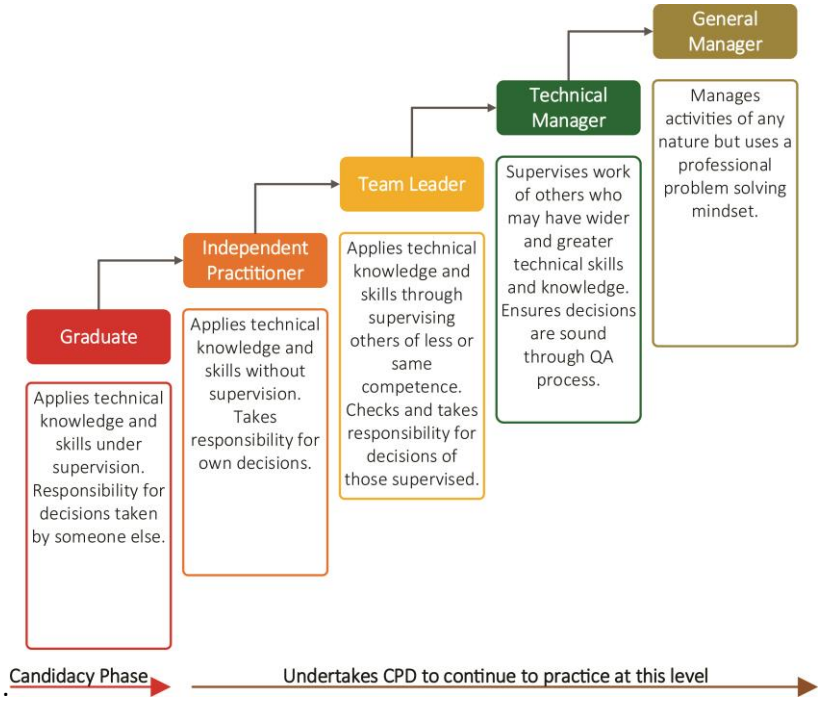


Figure 19: Career progression of professionals

Salaries

Despite the intention of OSD, the philosophy does not address all public sector structures. OSD does not apply in local government for instance, and the salaries paid by smaller or rural municipalities are such that they cannot attract experience professionals. A method of subventing salaries in these instances should be investigated.

Creating an enabling environment

While it is recognised that many more infrastructure professionals are required in the state, until such time as technical structures are redeveloped and an enabling environment is created to ensure that the state once again becomes an employer of choice, training additional infrastructure personnel for state positions will simply result in more unemployed graduates.

To create an enabling environment for technical professionals, it will be necessary to address challenges relating to supply chain, HR, finance, reporting and lack of authority.

- Supply chain

The arduous process of making purchases and appointing service providers is well known. The three-level decision-making process represented by the Bid, Adjudication and Awards committees presents challenges all the way in terms of skills, cooperation and interference and the PFMA has had the effect of commoditising professional services, rather than selecting service providers on merit. Professionals in the public sector are then faced with the burden of managing problematic contracts due to the inadequacy of service providers.

Supply chain for infrastructure should be administered by the infrastructure department and should not follow the same processes as those followed when purchasing goods and services.

- Human Resources (HR)

The Human Resource (HR) process, including decision making, has been totally removed from individual technical departments. As a result, new employees are at times not selected by those who will be employing or managing them. This disconnect between the employer and those handling the process results in delays and inappropriately qualified or inexperienced staff being appointed in many cases. It is essential that the screening, selection and appointment process reverts to technical departments and HR simply offers the support of advertising, setting up interviews and finalising the contracts.

Any interview panel should include professionally registered supervisor(s) and peer(s) where relevant, relating to the position. Interviewers should be at liberty to ask whatever questions are required to determine whether the interviewee is competent.

The practice of asking for specific qualifications, such as a BSc (QS) and then appending 'or equivalent' should cease. The 'or equivalent' offers the opportunity to appoint anyone, whether suitable or not. A list of acceptable qualifications and experiences should be made available.

- Financial decision-making

In the absence of adequately experienced personnel, a series of guidelines has been published over the years in terms of percentages which should be spent on various activities and commodities. For instance, in municipalities, a percentage for maintenance and for staffing relative to the overall budget has been suggested as a guideline by National Treasury. Most financial departments have adopted these figures as the rule and do not allow them to be exceeded.

It is well known that one size does not fit all. These percentages should vary depending on the type of organisation, the age of its infrastructure and pace at which development has, or is taking place. The recommendations of budget apportionment for infrastructure should be afforded to technical personnel. The financial department generally extrapolates annual budgets based on spending in the prior year, rather than engaging with all departments and generating zero-based budgets considering overall needs.

- Reporting

The need to report to many bodies on the same issues in many formats is extremely time consuming and frustrating to those involved. The absence of systems makes such reporting particularly difficult. Simple, online, real-time reporting on a select number of KPIs should be all that is required to ensure progress.

- Systems

Many previously functional systems have not been kept up to date and have all but been abandoned, making planning, reporting and financial control almost impossible. Systems need to be reinstated to improve the efficiency of technical departments. By having real-time information systems, the reporting burden would be a thing of the past, since reports could be generated as a standard by-product of such systems. In the absence of a sufficient number of skilled staff, comprehensive systems and processes should be in place to assist those remaining with their extraordinary workload. Standardised reporting formats should be developed across all levels of government.

The Infrastructure Delivery Management System (IDMS) developed by the cidb and NT is a good start.

- Authority

Support departments, while meant to support line departments, have usurped the authority and undermined the processes which are the domain of technical departments. Professionals in any discipline are specifically trained to investigate and solve problems and use their professional judgement to deliver solutions.

Working in the public sector is particularly frustrating for professionals whose highly developed ability to make professional judgement calls are overwritten by support personnel blindly following guidelines which are often not relevant to the issue at hand. Professionals are generally considered to be accountable for the services they deliver, but are often not responsible for the decisions made on their behalf based on inappropriate structures, systems or guidelines.

To create an enabling environment for technical professionals, it will be necessary to wrest authority away from support functions and return it to the leaders of line functions, while still respecting the need for transparency in the processes.

Rebuilding

When systems are not functioning there is always a temptation to restructure. In much of the public sector it is simply necessary to create teams of competent personnel trained appropriately for each post. Thus the solution is to rebuild and not to restructure.

In summary, organograms must be developed to suit the actual needs of departments, and staff must be appointed and offered workplace training. Career pathing and direction must be given to each employee. Lost data must be located. Systems and operating procedures must be developed, including those related to HR, finance and procurement. Performance must be driven at every level.

OT RECOMMENDATIONS

The following recommendations should be considered to address the use of professionals on all projects and to build a capable state.

OCCUPATIONAL TEAM RECOMMENDATIONS ON EMPLOYMENT AND RELATED ISSUES

Identification of Engineering Work

- Finalise Identification of Work definitions and regulations for Built Environment Professionals

Labour regulations

- Ensure that any changes to labour legislation do not reduce training opportunities in the workplace

Staffing

- Communicate and implement the existing framework to accommodate secondments into the public sector at senior level
- Ensure that every public sector structure with technical capacity sets up an internal training and development programme with the required support to ensure its sustainability
- Introduce training contracts with a payback period for those who are being trained by the state
- Set a deadline date by which all management in technical departments must be registered professionals in the discipline which they are managing
- Relax employment equity criteria for senior technical management posts

OSD and salaries

- Withdraw or reduce OSD allowances for candidates with immediate effect in terms of new appointments and by April 2016 for those currently working toward registration
- Offer OSD to professionally registered managers, managing infrastructure departments
- Review and subvent professional salaries in smaller and rural structures

Create an enabling environment

- Develop an appropriate approach to supply chain for professional services and infrastructure development
- Return control to line departments, affording technical professionals full authority in decision making where required, including HR and budgeting for development, operations and maintenance of infrastructure
- Develop national reporting systems to obviate the need for the multiplicity of reports currently required
- Redevelop systems and procedures

INCREASING ROLES EXPECTED OF COUNCILS

From the above, the importance of statutory councils can clearly be seen. Councils are not only expected to register professionals and ensure continuing professional development, but are also tasked with accrediting higher education qualifications on behalf of the Council for Higher Education (CHE), recognising Voluntary Associations (VAs), dealing with misconduct and generally protecting the interests of the public in terms of health, safety and responsible use of funds.

The only income earned by councils is from fees, fines and penalties. This is generally inadequate to handle anything more than their day-to-day business.

The Production of Professionals Technical Task Team (TTT) of the Human Resource Development Council of South Africa (HRDCSA) has suggested that councils should play a far more proactive role in developing the professions.[32]

Since Statutory Councils are required to set standards and protect the public, this in a sense represents a conflict of interest. Furthermore, few councils could afford this extended mandate without an annual subsidy or grant.

Much of the work of Statutory Councils such as peer reviews, setting exams, carrying out accreditation visits, participating in investigations and hearings is carried out by experts who are volunteers from VAs associated with each discipline and sub-discipline covered by the respective councils.

Since VAs are generally member bodies per discipline or interest groups, it is at this interface that extended support should be considered, although they too would require funding to play many of the roles suggested. To ensure there is no duplication of effort, statutory councils could ensure coordination of the work of all the VAs that they recognise.

DEVELOPING THE PROFESSIONS

The HRDC TTT research covered most of the bottlenecks outlined in this chapter. To address them requires a team effort of:

- Statutory Councils and VAs working together to promote careers, encourage their members to fund bursaries, offer workplaces with adequate

mentoring and supervision and provide registration support

- DHET to work with universities to overcome the throughput and infrastructure bottlenecks
- DHET and SETAs to work with industry to overcome the workplace bottlenecks and fund candidate training

PLAYING THE WATCHDOG ROLE

It has been suggested that statutory councils should play a far more proactive role in identifying and responding to poor practice, in the interests of public health and safety. Tapping into the skills within each discipline, this would indeed technically be possible, but once again this would require increased funding.

OT RECOMMENDATIONS IN TERMS OF EXTENDED ROLE

There is clearly the need for extensive engagement between government, the statutory councils, VAs, universities, industry and the SETAs to determine:

- What is needed by way of developing professionals?
- What are the bottlenecks?
- How should they be solved?
- Who should attend to them?
- Who would fund the solutions?
- What role will each of the stakeholders play?

It is anticipated that the detail of this chapter can form the basis of this dialogue and that work can begin on developing and implementing solutions.

BUILT ENVIRONMENT AND PLANNING PROFESSIONALS

A range of built environment professionals, associated with the planning, design and implementation of construction projects have been identify as priority skills. These include:

- Draughtspersons
- Geographical Information Scientists
- Landscape Architects
- Quantity Surveyors
- Land and engineering surveyors

In most cases they represent small communities who require considerable support in terms of increasing their numbers, ensuring that adequate education and workplace training opportunities exist and expanding their capacity to assess and register professionals.

DRAUGHTSPERSON

OCCUPATIONAL DESCRIPTIONS

Draughtsperson – Prepares technical drawings, maps and illustrations from sketches, measurements and other data and copies final drawings in support of architects and engineering professionals.

Draughtspersons are used in a range of disciplines including:

- **Architectural** – Prepares technical drawings from sketches, measurements and other data of architects
- **Civil** – Prepares topographical maps and production drawings for major construction or civil engineering projects, such as highways, bridges, and flood-control projects
- **Electrical** – Prepare wiring diagrams for the installation and repair of electrical equipment, power plants, distribution systems and buildings and, in the case of electronics, for circuit boards for manufacturing, installing, and repairing electronic devices and components

- **Mechanical** – Prepares drawings and details for a wide variety of machinery and mechanical devices
- **Mining** – Prepares 3D layout drawings of mining activity and ore bodies
- **Piping** – Prepares plans used in the layout, construction, and operation of oil and gas fields, refineries, chemical plants, and process piping systems
- **Structural** – Prepares drawings and details for fabrication, construction or manufacture of structures and buildings in concrete, steel, timber and other structural materials

LEARNING PATHWAY

For information on the learning pathway see the National Careers Advice Portal, http://ncap.careerhelp.org.za/occupation and select the occupation.

From Table 10 it can be seen that, unlike in most of the other occupations discussed in this chapter, there are numerous pathways including studying at TVET colleges, private draughting schools or completing a national diploma in a specific discipline. [33]

Having gained sufficient experience, those with NQF6 and higher qualifications may apply to become Members and those with NQF4 can become Associate Members of the South African Institute of Draughting.

Table 10: Number per NQF level of draughtspersons

NQF	Number
Not indicated	729
<1	767
1	-
2	666
3	792
4	4 195
5	920
6	2 869
7	869
8	979
9&10	589
Total	**13 374**

Source: QLFS 2009 -2013

OVERVIEW AND CHALLENGES

Traditionally, the draughtsperson at the drawing board did all production drawings and detailing, while tracers copied sketches and drawings to enhance quality. With the advent of computer-aided design, it became possible for engineers and technologists to generate production drawings as part of the design process. There has therefore been a school of thought that it is no longer necessary to train draughtspersons.

However, the drawings generated from design packages are generally only the starting point and require further attention to allow for integration of services, to check for conflicts and to customise the final drawings to match client standards.

Once fabrication, construction/manufacture is complete, there have invariably been changes along the way. Drawings need to be updated to reflect the final as-built situation. The draughtsperson needs to work closely with the commissioning engineer to mark up and amend drawings as changes on site are made.

Revisions must be managed, equipment drawings and specifications must be filed for safe keeping and easy reference.

The current approach to training draughtspersons is to teach them only how to use Computer-Aided Draughting (CAD) systems, rather than teaching the theory associated with field in which they are working. Industry complains that today's draughtspersons are effectively only tracers. There is a plea for courses to include more technical content.

There is also a shortage of good detailers, particularly in piping and structural steel. The South African Institute of Steel Construction has developed a two year detailing course which it is hoped will begin to address the shortage of detailers.

In response to the need for good theoretical knowledge and workplace development, SACAP has develop a category for registering an Architectural Draughtsperson. To become a registered professional, it is necessary to undergo formal training, serve at least three years in the workplace under the guidance of a mentor and pass a professional exam.

It would seem that a more rigorous approach to developing draughtspersons in the other disciplines is also needed.

SOLUTIONS

Comprehensive research is required per industry to determine the numbers required, the theoretical/technical knowledge required, what type of qualifications should be developed and whether professional registration should be considered. The possibility of QCTO qualifications should be considered, as well as the new Higher Certificates under the HEQF.

GEOGRAPHICAL INFORMATION SCIENCE (GISC) PRACTITIONER, TECHNOLOGIST, TECHNICIAN

OCCUPATIONAL DESCRIPTIONS

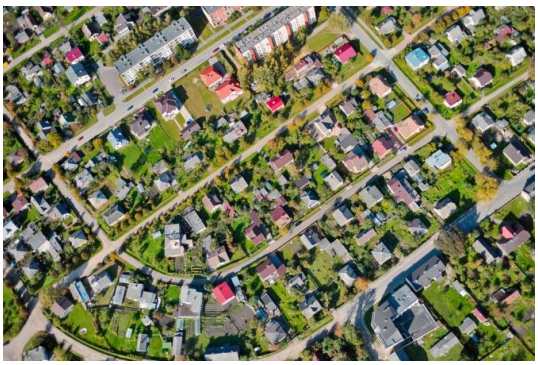
GISc is one of the specialisations within the broader geomatics, geomatics being the general term now used to describe all spatial sciences**.** All GIS practitioners are registerable in the categories of professionals, technologists, technicians and candidates.

GISc is concerned with technologies and processes for collection, storage, management, manipulation, analysis, visualisation, display and distribution of geographic data. The range of work carried out by GISc practitioners can include basic elements of surveying, remote sensing, land use, environmental studies and other relevant applications of geographic information.

Since 2004, the responsibility for GISc professional registration resided with the South African Council for Professional and Technical Surveyors (known as the PLATO Council). The Geomatics profession is currently in a transitional period as the PLATO Council will cease to exist when the South African Geomatics Council, established by the Geomatics Profession Act 19 of 2013, has its first meeting.

Currently the PLATO website refers to six GISc categories, namely GISc Practitioner, GISc Technologist and GISc Technician, as well as an 'In Training' category for each of these. The new Act refers to four categories namely, Geomatics candidate practitioner, Geomatics technician, Geomatics technologist and Geomatics professional.

Currently no Identification of Work exists but the new Geomatics Profession Act 19 of 2013



makes provision for reserving work by branch or category.

OVERVIEW AND CHALLENGES

GISc practitioners are part of the team that collect, store, interpret, manage, visualise, analyse, manipulate, display and distribute geographic data.

The availability of geographic information is key to all national infrastructural and economic development programmes. It is important for long and short-term planning of infrastructure and ultimately asset management, once infrastructure is installed.

The GISc profession is a relatively young profession which has become possible with the advent of geospatial technology and availability of digital geographic data. GISc practitioners are required in both the private and public sector and are currently distributed as shown in Figure 20.

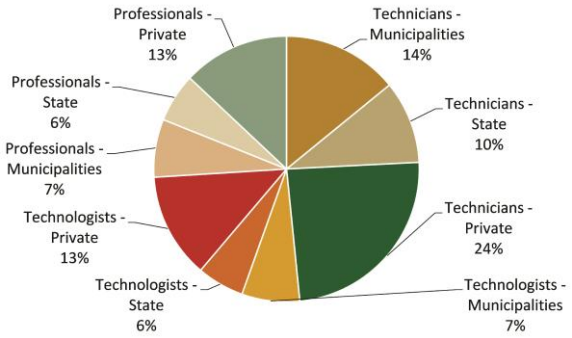


Figure 20: Sectors in which GISc practitioners are employed

Source: GISSA 2014

Greater numbers are required in both sectors to adequately plan, manage data, identify trends and monitor progress. The occupational team believes that the number of professionally qualified and registered GISc practitioners should increase substantially. A survey of the demand for GISc skills in South Africa is currently under way. Questionnaires have been distributed to public and private sector representatives. Results should be available towards the end of 2014.

SOLUTIONS

SCHOOL

Career guidance

Since GISc is a relatively new occupation specialisation, substantial career guidance and awareness is required.

The right subjects

Subjects for entry into GISc Qualifications are maths and science; geography is an advantage but not required.

Although geographic information systems (GIS) form part of the geography school curriculum, teachers need to be reskilled in teaching GIS and using GIS as a teaching tool.

THEORY

Currently GISc qualifications accredited by PLATO are offered at:

- The University of Cape Town
- The University of Pretoria
- The University of Stellenbosch
- The University of the Free State
- Cape Peninsula University of Technology
- UNIGIS

These institutions require considerable support to grow the numbers entering and successfully completing GISc studies.

Other universities may present individual modules but not an entire degree accredited by PLATO.

Equipment

Most university departments require substantially more modern computers and software along with geographic data capture equipment. Support is also needed in the acquisition of commercial data.

Staffing

Attraction of adequately qualified staff for all levels of qualifications is a problem. As this is a relatively young occupation, lecturers generally have the theoretical knowledge, with varying practical experience, or they have gained wide experience over the years but do not have the theoretical underpinnings required for these qualifications.

The development of the next cadre of academics is proving challenging. Funding for postgraduate scholarships and research projects, including equipment, computers, software, data acquisition, travel and additional project running costs is required.

Furthermore, academic staff do not have time to oversee research projects. Funding for research assistant posts and research grants to cover project expenses will have a positive impact on both undergraduate and postgraduate student success through access to cutting-edge research in the teaching and learning environment.

WORKPLACE-BASED LEARNING

Structured workplace training is required, with adequate mentorship, plus state of the art hardware, software and appropriate data and maps on which to create the required models. Funding for workplace training is required.

It is suggested that Geo-Information Society of South Africa (GISSA) and South African Growth Institute (SAGI) be awarded candidacy phase grants by the SETAs supporting GISc and mapping development and take responsibility for developing structured candidate training programmes, coordinate placements, provide mentorship and monitor the workplace training of graduates.

ASSESSMENT

Registration support and RPL

Given that GISc is a young profession, many practitioners have acquired their knowledge through experience and attending short courses. There is a need for a rigorous RPL programme to be designed, gazetted and implemented.

EMPLOYMENT AND RELATED ISSUES

Building a capable state

There is a shortage of registered GISc practitioners in municipalities and many provincial and national structures. In developing or updating organograms, the need for registered GISc professionals needs to be accommodated to address the latent gaps which currently exist.

OFO

Managing of geographic data is multi-faceted including gathering, storing, processing, and delivering geographical information, or spatially referenced information and requires a range of professionals. Recognising this, PLATO registers the full range of Geomatics professionals. There is a need for the range of occupations associated with Geomatics to be registered on the OFO to ensure that full teams of professionals are in place to support the infrastructure planning and delivery process.

PROJECTIONS

International reports suggest that the geospatial industry is growing rapidly and that demand for GISc knowledge and skills is likely to increase into the foreseeable future.[34,35,36.] Anecdotal evidence suggests South Africa is in a similar situation.

GISc is a relatively new occupation and there is a need to establish a critical mass of GISc professionals in the country. However, the geospatial industry is also growing at a rapid pace, adding to the demand for GISc professionals. The GISc OT have suggested that the numbers need to grow by an average of at least 3% per annum as shown in Figure 21.

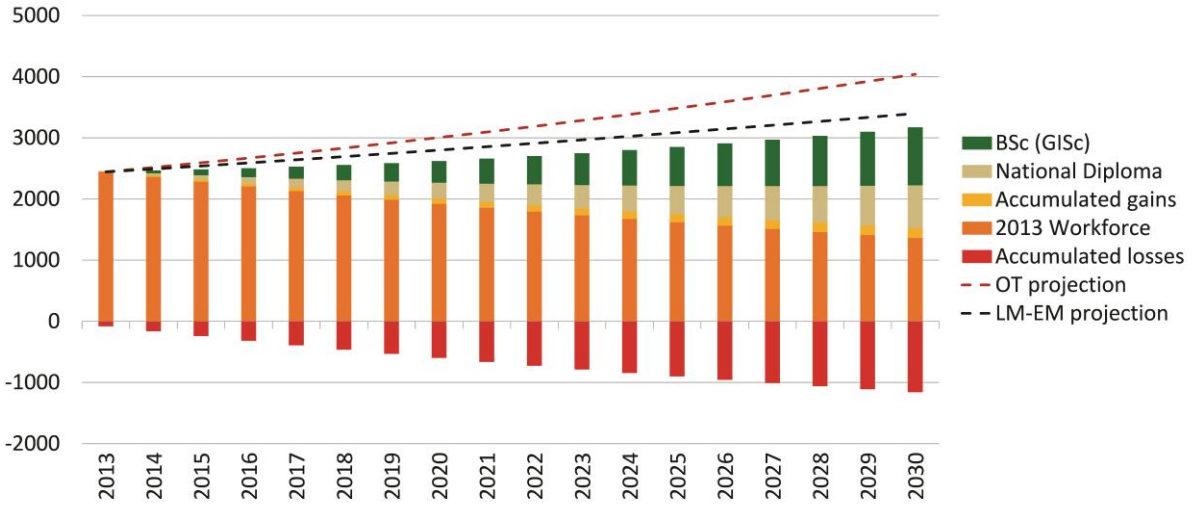


Figure 21: Projected demand for and supply of GISc practitioners

LANDSCAPE ARCHITECT, TECHNOLOGIST, TECHNICIAN

OCCUPATIONAL DESCRIPTIONS

Professional Landscape Architect - Consults around elements of landscape architecture which include but are not limited to the planning and design of land areas for projects such as open space networks, parks; rehabilitation of roads reserves; and external areas for all building types including institutional, commercial, industrial, education and residential.

Masterplanning of the open spaces within large housing schemes or office and industrial parks is also undertaken. The guiding principles for the development are set.

Specialist input is provided in the green building projects in terms of improving the ecological attributes of the sites as well as dealing responsibly with plant choice in relation to water consumption. Other specialist areas of expertise include visual impact assessment and assessing sites of cultural and historical significance.

The distinguishing elements between a Professional Landscape Architect and **Professional Landscape Technologist** hinges around the project complexity as well as the size of the project team within which the individual operates.

Professional Landscape Technicians and Professional Landscape Assistants support the other professionals in meeting the desired project outcomes by preparing the technical documentation in conjunction with such.

LEARNING PATHWAYS

For information on the learning pathway see the National Careers Advice Portal,

http://ncap.careerhelp.org.za/occupation and select the occupations.

OVERVIEW AND CHALLENGES

Landscape Architecture is a relatively young profession. There are currently some 170 registered landscape architectural professionals and 70 candidates. It is expected that some at least 200 landscape architectural professionals will be needed over the life of the SIPs, which means that the country will require many more such professionals to be able to address private and public sector needs over and above those of the SIPs.

Of great concern is the fact that there are only three professionally registered landscape architects employed by national and provincial government, which can be seen from the spread of employment in Figure 22.

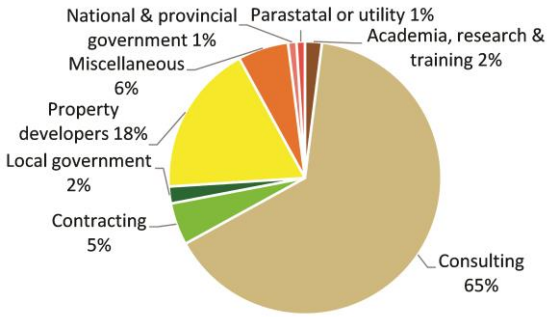


Figure 22: Sectors in which landscape architects are employed

Source: SACLAP 2014

SOLUTIONS

SCHOOL

Career guidance

The shortcomings in career guidance and subject choices are discussed in Chapter 13 and are particularly relevant to landscape architecture and related fields as is it a young and little known occupation. SACLAP needs to engage with NCAP to enhance career information associated with their occupations and promote them through national radio and outreach programmes.

THEORY

Landscape architecture is offered only at:

- University of Pretoria – undergraduate and postgraduate (BSc, B Hons, ML (Prof))
- University of Cape Town – postgraduate only (MLA (Prof))
- Cape Peninsula University of Technology – (N Dip, BTech)

There is a need to increase the number of students enrolling at the current institutions and investigate the need and feasibility of expanding the number of institutions that offer programmes in landscape architecture. An additional option would be to develop a fully accredited part-time course

Facilities

There is a need to expand studio capacity in some institutions

The curriculum

Curriculum reform is needed to be more focused on landscape architecture and expansion of certain aspects such as environmental and urban planning. Currently the undergraduate programme at UP has courses that are common with architecture which results in some individuals migrating to architecture in later years of study.

Accreditation

At CPUT, only partial accreditation has been granted and efforts to address quality are under way to ensure full accreditation can be achieved.

Student support

- Develop a buddy system for final year students to support first year students
- Identify and create bursary opportunities and streamline access to these bursaries

WORKPLACE-BASED LEARNING

Workplace development opportunities are limited as most practices are small and cannot afford to take on graduates for development towards professional registration. Few understand what is required to train candidates and landscape construction budgets are small when compared with aspects such as architecture and engineering. This is exacerbated by the fact that some clients insist on discounted professional fees and the services of a landscape architectural professional are easily undertaken by others. The following needs to be put in place:

- **Placements** – Identify workplace training opportunities in bigger private and public organisations
- **Structured workplace training** – Develop a more structured approach to candidacy
- **Systems** – Develop a recording and monitoring system within SACLAP
- **Coaching and mentorship** – Explore opportunities to secure retired individuals for mentorship and train in-house and external supervisors and mentors for the candidate training process
- **Funding** – Identify funding sources to cover the use of mentors and develop the above process and systems
- **Coordination** – SACLAP be appointed by funders to coordinate workplace training and assist and support candidates and mentors

ASSESSMENT

RPL and registration support

SACLAP currently undertakes RPL to accommodate:

- Those with foreign qualifications wishing to register
- Those with qualifications from non SACLAP accredited programmes
- Those with qualifications in related fields but with specialised experience in landscape architectural aspects.

It is expected that some 15 landscape architectural professionals per annum for the next five to seven years could be added to the register of professionals through this process. There is a need to:

- Train more individuals to assist with evaluation of RPL
- Undertake more awareness creation around RPL
- Develop a list of programmes/courses that can be undertaken for non-degree purposes to enable individuals to upgrade through RPL

Graduates who have left the industry should also be traced and offered support to develop towards professional registration.

Funding for reviewers

As with most small statutory bodies, capacity is a challenge, requiring external funding to train reviewers and remunerate them until such time as there is an adequate pool of volunteers to handle the review process.

New designations

Additional registration categories dealing with implementation and management of landscapes have been identified as important aspects to further protect the public and enhance service delivery in the built environment. SACLAP is busy developing new categories of registration.

EXPERTISE

Continuing professional development for all registered professionals is essential to ensure that they keep up to date and continually develop expertise. SACLAP is substantially under-resourced as it is a young and developing Council. Funding is required to:

- Develop a robust CPD process
- Administer the CPD system
- Investigate and put an end to inappropriate CPD activities that are claimed by registered professionals

EMPLOYMENT ISSUES

Identification of Work

In terms of the profession transforming, particularly in terms of race, there appears to be a misconception that landscape architectural professionals are 'glorified gardeners'. Thus there are many situations where professionals and their candidates should be engaged but this does not happen and candidate mentoring opportunities are lost.

The Identification of Work for statutory professions must urgently be addressed.

Research

Research into the landscape architectural profession is limited and is urgently required to determine the number of individuals required as well as refine the scope of services required.

OFO

The new occupations envisaged will need to be included on the OFO.

Building a capable state

There are fewer than 10 landscape architects employed across the whole of the public sector with most of these being employed by the City of Cape Town.

While it may be an option to consider importation of skills, such professionals will need to become familiar with local legislation, and conditions, so this is not considered to be a practical short term solution. Local professionals are also generally not available to be seconded to the public sector.

Until a larger pool of landscape architectural practitioners has been developed and internal posts have been filled, it is suggested that MISA partners with SACLAP to form an advisory committee that supports municipalities with landscape related planning and project implementation.

PROJECTIONS

By ensuring the above actions are put into place, the number of landscape architects will increase as shown in Figure 23.

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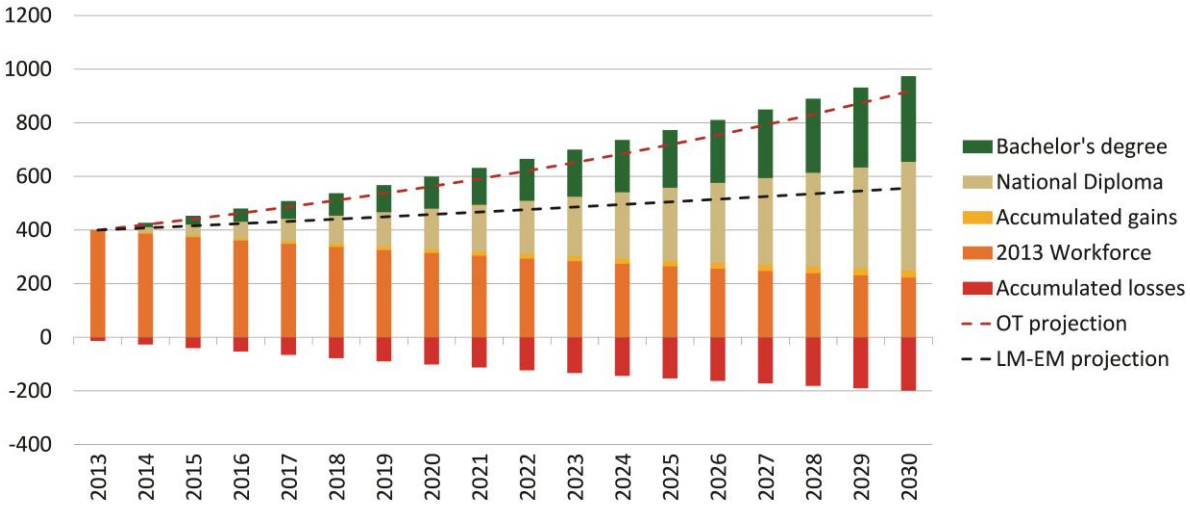


Figure 23: Projected demand for and supply of landscape architects

LAND, ENGINEERING SURVEYOR

OCCUPATIONAL DESCRIPTIONS

The land and engineering surveying specialisations in geomatics relate to technologies and processes in spatial measurement and geo-information management.

Professional Land Surveyor – Plans, directs and conducts cadastral survey work to determine, delineate, plan and precisely position tracts of land, rights in land, natural and constructed features, coastlines, marine floors and underground works, and manages related information systems

According to the Land Survey Act 8 of 1997, the Land Surveyor is the only registration category and specialisation enjoying reservation of cadastral works. In terms of Engineering Survey Work, no work reservation currently exists.

The categories of engineering surveyors are:

Professional Engineering Surveyor – Plans, manages and implements measures to record natural and built features to create accurate maps and charts used for design and construction or any engineering activity. These include performing surveys necessary for geospatial control, setting-out and monitoring of the construction of infrastructure and any activities in spatial positioning and management.

Survey Technologist – This is a diploma graduate who has met sufficient criteria as laid down by PLATO and may undertake for their own account the same activities as a Professional Engineering Surveyor.

Survey Technician – This a diploma graduate who may not operate for his or her own account and must be under the supervision of a professional or a technologist. Such technician

performs survey functions under the direction of a professional or technologist.

LEARNING PATHWAY

For information on the learning pathway see the National Careers Advice Portal, http://ncap.careerhelp.org.za/occupation and select the occupations.

OVERVIEW AND CHALLENGES

Surveyors were found to be one of the occupations in shortest supply when researching SIP skills needs.

Land Surveying is one of the oldest recognised professions in South Africa, with the first land surveyor arriving in the Cape in 1657.[37]

From 1813 no sale of land was recognised unless that land had been properly surveyed and registered.

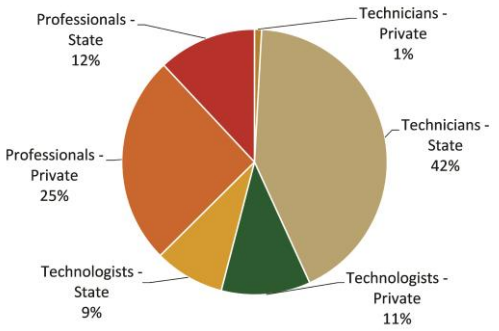


Figure 24: Sectors in which surveyors are employed

Source: PLATO 2014

The Land Survey Act of 1927 put cadastral surveying in South Africa in the position it is today; one of the best and most reliable systems of defining the boundaries of properties, and the positions of rights affecting those properties anywhere in the world.

It is clear that the role of the land surveyor is critical when land is being acquired, transferred and sub-divided, including all maintenance and management of Land Assets. Land Surveyors also deal with rights in land such as planning applications and legislative approval processes.

By the late nineties, graduation of land surveyors had peaked, as can be seen from Figure 25. As with most professions, once training opportunities in the public sector reduced, class sizes reduced.

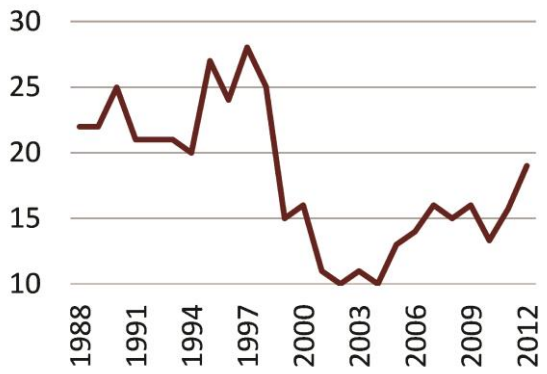


Figure 25: Graduation of land surveyors since 1988

Source: SAPSI and HEMIS

The availability of spatial information is key to all national, provincial and local development. The demand for surveyors needs to increase as properties are being sub-divided, townships established, and in terms of the SIPs, new towns are being developed and a multitude of projects need to be set out and planned.

There are currently 1 779 land and engineering surveyors registered through PLATO, excluding persons in training categories. Their distribution between the private and public sectors is shown in Figure 24.

The range of activities required in the public sector are varied and not limited only to the built environment. Work includes monitoring the movement of structures such as bridges, dam walls and stadiums to detect structural weaknesses before disasters strike. Surveyors, as specialists in spatial positioning, also record and maintain records on all spatial assets such as land, pipelines, power lines, roads, road furniture, underground utilities and buildings.

Professional Surveyors are needed by most organs of state but are currently not within all such structures.

From the QLFS, it is seen that there are some 3 000 higher education educated surveyors in the labour force and another 4 800 with NQF 5 and below qualifications acting as survey assistants.

SOLUTIONS

SCHOOL

Career guidance

The survey profession needs to provide career guidance material for the various national career websites and to participate in career shows and career discussions on radio to reach more potential feeder schools to grow the intake.

The right subject and results

Learners need to take maths and science and those wishing to become land surveyors need to achieve at least a B in maths.

Selection

More sophisticated selection methodologies need to be developed since surveying requires enhanced capabilities in trigonometry and mathematics in general.

THEORY

Currently qualifications in land surveying are offered at:

- University of KwaZulu-Natal
- University of Cape Town

Engineering surveyors are trained at:

- Cape Peninsula University of Technology
- Durban University of Technology
- Mangosuthu University of Technology
- Tshwane University of Technology

These institutions require support to grow the pool. The Department of Land Affairs has made considerable funding available for bursaries in the past 10 years. The University of KZN and UCT have responded to the challenge and have increased their enrolment numbers by 10 each year since 2011. The University of KZN is considering increasing their enrolment again, allowing up to 50 to 55 entrants a year. However, there are many constraints to achieving this growth, solutions for which are outlined.

Equipment

Most departments require substantially more modern survey equipment so that all students can gain hands-on experience. Equipment required includes survey total stations, GNSS receivers, spectrometers, multispectral cameras, scanners, side scan sonars, faster and more powerful computers and associated software.

Staffing

Attraction of adequately qualified staff for all levels of qualifications is a problem. Due to the extreme shortage of surveyors, premium salaries are being paid in the state and private sector, so salary increases, or subvention with the help of industry are required to attract and retain academics.

The development of the next cadre of academics is proving challenging. Funding for postgraduate scholarships and research projects, including equipment, computers, software, data acquisition, travel and additional project running costs is required.

Furthermore, many academic staff do not have time to oversee research projects. Funding for research assistant posts and research grants to cover project expenses will have a positive impact on both undergraduate and postgraduate student success through access to cutting-edge research in the teaching and learning environment.

Partnerships between industry and academia need to be strengthened to ensure that developing academics can gain practical experience, and funding should be provided for academics to attend conferences and workshops to keep up with the latest trends and technology.

The curriculum

Academic Institutions contend that their curricula are out of date and this view is supported by PLATO, the body appointed to carry out accreditations, as well as the Industry through SAGI. Funding for a nationally coordinated curriculum review is required in conjunction with industry.

Teaching and learning

It is considered essential that staff are trained to be able to teach the complex topics covered.

Student support

Student support is the area requiring the greatest attention, with the need for tutoring and additional research project support. Bursaries are also important to attract top students.

WORKPLACE-BASED LEARNING

As most practices in the private sector are small, taking on and training graduates towards professional registration needs to be subsidised to cover not only mentorship but additional equipment, systems and software which is expensive. Access to candidacy grants will help the situation.

It is suggested that the professional body coordinates work by recognised associations such as SAGI with support in candidacy phase grants by the SETAs in supporting survey development. In association with HEIs, a new structured training programme must be developed by industry and coordinated placement, training, mentoring and monitoring of workplace development instituted.

Where there is capacity in the State to offer training, as many graduates as possible should be absorbed. Where inadequate mentoring and coaching capacity exists, retired surveyors should be harnessed to perform these roles.

Consideration should also be given by PLATO or the new Geomatics Council (when operational) to the establishment of a Geomatics Centre of Excellence which can provide training to those who cannot find placement as well as training on constantly evolving technologies.

ASSESSMENT

Registration support and RPL

There are many potential candidates who require support towards registration in the various Surveying Categories. These include:

- Persons who have never registered and have degrees/diplomas under old qualifying criteria
- Persons who have newer degrees/diplomas but have not been surveying under supervision of a registered person
- Persons who have foreign qualifications
- Persons who have experience from a foreign country

Assessment of foreign qualifications is particularly time consuming given that PLATO does not have full time staff dedicated to the evaluation of such degrees/diplomas.

Assessment model

PLATO currently assesses candidates based on a number of days per stipulated task along with a supervisor's assessment letter. Since this is no indication that the candidate is actually fully competent in such tasks there is a need to urgently implement an outcome-based assessment model.

Currently PLATO does not have sufficient funds or resources to implement such an outcomes-based model. HEIs which have implemented successful work-integrated learning (WIL) and staff with additional education qualifications must be contracted. Retired professionals, after thorough training in assessment methods, may also be invited for this, but funding remains a constraint to this improved method of assessment.

International resources

Recognising the shortage of academic capacity locally, it is recommended that international academics are encouraged to enter the country in the short term to handle the academic workload and in particular to develop young academics.

EMPLOYMENT AND RELATED ISSUES

Building a capable state

Apart from metros, no municipalities have any surveying staff, and the same is true of most provincial and many national organs of state. In developing or updating organograms, the need for survey professionals needs to be accommodated to address the latent gaps which currently exist. Virtually all organs of state have land assets, spatial requirements or

built environment needs and need surveying professionals within their departments.

Many organs of state are unaware of the full spectrum of surveying activities and technologies available.

OFO

There is a need for the range of occupations associated with Geomatics to be registered on the OFO to ensure that full teams of professionals are in place to support the work.

PROJECTIONS

From the above, it can be seen that there is a need to increase the numbers currently studying at universities and universities of technology and improve the throughput.

The OT has suggested that an average growth of at least 4% per annum is required, as shown in Figure 26.

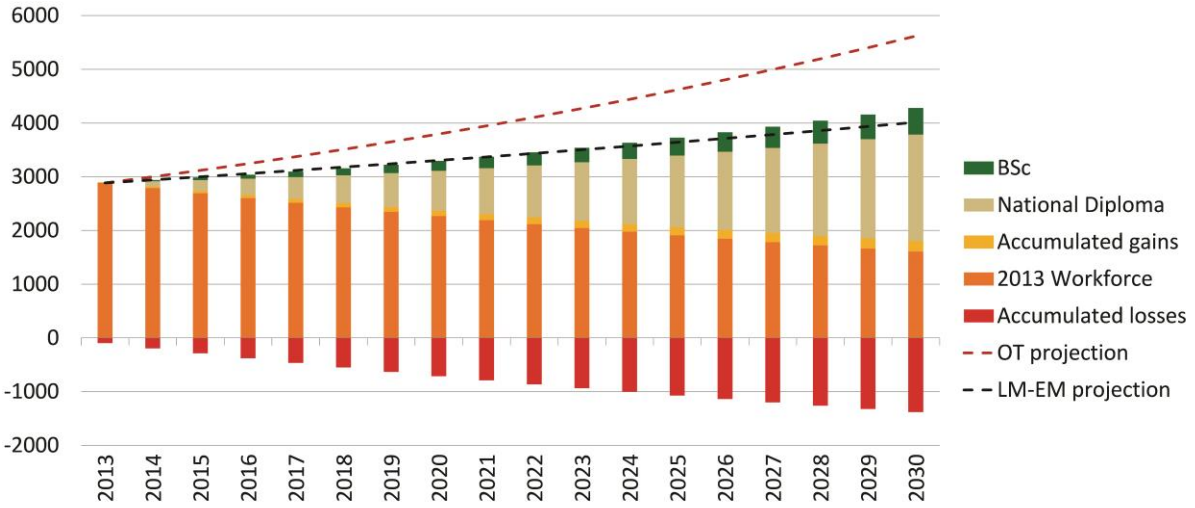


Figure 26: Projected demand for and supply of surveyors

QUANTITY SURVEYOR AND ESTIMATOR

OCCUPATIONAL DESCRIPTIONS

Quantity Surveyor – Estimates and monitors construction costs from the feasibility stage, through tender preparation, to the construction period and beyond.

Organisational and Methods Analyst (including Scheduler and Estimator) – Estimates the cost for products or services.

LEARNING PATHWAYS

There are several routes to becoming a registered quantity surveyor as follows:

- Completing an accredited quantity surveying degree or diploma and three or four years of structured workplace training under the supervision of a Pr QS
- Completing a Construction Management or Property Studies degree or diploma and four or five years of structured workplace training under the supervision of a Pr QS
- Completing a non-accredited quantity surveying degree or diploma and four or five years of structured workplace training under the supervision of a Pr QS

Once the person is competent the final process is to submit appropriate reports and a logbook, and attend a review for assessment to be registered professionally.

For more information on quantity surveying see the National Careers Advice Portal, http://ncap.careerhelp.org.za/occupation and select the occupations.

OVERVIEW AND CHALLENGES

There is only one tier of registration for quantity surveyors – Professional Quantity Surveyor (PrQS). The PrQS is the authority on construction economics in the construction and engineering environment. The distribution of

quantity surveyors in industry is shown in Figure 27.

Although many QSs work in construction and development, increasing numbers are required at all levels of government to conduct feasibility studies, prepare budgets, and costing and quantities relating to infrastructure development, maintenance and upgrades.

More quantity surveying professionals are required, which will come from addressing throughput, RPL and considering a new designation focused on the construction site.

SOLUTIONS

THEORY

Staffing

- More lecturers are required to address student: lecturer ratios and improve throughput

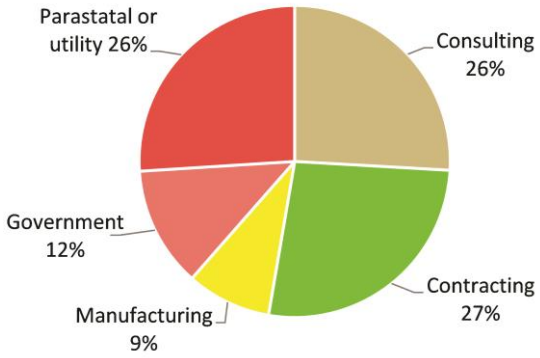


Figure 27: The distribution of quantity surveyors

Source: QLFS 2009 – 2013

- Relax the requirements for Master's degrees at UoTs to attract more lecturers
- Call on industry to sponsor Chairs and contribute to investment funds to subvent salaries in order to attract more lecturers
- Offer postgraduate scholarships to develop a new cadre of academics and increase the level of research taking place
- Offer scholarships to existing academic staff to enhance their qualifications
- Remove the compulsory retirement age of 65 for lecturing staff

The curriculum

- Curriculum reform is required to address the high teaching load and ensure that curricula are acceptable to industry
- Set up convenor universities or UoTs to ensure consistency in the development of new qualifications
- Not all of the HEIs offering QS courses are accredited by SACQSP. There is a need for the curricula in these institutions to be enhanced to satisfy the accreditation outcomes.

Teaching and learning

Improved teaching and learning methods

Student support

Expand student support in terms of full bursaries and tutoring to address under-preparedness

WORKPLACE-BASED LEARNING

Most quantity survey practices are small and lack capacity or funding to take on graduates. The SACQSP has developed a structured workplace training programme and system which will assist employers with training of candidates, but funding to encourage them to take on candidates is required. Candidacy phase grants from the SETAs should be made available.

ASSESSMENT

RPL

The most direct route to registration is via an NQF Level 8 qualification. Registration from NQF 7 and below requires that candidates undertake additional academic training in the form of an honours degree, or complete the equivalent 18 Professional Skills Modules as offered by SACQSP. Only 20% of this group ultimately pursue registration.

Many PDI candidates need to follow this route to achieve professional status. Once-off funding of R10 260 over a two year period per candidate is required to receive on-line mentoring and complete the 18 modules and sit a final professional examination.

New designations

An additional tier of registration, Construction Cost Surveyor is being developed to cover financial construction cost management, working with contractors. This will, to some extent, reduce the load on the current Pr QS and address the shortages, and improve the overall competency at contractor level, particularly emerging contractors.

OFO

The additional occupation being envisaged will need to be loaded on the OFO.

PROJECTIONS

With adequate investment in RPL and the balance of the above recommendations capacity will be much improved.

PLANNERS

OCCUPATIONAL DESCRIPTIONS

Urban and Regional Planners develop and implement plans and policies for the controlled use of urban and rural land and advise on the economic, environmental and social needs of land areas.

Professional Planner – Takes a leading role in strategic projects, spatial development frameworks and integrated development planning.

Technical Planner – Plays a major role in land use management, controlling the illegal use of land and evaluation of site development and building plans.

LEARNING PATHWAY

For information on the learning pathway see the National Careers Advice Portal, http://ncap.careerhelp.org.za/occupation and select the occupations.

OVERVIEW AND CHALLENGES

Planners are essential to give effect to the objectives of the National Development Plan and vital for the implementation of SIPs in various stages of the development process. Essentially planning entails the spatial implementation of government policy on how the country should be developed. In the apartheid era, Planners were prevailed upon to entrench apartheid policies of separate development which cast the profession in a bad light. In the new dispensation, there has been a propensity for those not qualified to take planning into their own hands to right the wrongs of the past, but this has resulted in haphazard development which must now be addressed.

NATIONAL POLICIES AND LEGISLATION

The enactment of the new Spatial Planning and Land Use Management Act of 2013 (SPLUMA) is due to take place on 1 September 2014, and it determines that a Municipal Planning Tribunal should be established in every municipality to decide on land development applications. Each tribunal should consist of at least five persons who have knowledge and experience of spatial planning, land use management and land development and a tribunal may not include any municipal councillors.

The role of Planners will become central to all land related processes and be crucial for the implementation of all SIPs.

The NDP and the new Act create a major demand for registered Planners.

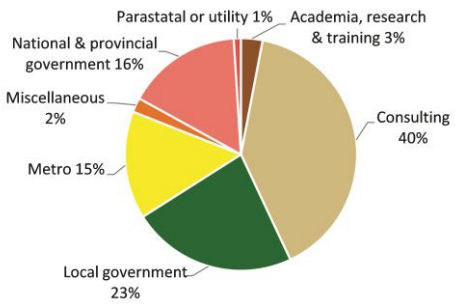


Figure 28: Sectors in which town planners are employed

Source: SAPI 2014

THE NUMBERS

There are currently approximately 3 500 Planners in South Africa of which an estimated 70% are registered with the South African Council for Planners (SACPLAN).From Figure 28 it can be seen that more than 55% of Planners are employed in the public sector, with around 3% as academics and 40% in the private and corporate sectors. Given the demands of SPLUMA, numbers in municipalities need to increase and it is suggested that at least 800 more Planners will be needed over the life of the SIPs.

A turnaround strategy for the state of planning in the country should start with a major drive in the public sector (especially municipal planners) and then focus on buy-in from the private sector.

SOLUTIONS

SCHOOL

Career guidance

Although town and regional planning as a career has been around for decades in South Africa, very few school learners are aware of what a career in Planning entails.

Since entry requirements into higher education are not as onerous as for engineering and some other occupations, planning is often a fall back for those who are not accepted into their first choice of career.

SACPLAN needs to engage with NCAP to enhance career information associated with their occupations and promote them through national radio and outreach programmes.

THEORY

In planning circles it is not uncommon to hear industry complaining about the major gap between knowledge gained at HEIs versus knowledge necessary to execute basic planning tasks in the workplace.

The following quote is relevant:

'Unfortunately the gap between theory and practice is not as wide in theory as it is in practice' – Author Unknown

The curriculum

There is a profound need to re-curriculate to incorporate detailed course modules covering:

- The National Development Plan
- The Spatial Planning and Land Use Management Act and its implementation
- How to prepare and implement Integrated Development Plans (IDPs)
- Understanding local government structures, procedures and management

Competencies and Standards should be finalised by SACPLAN to ensure sound accreditation of planning schools and managing of planning curricula. Not all planning qualifications are accredited by SACPLAN. This needs attention.

Staffing

Attracting adequately qualified and experienced lecturers is problematic. The best lecturers are often attracted into the private sector with much better packages and premium benefits.

Industry always looks for experienced planners and is loathe to employ new graduates. Students unable to get employment continue to Master's degrees in the hope of finding employment while studying. When they are still unsuccessful with finding employment, they accept lecturing posts, continue with PhDs and become academics. Their only experience is research and teaching and they have little practical experience to share. This widens the

gap between theory taught at university and practical knowledge needed in the workplace.

Subvention of salaries is required so that experienced planners from the public and private sector can be attracted into academia.

The problem is exacerbated where specialist subjects need to the taught such as transport planning, computer design for planners, environmental planning and the like. These lecturers need to have had specialist practical experience in that field to maximise the learning experience for the students and prepare them for the workplace.

All the interventions outlined at the beginning of the chapter are required to attract and retain academic staff. In addition, since it is so important that lecturers have had practical experience the following should be considered:

- **Academic-Private-Forums (APFs)** – A forum should be established in each HEI centre where academic planners and private sector planners meet monthly to discuss market trends, challenges in the industry, upcoming opportunities and similar matters. These could then form the networks that would feed into the Occupational Teams.
- **Registration and CPD** – All lecturers should be encouraged to work towards professional registration and should be sponsored to attend CPD bearing practical courses and workshops to support CPD.

Student support

- Most students rely on loans to obtain a higher education qualification. Bursaries need to be made available to deserving students from the onset of the first year.
- Scholarships for Master's and Doctorate students need to be available for those wanting to enhance their qualifications.

WORKPLACE-BASED LEARNING

The most frustrating reality for Planners is the fact that, although it is a scarce skill, there are scores of graduates who cannot find employment. In the public sector where municipalities and other structures are willing to employ them, there are no experienced Planners to mentor them, limiting the potential for them to develop professionally.

The solution is to launch a programme where external Professional Planners are used to assist in mentoring candidates in workplaces. The Professional Development Centre of the South African Planning Institute (SAPI-PDC) has offered to design and manage such a programme, but funding is required. In essence the following should be put in place:

- **Placement** – Candidates in municipalities, other public sector structures and private sector organisatons where opportunities exist
- **Developing a structured programme** – Incorporating all the key elements required to produce excellence – practical training, workplace skills, classroom skills development, mentorship and SACPLAN registration
- **Mentorship** – All Young Planners should be mentored from graduation to registration
- **Considering the needs of the Young Planner** – Directing funding and grants towards development as a professional first and then to the needs of the organisation rather than the other way around
- **Preparing a plan** – The system should include the development of a workplace training plan per candidate that requires sign-off by the mentor and the candidate
- **Recording and reviewing** – A system of recording experience, coaching, mentorship and reviewing progress on an on-going basis is required to support candidates working towards professional registration
- **Rotation or secondment** – Where candidates cannot gain adequate experience in one

department or organisation, the opportunities for rotation or secondment should be in place

- **Mentor training** – It is of paramount importance that mentors are trained to become aware of the most recent registration requirements of SACPLAN. This training should be provided free of charge and funded by government to attract private planning firms for mentorship opportunities.

Public sector funding is crucial to implement such a project. It is a perfect opportunity for a Public-Private-Partnership (PPP) in order to develop registered Planners to be ready for the implementation of the SIPs projects across the country.

ASSESSMENT

In a bid to ensure that registration is relevant and all those practicing in the planning field are registered, the South African Council for Planners (SACPLAN) has invested time and energy in reinventing itself post the apartheid era. It has defined new competencies and standards for the Planning profession which has made it necessary to evaluate current qualifications, revisit the registration process, manage work-integrated learning (WIL), and make provision for a CPD policy, recognition of foreign qualifications and job profiling. There is some urgency to complete this process to ensure that all planners learn and apply up to date principles and policies in the execution of their duties.

RPL

The SACPLAN does not recognise prior learning and should develop an RPL policy to assist the registration of scores of experienced people in the planning sector but funding is required to appoint consultants to develop an RPL policy.

CPD

The SACPLAN is still in the process of drafting a CPD policy for registered Planners. This is long overdue and the industry and voluntary associations are ready to provide professional development opportunities but, as it is not compulsory, individuals are not motivated to attend workshops and courses.

The SACPLAN CPD policy project needs to be finalised urgently.

PROJECTIONS

The OT has suggested that an average growth of at least 4% per annum is required, as shown in Figure 29.

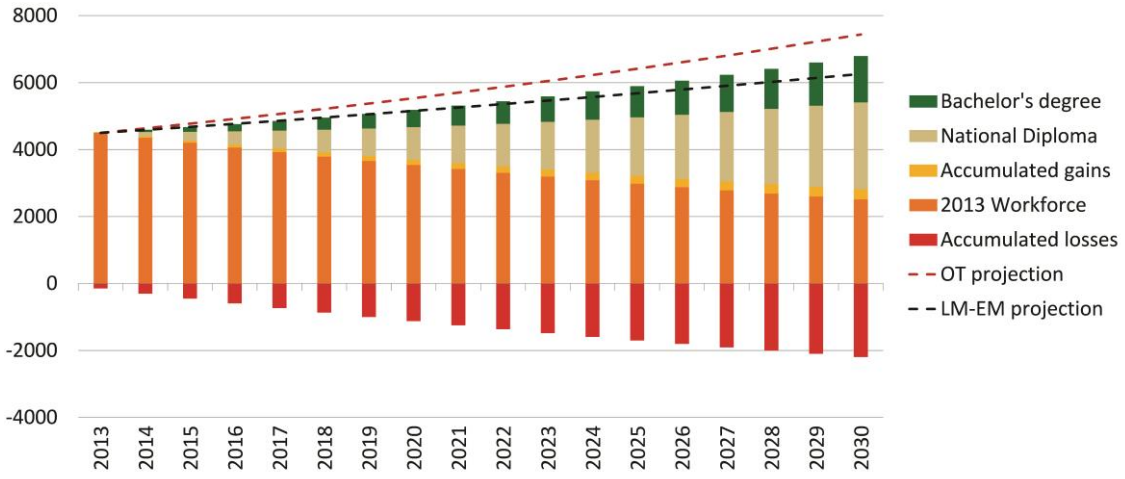


Figure 29: Projected demand for and supply of planners

CONSTRUCTION PROFESSIONALS

THE OCCUPATIONS

The South African Council for Project and Construction Management Professionals (SACPCMP) registers construction professionals who work at the coal face of delivering construction projects. The professionals are:

- Construction Project Manager
- Construction Manager
- Construction Health and Safety
- Construction Health and Safety Manager
- Construction Health and Safety Officer

Figure 30 shows the relationship of construction professionals to other professions associated with the delivery of infrastructure.

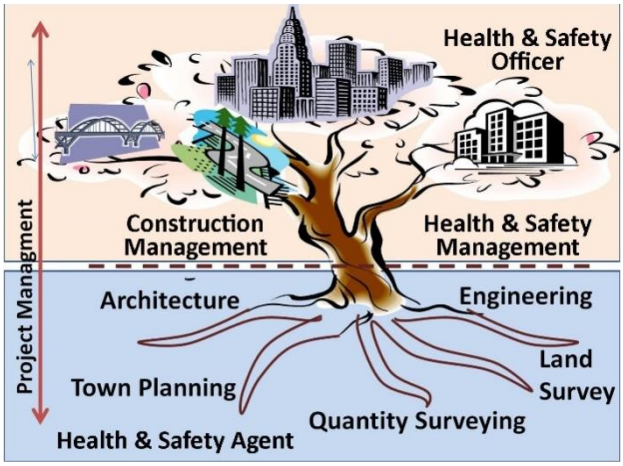


Figure 30: Professionals associated with the delivery of infrastructure

With the protracted slowdown in the demand for construction work from the 1980s to 2005 and the decline of the trades in the past two decades, the feeder stream into supervision and middle management levels of charge hand, trade foreman, junior site foreman and general foreman have been lost.[38]

These occupations were responsible for the quality of work of their teams and the health and safety of those reporting to them. Candidate professionals learnt much from these managers in the early days of their careers and were the interface between the trades and experienced professionals. With this break down, it is difficult for candidates to learn the processes on-site and mid-career professionals, finding themselves with limited support, cannot cope and are leaving the profession in alarming numbers. This further reduces the capacity to develop young graduates to full professionals.

Furthermore, there has been a decline in the number of construction managers studying and graduating over the past 15 years which is further contributing to the shortage of construction professionals.

STAGES OF A PROJECT

The project work stages for delivering typical construction projects are as follows:

- Project initiation and briefing
- Concept and feasibility
- Design development
- Tender document and procurement
- Construction documentation and management
- Project close out

Construction professionals are involved in some or all of the stages, depending on the category of registration.

CHALLENGES

The construction sector has long been considered as a sector which can support job creation and contribute towards the alleviation of poverty in South Africa. However, the project environment has become extremely toxic due to many changes and frustrations which have built up over the years.

In researching challenges facing the industry the CPM (2010)[39] report highlighted the following as key issues to be addressed:

- Clients who do not understand the process
- Constant late information and design changes

- Late payment and client lack of skills in contracts and procedures
- Lack of continuity of work
- Short duration contracts
- Development procurement and selection rules

These challenges result in cost and time overruns, contractors making a loss or even going into liquidation, and the final product not satisfying the original requirements.

The need to build a capable state is more crucial in the construction sector than most due to the investment in infrastructure development. Planning and monitoring implementation is key to achieving the desired outcomes.

INCREASING REQUIREMENTS

The requirement to use local labour; labour-based methods; joint ventures and other BBBEE initiatives; and to appoint many compliance personnel including health and safety professional consultants, managers and officers to deal with numerous compliance issues, has changed the focus and legal liability on projects, requiring much more highly qualified personnel in a range of disciplines. Existing curricula need to be extended and new qualifications are required to cover the increasing demands placed on the construction industry.

The practice of using Labour-Only contracting, particularly on projects above R5m is also proving a challenge as these projects are often inadequately managed. In this form of procurement, it should be a requirement that a Professional Construction Manager is in place to manage the production process.

COORDINATION

The entire built environment is very fragmented and industry bodies have not been able to ensure integration of efforts. Apart from BBBEE, there has been no industry wide effort to look at planning or come up with improved methods or development strategies.

Industry needs to understand the current development landscape and the scale of the problem has caused people to burn-out or leave and to find ways to streamlines processes and coordination to make the workplace and the environment supportive and to make careers in construction attractive.

It is suggested that a Unity Summit be organised by industry itself, at which all BEP professionals meet to learn about the problems of each and the problems of the industry as perceived by others. Emanating from this, a United Leadership committee should be elected to identify the problems and potential solutions and develop plans to address each problem area.

CONSTRUCTION PROJECT MANAGER AND CONSTRUCTION MANAGER

OCCUPATIONAL DESCRIPTIONS

Construction Project Manager – Manages projects within the built environment from conception to completion, including management of related professional services.
Construction Manager – Manages the physical construction process within the built environment and includes the co-ordination, administration and management of resources.

LEARNING PATHWAYS

For information on the learning pathway see the National Careers Advice Portal, http://ncap.careerhelp.org.za/occupation and select the occupations.

OVERVIEW AND CHALLENGES

There is a view that any well trained manager can manage any project. This is not so in the construction industry where technical skills and know how are essential to understand the process, recognise and solve problems and ensure that projects are implemented on time, within budget and to specification. Construction project managers and construction managers are technically trained and registered specifically in the construction field.

Both Construction managers and construction project managers require an accredited qualification in the Built Environment with a minimum number of years of postgraduation relevant practical experience. The difference between these professions is the type and specialisation of postgraduate experience. Many graduates elect to pursue a career in Construction Project Management based on perceptions that this is a more desirable

career than Construction Management which is often perceived as dirty.

Attrition of the profession is significant and attributable to these perceptions coupled with disillusionment, stress, lack of support and burnout.

Many CMs migrate to Construction Project Management since they possess the requisite qualifications and have practical construction knowledge and experience.

In researching the challenges facing the construction industry, the CMP report of 2010 showed that six of the top 14 challenges related to skills are as follows:

- Lack of skills and capacity in others (e.g. client or consultant)
- Lack of skills in own organisation
- Number of skilled people leaving the profession
- Few young people entering
- Lack of artisans
- Shortage of support people

The number graduating as construction managers has been in decline over the past few years.

Over the entire period, the total only equates to 2 500. Allowing for losses and given that there are some 5 000 projects under construction at any one time, it can be seen that there is an extreme shortage of

construction managers. It is suggested that the number in industry should treble.

This reduction in the student population must be reversed to ensure an adequate supply for the long-term roll out of the SIPs.

CONSTRUCTION REGULATIONS 2014

The competent person to be appointed as the construction manager defined in Clause 8(1) of the regulations is responsible for the management of the physical construction processes and the coordination, administration and management of resources on a construction site with the duty of managing all the construction work on a single site, including the duty of ensuring occupational health and safety compliance.

The DoL has confirmed that the competent person can be a SACPCMP Pr CM, or an ECSA Pr Eng, Pr Tech Eng or Pr Techni Eng, or any person who holds the qualifications and competency to be eligible to be registered.

SOLUTIONS

SCHOOL

Career guidance

A major awareness campaign is needed to increase entrants to these occupations. The SACPCMP needs to team up with NCAP to mount a major promotion and provide career promotion props and methods to be used at all career promotion events.

THEORY

Facilities

Given the low numbers being trained and entering the industry, it is considered that more students should be enrolled and more universities should offer CM qualifications to ensure an adequate spread nationally.

Staffing

- More lecturers are required to address the large student: lecturer ratios
- Relax requirements for Master's degrees at UoTs, to attract more lecturers and ensure that staff with experience in construction management are appointed
- Create and support the establishment of three Chairs in Construction Management and maintain them at R10m a year
- Create a Subvention fund for five years for support of specialist CM staff salaries to encourage more people with practical experience to take up posts
- Offer scholarships to existing academic staff to enable them to enhance their qualifications

Curriculum

Currently several courses are attended by both construction management and quantity surveying students. There is a need for a return to dedicated CM Chairs and stand-alone CM qualifications to ensure that diluted and hybrid qualifications are not perpetuated. CMs born from these hybrid qualifications migrate to QS roles and this perpetuates the void in the CM profession. This will require:

- Degree Courses in Construction Management
- Hons in Construction Management
- MSc in Construction Management

Student support

- Student support in terms of full bursaries
- VAs to support students at university with encouragement and providing part-time lecturers
- Encourage and support an annual CM student conference – rotating to each university

WORKPLACE-BASED LEARNING

Margins and deadlines in the construction sector are extremely tight and the pressure to deliver is substantial. Employers rarely have adequate time to spend developing graduates. When they begin work and find

that projects are unsupportive environments, they leave the industry.

Employers must understand the needs of new entrants and to develop adequate training programmes and make capacity available to support them. Funding from SETAs should be accessed for candidate training to ensure that adequate structure and mentorship is in place to develop them towards professional registration.

A total of 100 new candidates should be taken on annually and it is necessary to consider the current backlog of over 1 000 candidates who have not received structured training and support.

PROJECTIONS

Substantial energy and investment will be required to grow an adequate pool of construction managers.

CONSTRUCTION HEALTH AND SAFETY AGENT, MANAGER, OFFICER

OCCUPATIONAL DESCRIPTIONS

Health and Safety Agent – Acts as a representative for a client in the planning, implementation and management of construction health and safety management systems, performance, compliance with the Occupational Health And Safety Act 1993 (Act No.85 of 1993); and the Construction Regulations 2014.

A Construction Health and Safety Agent must demonstrate detailed knowledge of health and safety requirements at all levels, with the capability to design, compile, implement and manage the health and safety requirements for a construction project from initiation and briefing to project close-out.

Health and Safety Manager – Manages the planning and implementation of construction health and safety systems.

LEARNING PATHWAY

For information on the learning pathway see the National Careers Advice Portal, http://ncap.careerhelp.org.za/occupation and select the occupation.

OVERVIEW AND CHALLENGES

The number of accidents on site has been on the increase for a long period as shown in Figure 31.

The Construction Industry Development Board report on the status of Construction Health and Safety released in June 2011 recommended:

- Enhancing the understanding of the status of construction H&S in South Africa
- Establishing minimum competence standards and accreditation of client appointed H&S agents in terms of the Construction Regulations
- Establishing an H&S Agency as a focus point for the promotion, awareness, information, advice and promotion of research on construction H&S

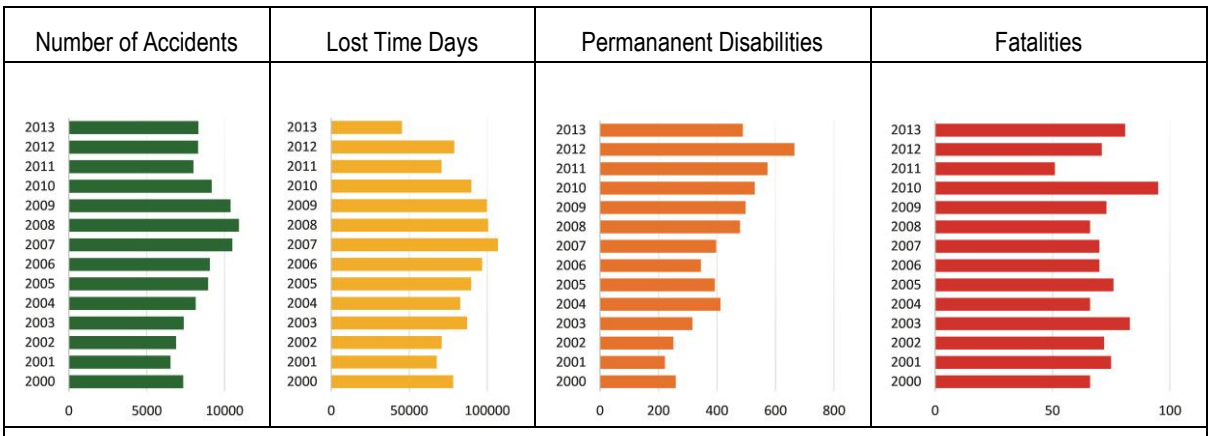


Figure 31: Number of accidents on site

Source: FEM

Based on this, the South African Council for the Project and Construction Management Professions (SACPCMP) took ownership of the CHS professions and three new categories of registration under the discipline of CHS have been approved as listed above.

CONSTRUCTION REGULATIONS 2014

As a key Construction Health and Safety risk reduction strategy, the Construction Regulations 2014 require that the Health and Safety on all Construction projects above R13m (cidb [6]) be included in project design from inception to close-out by a professionally registered Construction Health and Safety Agent. In some instances, the risk profile of a project may require the employment of a CHS Officer or CHS Manager.

There is a risk to the construction industry, in that the registration of the profession is new. Few are registered at present and there is low awareness of the requirement for registration.

The DoL has confirmed that the Pr CHSA may assume the occupational health and safety compliance role on a site without having a CHSO on site. This will depend on the risk and the range of H&S activities to be undertaken to mitigate the risks. The CHSO need not be present on every construction site (risk dependent). However, the details of the competent person and CHSO (if required) must be specified on the submission made to DoL on projects of Grade 6 and above. DoL reserves the right to require a CHSO if necessary (Clause 8(5)).

The need now is to develop qualifications, bridging qualifications, RPL those with experience, and create awareness and critically, register sufficient professionals in terms of the new construction regulations by the August 2015 cut-off date. Failure to have sufficient registered persons would mean that very few construction sites would receive consent to commence construction from the Department of Labour.

SOLUTIONS

AWARENESS

PR and career guidance

Substantial effort will be required to create awareness of these careers. Not only will career guidance be necessary at school level, but road shows and public relations activities in general will be necessary to create awareness of the need for existing practitioners to enhance their skills and/or register in time for the legislated date of implementation in August 2015.

THEORY

New qualifications

Currently there are two structured MSc. qualifications. These are offered by NMMU and IRCA (Da Vinci Institute). Assistance is required to establish and develop qualifications in a number of additional institutions. Due to the very specific scope of services and deliverables for this profession, hybrids of existing qualifications are not suitable. New qualifications could be modelled around the existing qualifications and international best practice examples to cover Health and Safety (H&S) and Operations Risk Management (ORM). Assistance from the DHET is required to establish qualifications in multiple institutions. Courses required are:

- Degree Courses in Construction H&S Management /ORM Construction
- Hons in Construction H&S Management /ORM Construction
- MSc Construction H&S Management /ORM Construction
- QCTO qualifications

Staffing

Introducing new courses will require more lecturers and scholarships to develop academics.

Student support

Bursaries and funding for WIL will be required to attract potential candidates.

ASSESSMENT

RPL

There are many individuals with some experience in Construction Health and Safety. This is not ideal as it is a specialist field which requires both specialist experience and knowledge. There is a need to assist them with their development by providing short courses to address deficiencies in their knowledge.

Targeted approved short courses (NQF 3 – 5) can play a significant role in filling the academic void and are, in the interim, considered amongst the minimum academic requirements for SACPCMP registration for CHSO and CHSM categories.

It will be necessary to make assessors available to assess each applicant and determine whether their knowledge and experience is consistent with that of a registered person.

Training of Assessors

The anticipated applications for professional registration follow a thorough assessment process which takes approximately 4 months. The most significant reason for this duration is that the pool of assessors is very limited and there is a need to train new assessors immediately and over the next 3 years to assist in the process.

EMPLOYMENT RELATED ISSUES

OFO

The new occupations envisaged fall under existing OFO definitions and will need to be included on the OFO as separate occupations with new descriptors.

PROJECTIONS

The cidb estimates that the industry need is for about 3 500 H&S Officers. It is estimated that around 3 000 of these are already on sites but not registered. The cidb estimates that there is a need for an additional 500 new H&S officers. The number of Pr CHS Agents required to meet immediate demand is estimated by the SACPCMP as 338. The projected shortfall is estimated at around 130. The number of CHS Managers required to meet immediate demand is estimated by the SACPCMP as 440. The projected shortfall is estimated at 200.

ENGINEERING PROFESSIONALS

The Engineering Council of South Africa (ECSA) registers professionals in nine disciplines being:

- Aeronautical Engineering
- Agricultural Engineering
- Chemical Engineering
- Civil Engineering
- Electrical Engineering
- Industrial Engineering
- Mechanical Engineering
- Metallurgy Engineering
- Mining Engineering

The categories of registration are:

- Professional Engineer
- Professional Engineering Technologist
- Certificated Engineer
- Professional Engineering Technician

THE WORKFORCE

THE ENGINEERING TEAM

Delivering any project or product requires the involvement of the entire engineering team as shown in Figure 32.

Figure 32: The engineering team

In the planning phase, engineers, technologists and technicians play a major role, while in the implementation phase, many technicians, artisans, operators and elementary workers are required. In the case of maintenance, certificated engineers may also be required.

There is no ideal ratio of engineers to technologists to technicians. These vary per discipline and stage of the project cycle. There is a strong feeling that certificate courses should be developed for specialist technicians, who should then be registered by ECSA under 'specified categories'.

THE NUMBERS

Since there is no requirement for professional registration in many sub-sectors, it is difficult to determine the number of engineering practitioners active in South Africa.

This challenge is not unique to South Africa but is lamented worldwide.[40,41] Determining the actual number working in engineering, versus those in other sectors of the economy is considered problematic, though it is recognised that graduates working in other spheres continue to use their problem-solving skills to contribute to the economy.

The finalisation of the Identification of Engineering Work will offer a better picture of all working in engineering and will assist with quantifying and understanding the supply.

Graduations since 1918 are shown in Figure 33. Peaks of graduations are to be seen after the First and Second World Wars and after Apartheid development activities. The number of engineers graduating topped 2 000 for the first time in 2010. There had, however, been a dramatic decline in graduations from the mid-nineties for a ten year period. This, together with significant emigrations in the early nineties, have impacted on the number of mid-career professionals available today.

DEMAND

Internationally it is recognised that demand is difficult to determine due to the volatility of world economics and the impact of political events.

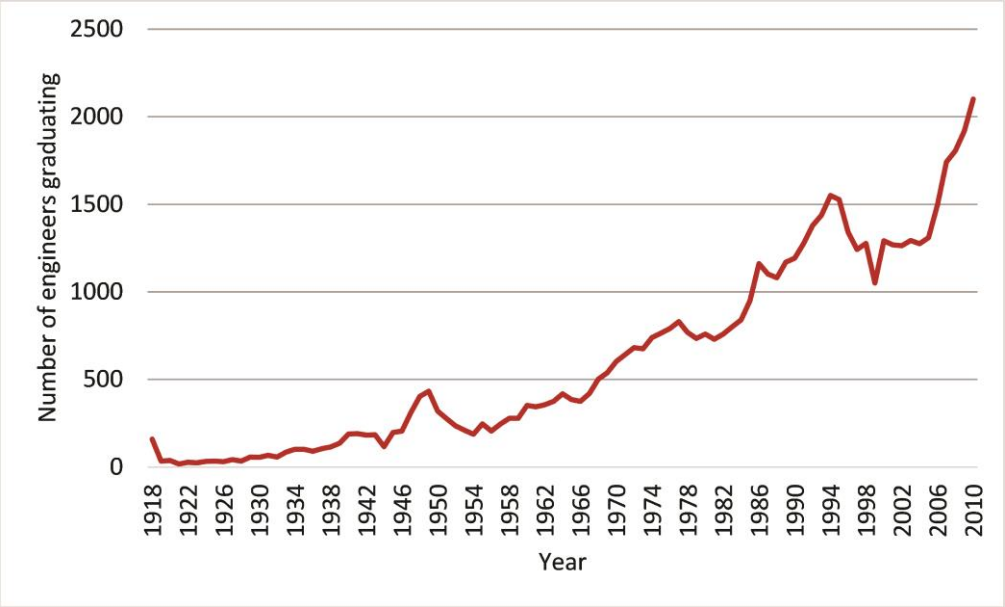


Figure 33: Graduation of engineers from South African Universities since 1918[42,43,44,45,46,47]

Demand is not only indicated by vacancies, but also by the work that should be done, but is not being attended to. This is particularly prevalent in the engineering sector in South Africa where limited attention is being paid to operations and maintenance, which is evident from the visible degradation of much infrastructure and related services.[48]

Exact numbers have been difficult to determine, but in recognising South Africa's desire to move from a resource-based economy towards a knowledge-based economy[49] the development of professionals beyond the exact need of the SIPs will make a contribution.

SUPPLY

In developing the long term model, supply numbers have been based on graduations in 2012, as shown in Table 11.

Table 11: Engineering graduations in 2012

Discipline	Engineer	Technologist	Technician	Total
Aeronautical engineering	17	0	0	17
Chemical engineering	366	284	499	1 149
Civil engineering	517	473	765	586
Electrical engineering	482	568	1 536	2 586
Industrial engineering	235	197	253	685
Mechanical engineering	612	596	793	2 001
Mining engineering	157	64	118	939
Total	**2 386**	**2 782**	**3 964**	**9 132**

Source: HEMIS 2012

AERONAUTICAL ENGINEER

OCCUPATIONAL DESCRIPTION

Aeronautical engineer – Designs, develops and supervises manufacturing, maintenance and modification of aircraft and spacecraft, particularly for high risk items.

Aeronautical engineering technologist – Supervises engineering work concerned with the design, development, manufacturing, maintenance and modification of aircraft and spacecraft. Carries out design work for lower risk items.

Aeronautical engineering technician – Carries out manufacturing, maintenance and modification of aircraft and spacecraft.

LEARNING PATHWAY

For information on the learning pathway see the National Careers Advice Portal, http://ncap.careerhelp.org.za/occupation and select the occupations.

OVERVIEW AND CHALLENGES

Aeronautical engineering will contribute towards several SIPs, particularly in terms of increased trade and the need to expand the airports and surrounding infrastructure and to address the increasing demand for maintenance and repair.

The industries in which aeronautical engineering practitioners are employed can be seen in Figure 34.

Although aeronautical engineering has shown significant growth in some industries, it has shown a reduction in others, particularly in defence related industries. With drastic cuts in defence expenditure and small growth overall in non-defence related aeronautical engineering, a large number of the most qualified design practitioners have either

migrated to non-aeronautical industries or have emigrated.

There is a significant shortage of qualified engineers, technologists and technicians as well as scientists researching in specialist areas in support of aeronautical engineering.

Several companies in the aeronautical sector have low levels of staffing with little hope of catching up the backlog.

The market for locally designed aeronautical products remains small and, because of large capital expenditure needed to establish significant development capabilities, unless companies have good orders from international clients, they struggle to expand.

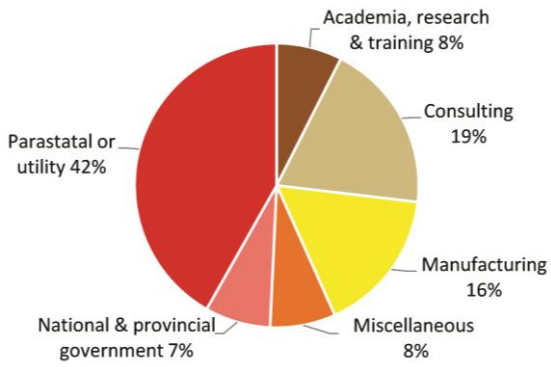


Figure 34: Sectors in which aeronautical practitioners are employed

Source: ECSA Industry Research 2013

There is however a lot of potential for significant growth in the recreational aviation market, particularly for indigenous design.

There is also huge potential market for recycling and repurposing of airframes and parts, which will require a large number of technicians and artisans.

Air transport is however increasing in Southern Africa at a rate of approximately 6% per annum (average for the last decade) above the world average. Projections indicate that the growth will be far greater in the next 20 years. Air transport is critical to the growth of Africa's economies and tourism.

There should thus be a commensurate growth in the production of aeronautical engineering graduates and other aeronautical professionals and scientists.

SOLUTIONS

THEORY

Infrastructure

Dedicated aeronautical engineering laboratories are required at learning institutions. While wind tunnels exist at several universities, few have testing facilities for other items such as power plants, undercarriages and wing beams.

To accommodate the increases suggested, it will be necessary to expand facilities including lecture space, increased and/or updated laboratory equipment and computers.

Staffing

- Suitably qualified and experienced lecturers are in short supply
- Subvention of lecturer salaries to attract and retain existing lecturers could help
- Support industry involvement in academia including short term visiting lectureships from industry, academic placements in industry and develop a culture of research collaboration between aeronautical academics and industry

Student support

- Student support in terms of full bursaries, tutoring and mentoring would be advantageous. Significant employment prospects do much to motivate students to continue and complete their studies
- Aeronautical engineering is arguably the most challenging discipline to study in engineering with fewer than 45% completing after five years. A large number of students who commence study move to other disciplines when they realise how difficult the course is or, if they find bursary funding
- The lack of national diploma and BTech programmes in aeronautical engineering means that students who are better suited to a practice-based programme end up failing the BSc programme and are often lost from the system.

Funding

In common with other disciplines, the funding formula is still too low for aeronautical engineering. Higher grants per student would do much to ensure departments are adequately resourced for higher numbers in this difficult discipline.

WORKPLACE-BASED LEARNING

Most of the development required for aeronautical engineering professionals takes place in the workplace with further implications on infrastructure for aerospace industries. It will be necessary to identify both public and private sector organisations that can support graduate training.

There is also a need for vacation work placements in industry. Currently many students are forced to do the work in other industries and are often recruited away from aeronautical engineering as a result.

In the past there were good facilities and capabilities in Denel companies, the CSIR and others. Many of these organisations have been critically drained of their expertise because of defence budget cuts and off-the-shelf purchases of armaments from overseas suppliers rather than investment in local capabilities. A change of focus toward specific investment in development projects will be essential for the local capability to be re-established.

Particular attention should be paid to the MRO and aviation sectors. Both are routinely omitted from policy and strategic discussions, yet they hold the most potential for industry growth and can be a catalyst for skills development at artisan and technician levels. They are also an essential component without which air transport cannot operate, let alone grow.

Aeronautical engineers do not receive very high salaries and many move to other disciplines or emigrate. Typically only a very small group of highly passionate people remain in aeronautical engineering throughout their careers.

Traditionally the aerospace industry has been kept vibrant mostly by defence related work that was government funded and carried out by parastatals such as the SANDF, CSIR and Denel companies.

Companies find training expensive and mistakes by trainees cannot be afforded. Companies should receive incentives to train aeronautical engineering professionals to offset costs. Although private sector companies would like to do more training, there is very little profit incentive to do so.

Specialisation

Through the course of their careers it is necessary at times to retrain or upskill e.g. as industrial or systems engineering specialists. Postgraduate qualifications such as MSc(Eng) Systems Engineering are essential but specialist programmes are usually poorly funded and need additional support, particularly in the set up phase.

CHEMICAL ENGINEER, TECHNOLOGIST, TECHNICIAN

OCCUPATIONAL DESCRIPTIONS

Chemical engineer – Designs and prepares specifications for chemical process systems and the construction and operation of commercial-scale chemical plants, and supervises industrial processing, fabrication and manufacturing of products undergoing physical and chemical changes and related technologies.

Chemical engineering technologist – Converts concepts prepared by the chemical engineer into working solutions, analyses and modifies new and existing chemical engineering technologies and applies them in the testing and implementation of chemical engineering projects.

Chemical engineering technician – Tests new and existing engineering technologies related to chemical, biochemical, industrial chemistry, chemical quality control and environmental protection and manages operations and maintenance of processes.

LEARNING PATHWAYS

For information on the learning pathway see the National Careers Advice Portal, http://ncap.careerhelp.org.za/occupation and select the occupations.

OVERVIEW AND CHALLENGES

Chemical engineering will contribute towards several SIPs, particularly in terms of process plants, food and water security. The industries in which chemical engineering practitioners are employed can be seen in Figure 35.

The average growth rate for chemical engineering in the past decade has been 2.7%, which means that there should be a commensurate growth in the production of

chemical engineering graduates. This has not been the case. Throughput rates at UoTs average 17% and there is a need for more academics and research, as these are key to developing tomorrow's chemical engineering professionals.

SOLUTIONS

THEORY

It is suggested that enrolments should increase by 5% per annum for the foreseeable future. This will require more career awareness and expanded facilities.

Infrastructure

- Expansion of facilities including lecture space and adequately equipped laboratories
- It is suggested that the calculation of the new funding formula considerably underestimated the cost of engineering equipment and facilities and operations and maintenance and should be revised

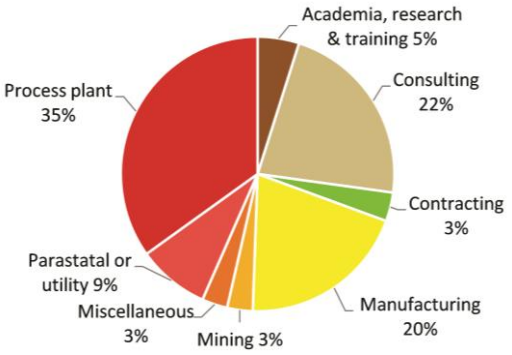


Figure 35: Sectors in which chemical practitioners are employed

Source: ECSA Industry Research 2013

- Increased funding to replace and/or update laboratory equipment and computers

Staffing

- More lecturers to address the high student: lecturer ratios (current average is 40:1)
- Subvention of lecturer salaries in order to attract more lecturers and retain existing
- Offering lecturers scholarships to existing academic staff to enhance their qualifications
- New academics be developed at a rate of 10% over the next five years (Also note that there is an aging workforce in the engineering academic sector)
- New posts should be created to ensure that the staff: student ratio can allow for innovative teaching which will lead to higher throughputs

Curriculum

- Institutions are currently re-curriculating according to the new HEQF.
- There must be interaction between institutions and industry to ensure that the curriculum is relevant for the chemical engineering sector. Occupational Teams with networks across the country are well positioned to drive this process

Teaching and learning

- Funding is required to ensure adequate facilitation of project-based learning which requires the provision of teaching assistants and/or tutors/mentors.

Student support

- Student support in terms of full bursaries, tutoring, mentoring to address underpreparedness. Bursaries should be tied in with candidacy training and ultimately with registration. This can be a joint venture between industry partners and the SETAs.
- Funding is required from all engineering SETAs in support of work-integrated learning (WIL)

Funding

- The funding formula is still too low for engineering – need for higher grant per student to ensure departments are adequately resourced for high student numbers and the complexity of curriculum

WORKPLACE BASED LEARNING

Develop structured workplace training systems per sub-discipline and provide workplaces and mentorship for all graduates.

Funding is required for the candidacy phase. Partnerships need to be developed between industries and the SETAs and targets need to be set for funding the development of at least 30% of all graduates per annum.

PROJECTIONS

The OT has suggested that an average growth of at least 4.5% per annum is required to catch up on the backlog, as shown in Figure 36.

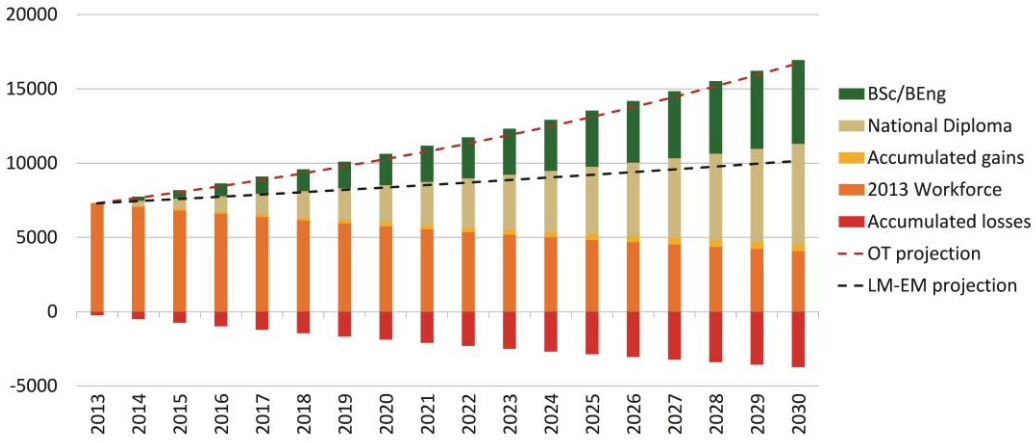


Figure 36: Projected demand for and supply of chemical engineering practitioners

CIVIL ENGINEER, TECHNOLOGIST, TECHNICIAN

OCCUPATIONAL DESCRIPTIONS

Civil engineer – Plans, designs, organises and oversees the construction, operation and maintenance of civil engineering projects such as structural, transportation or hydraulic engineering systems

Civil engineering technologists – Works as consultants, contractors, or as part of a team of engineers to plan, design, manage, carry out and maintain large construction projects

Civil engineering technician – Manages tests, systems and process and must have a good knowledge of materials, technical standards, procedures as their work is very practical

LEARNING PATHWAYS

For information on the learning pathway see the National Careers Advice Portal, http://ncap.careerhelp.org.za/occupation and select the occupations.

OVERVIEW AND CHALLENGES

Civil engineering professionals are always in demand when it comes to infrastructure development as they are required in many sectors to ensure that there is adequate planning, capacity to design, implement, operate and maintain infrastructure as shown in Figure 37.

The short-term challenge is the need for experienced professionals and the long-term need is the replacement demand in view of significant numbers retiring in the next few years. Currently there are large numbers enrolled in civil engineering studies but throughput is a challenge. Furthermore, the number and quality of workplace training opportunities are limited.

From Figure 37 it can be seen that some 20% of all civil engineering practitioners are employed by the state. Given that the state contributes to some 60% of civil engineering spending, this number should be substantially higher.

SOLUTIONS

Solutions are required across the pipeline – many of which are outlined in the chapter overview. In terms of civil engineering, the specific solutions which require attention are discussed below.

THEORY

Facilities

- Upgrade and expand laboratory facilities and replace outdated equipment.

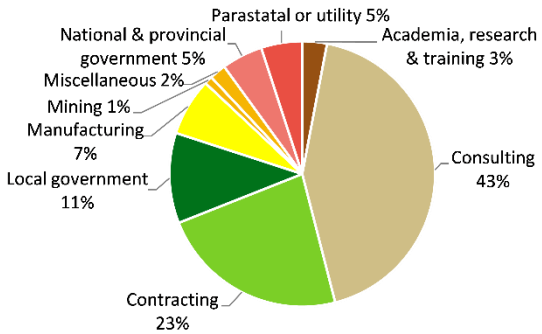


Figure 37: Sectors in which civil engineering practitioners are employed

Source: Numbers and Needs 2004 and updated review in 2011

Staffing

- More lecturers are required to address the high student: lecturer ratios – as at 31 August 2013, there were 31 vacancies in UoTs
- Salary increases of 25% to 30% are suggested to attract additional staff and retain the current staff
- Relax the requirements for Master's degrees at UoTs to attract more lecturers
- Call on industry to sponsor Chairs and contribute towards investment funds to subvent salaries to attract more lecturers
- Offer at least seven new postgraduate scholarships per annum for five years to budding academics to fill the current vacancies
- Offer scholarships to existing academic staff to enhance their qualifications
- Remove the compulsory retirement age of 65 for lecturing staff

The curriculum

- Curriculum reform is required to address the high teaching load and ensure that curricula are acceptable to industry. Industry wide workshop and consultation is required
- There is a need for consistent course materials to be developed per discipline
- Set up convenor universities or UoTs working with Occupational Teams to ensure consistency in the development of new qualifications

Teaching and learning

- Ensure that all academics attend the E3 course to enhance their engineering lecturing skills

Student support

- Expand student support in terms of full bursaries, tutoring and numeracy including the introduction of NumberWise.

WORKPLACE-BASED LEARNING

Structured workplace training is essential to develop civil engineering candidates towards professional registration. Experience in the full project cycle should be planned and candidates need increasingly complex work and responsibility under supervision, overseen by a mentor. Funding for candidate programmes is urgently needed to ensure that candidates register in less than the current average of seven years after graduation.

BUILDING A CAPABLE STATE

All the support outlined at the beginning of the chapter for building a capable state is applicable to civil engineering.

PROJECTIONS

The current rate of growth of approximately 3% should be maintained which can largely be achieved by improving throughput in higher education.

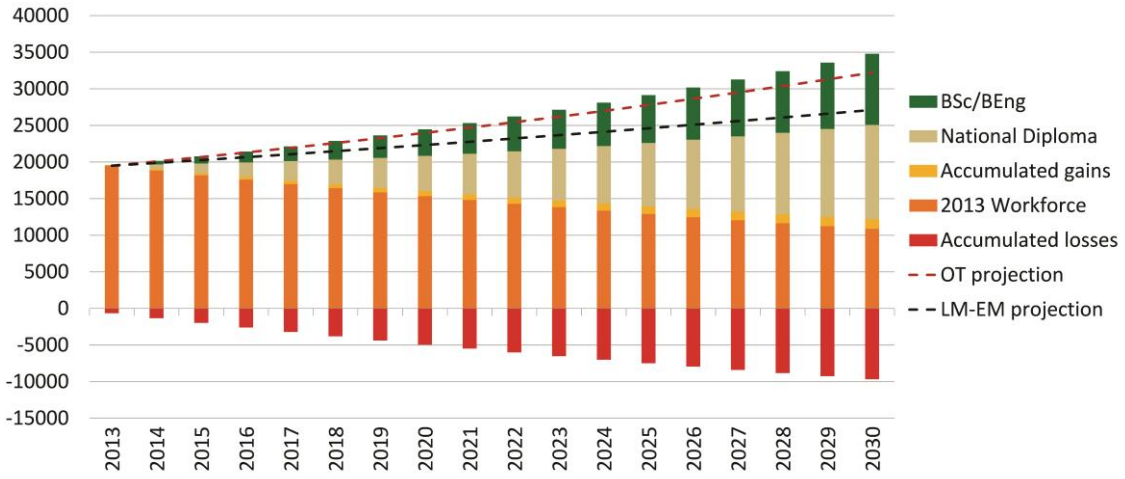


Figure 38: Projected demand for and supply of civil engineering practitioners

ELECTRICAL ENGINEER, TECHNOLOGIST, TECHNICIAN

OCCUPATIONAL DESCRIPTIONS

Electrical engineering professionals are trained in a number of specialist areas which are important for the roll out of the SIPs.

Electrical engineer – Designs, develops and supervises the manufacture, installation, operation and maintenance of equipment, machines and systems for the generation, distribution, utilisation and control of electric power

Electrical engineering technologist – Analyses and modifies new and existing electrical engineering technologies and applies them in the testing and implementation of electrical engineering projects

Electrical engineering technician – Conducts tests of electrical systems, prepares charts and tabulations, and assists in estimating costs in support of electrical engineers and engineering technologists

Electronic engineer – Designs, develops, adapts, installs, tests and maintains electronic components, circuits and systems used for computer systems, communication systems and other industrial applications.

Electronic engineering technologist – Analyses, modifies, maintains and repairs new and existing electronic systems and applies them in the testing and implementation of electronic engineering projects

Electronic engineering technician – Conducts tests of electronic systems, collects and analyses data, and assembles circuitry in support of electronics engineers and engineering technologists.

Telecommunications engineer – Designs and develops telecommunications systems, devices and products.

Telecommunications engineering technologist – Analyses, modifies, maintains and repairs new and existing telecommunication systems and applies them in the testing and implementation of telecommunication engineering projects.

Telecommunications engineering technician – Performs technical tasks connected with telecommunications engineering research, as well as with the design, manufacture, assembly, construction, operation, maintenance and repair of telecommunications systems.

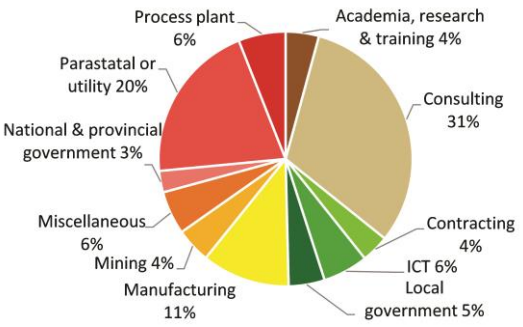


Figure 39: Sectors in which electrical practitioners are employed

Source: ECSA Industry Research 2013

LEARNING PATHWAYS

For information on the learning pathway see the National Careers Advice Portal, http://ncap.careerhelp.org.za/occupation and select the occupations.

OVERVIEW AND CHALLENGES

Some 30% of electrical engineering practitioners are employed in the public sector, in all three spheres of government, and parastatals such as Eskom, Transnet and Denel. Electrical engineering services will be widely used in the development of the power stations, expanding the transmission and distributions networks and in the rail projects associated with the SIPs.

Electronic engineering is a sub-discipline of electrical engineering which addresses control and instrumentation (C&I), measurement and automation. The field of automation has changed from largely pneumatic controllers to electronic automation of processes by making use of Programmable Logic Controllers (PLC) and Distributed Control Systems (DCS).

This introduction of computers into the operational arena has made optimisation and full process integration possible but there is a shortage of technicians, technologists and engineers who can understand and integrate computers, chemical process characteristics, electrical equipment as well as instrumentation and measurement techniques. Electronic engineering services will be widely used in the SIPs, considering systems associated with power stations, hospitals, process plants, mines, rail and harbours.

Telecommunications is a further sub-discipline of electrical engineering and represent 6% of South Africa's GDP. Effective communications and data transfer are critical in terms of advancement and competitiveness.

Given the long range of these projections it is difficult to suggest exact development requirements since advances in technology may well require different skills in the longer term. It should be noted that already technology has advanced to the extent that many tasks which were previously the domain of the artisan need to be assigned to those with more complex theoretical training such as technicians and technologists.

In the medium to long term, the number of electrical engineering professionals should double. There is a view that the number of technicians needs to be increased substantially. Ratios of 1:3:6 have been suggested for engineer to technologist to technician. The ratios in Eskom are of the order of 1:0.2:2.5[50]. This is based on Eskom's drive towards achieving a ratio of 1:3:5 for engineer to technician to artisan.

Research needs to be carried out on the types of training and specialist qualifications required if ratios are to change. These could include Higher Certificates in Engineering or QCTO awards. Should these be decided upon, additional 'specified categories' may need to be considered for registration with ECSA.

SOLUTIONS

THEORY

Equipment

- To ensure that students use leading-edge products and equipment, it is suggested that entities be encouraged to share their equipment with HEIs, or make donations available to expand and replace equipment.

Curriculum

- In the light of the new HEQF and QCTO, curricula must be developed to address industry needs
- Consistent course material needs to be developed

- In terms of electronic engineering, content and practicals addressing Control and Instrumentation (C&I), Automation and Manufacturing Execution Systems (MES) must be reworked to prepare graduates for the workplace

Staffing

- More lecturers to address the high student: lecturer ratios
- Subvention of lecturer salaries in order to attract more lecturers and retain existing lecturers

Student support

Student support in terms of full bursaries, tutoring, mentoring, winter and summer schools to address under-preparedness

WORKPLACE BASED LEARNING

- Develop structured workplace training systems per sub-discipline
- Provide workplaces and mentorship for all graduates – public sector and large private sector organisations to participate
- SETAs to provide funding for mentorship, coaching and training and streamline the process of claiming grants

EXPERTISE

Electrical engineering work is more complex than many other engineering technologies dictating that, in the short term, all experienced practitioners need to be harnessed, including retirees and international capacity. It is suggested that employment equity criteria be relaxed when experience is required, and that retirement ages should be extended for those with priority skills. Experienced personnel should be called upon to mentor younger electrical engineering staff.

SPECIALISATION

A range of specialists is required. It is suggested that funding be made available for postgraduate studies in, among others:

- Control and instrumentation
- Renewable energy
- Demand/supply side management
- Asset management

PROJECTIONS

The OT has suggested that an average growth of at least 3% per annum is required particularly in the development of technicians, as shown in Figure 40.

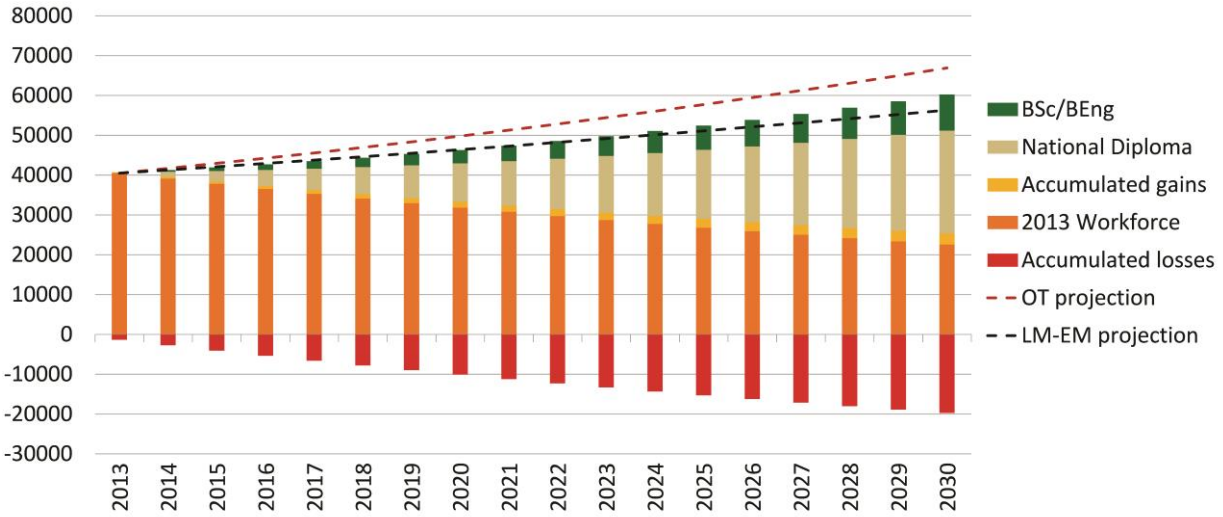


Figure 40: Projected demand for and supply of electrical engineering practitioners

ENVIRONMENTAL ENGINEER

OCCUPATIONAL DESCRIPTION

Environmental engineer – Conducts research, advises on, designs and directs implementation of solutions to prevent, control or remedy negative impacts of human activity on the environment and conducts environmental assessments of construction and civil engineering projects and applies engineering principles to pollution control, recycling and waste disposal.

LEARNING PATHWAYS

For information on the learning pathway see the National Careers Advice Portal, http://ncap.careerhelp.org.za/occupation and select the occupation.

OVERVIEW AND CHALLENGES

Environmental Engineering is a specialisation of many engineering disciplines. The ECSA research report released in May 2014 showed that 44% of all respondents have technical postgraduate qualifications. The percentage of respondents involved in environmental engineering per discipline is shown in Table 12.

This would indicate that some 3.3% of all engineering practitioners are involved in environmental engineering.

Table 12: Percentage of respondents involved in environmental engineering

Discipline	%
Agricultural Engineering	3%
Chemical Engineering	12%
Civil Engineering	5%
Mechanical Engineering	3%
Mining Engineering	3%

There is currently no dedicated environmental engineering degree. There are however several postgraduate courses which enable engineering graduates to specialise in environmental engineering as shown in Table 13. The criticism of these courses is that many are very theoretical or research based, which is not what engineers are looking for when they wish to expand their horizons into the environmental field.

SOLUTIONS

THEORY

Enrolment

In the short-term, to increase the numbers, the solution would be to enrol more students on the range of postgraduate environmental engineering courses offered.

New qualification

In the long-term, it may be necessary to develop a dedicated environmental engineering degree. This would, however, require dedicated staffing, facilities, a new curriculum which will need to be accredited by ECSA and for ECSA to recognise an additional field of engineering under which applicants may register professionally. The entire process would not be complete in less than five years.

Research is required to determine whether an undergraduate course is required, or whether additional postgraduate courses are required for engineering practitioners.

Table 13: Environmental engineering postgraduate qualifications

University	Discipline	Qualification	Specialisation
UKZN	Civil Engineering	MSc	Water and waste water treatment
	Chemical Engineering	MSc	Waste management
		MSc	Environmental modelling
Wits	Civil Engineering	MSc	Waste water engineering
		MSc	Pollution control and abatement
		MSc	Environmental management
Stellenbosch	Civil Engineering	MSc	Water and environmental engineering
Pretoria	Chemical Engineering	MSc	Water management
		MSc	Environmental management
		MSc	Air management
		MSc	Design for the environment
UCT	Chemical Engineering	MSc	Bioprocess engineering
	Civil Engineering	MSc	Water chemistry
		MSc	Waste water treatment
TUT	Civil Engineering	BTech	Civil and environmental engineering
UJ	Civil Engineering	BTech	Civil and environmental engineering
NMMU	Civil Engineering	BTech	Civil and environmental engineering
Unisa	Civil Engineering	BTech	Civil and environmental engineering
	Chemical Engineering	BTech	Chemical and environmental engineering

INDUSTRIAL ENGINEER, TECHNOLOGIST, TECHNICIAN

OCCUPATIONAL DESCRIPTIONS

Industrial engineer – Investigates and reviews the utilisation of personnel, facilities, equipment and materials, current operational processes and established practices to recommend improvement in the efficiency of operations in a variety of commercial, industrial and production environments

Industrial engineering technologist – Analyses, modifies and uses new and existing industrial engineering technologies and applies them in the testing and implementation of industrial engineering projects

Industrial engineering technician – Tests new and existing engineering technologies relating to the utilisation of personnel, facilities, equipment and materials, current operational processes and established practices to recommend improvement in the efficiency of operations in a variety of commercial, industrial and production environments

LEARNING PATHWAYS

For information on the learning pathway see the National Careers Advice Portal, http://ncap.careerhelp.org.za/occupation and select the occupations.

OVERVIEW AND CHALLENGES

Industrial engineers are trained to optimise the development and management of systems and processes and can therefore play a leading role in many activities in the SIPs and in addressing the development of a capable state.

Many of the management categories discussed under the Management section can,

and should be handled by industrial engineers. Typically, industrial engineers can oversee operations and maintenance and ensure continuous improvement, address supply chain management, planning, quality management, programme, project and engineering management, configuration management, logistics to name but a few. The discipline has also developed to incorporate the design, implementation and improvement of business and service oriented processes, making it applicable to the majority of public sector services, e.g. public health care, supply chains of schools and education provision, municipal management, asset management, transport systems, communications, human settlements and the like.

As can be seen Figure 41 industrial engineers are used by many industries, with the category 'Other' including sectors such as

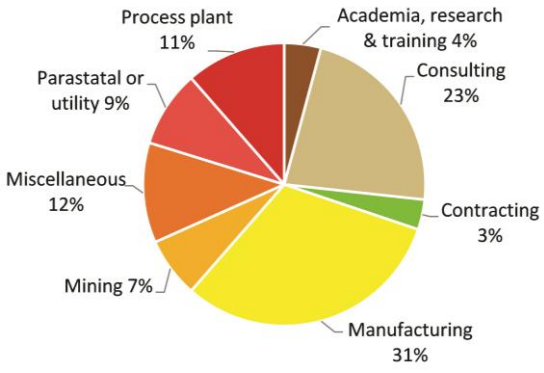


Figure 41: Sectors in which industrial engineering practitioners are employed

Source: ECSA Industry Research 2013

finance, health, trade and the three spheres of government. There is a view that the number of industrial engineers should be increased, however, industrial engineering is not well known or understood and considerable effort is required to increase the numbers. It is currently estimated that the identifiable shortage of industrial engineering practitioners is at least five times the number of Industrial Engineering students currently completing their studies.

The present average supply of industrial engineers is approximately 200 graduates per annum. Taking into account that the scarcity stems from both the supply and (ill-defined) demand side, it is envisaged that the number of graduates should increase in the mid to long term.

Considering the Design Build phases of the 18 SIPS, the additional demand for Industrial Engineers, could be in excess of 500 individuals, whilst the demand for B Tech and N Dip type skills could be several thousand.

For the Operate and Maintain phases, most of the SIP projects will directly employ approximately 5~10% of their construction staff complement, while related and supporting industries would employ a further 5~10%.

Further to this, in supporting the SIPS, there will be demand for industrial engineering skills for upstream service providers from manufacturing, logistics, banking, management consulting and assurance.

SOLUTIONS

SCHOOL

There is a need to increase enrolment. This will require more career awareness and bursaries to attract students.

THEORY

Many elements associated with the delivery of industrial engineering qualifications require attention to support increased enrolment and improve throughput, including:

Equipment

- Several institutions report having antiquated or inadequate infrastructure and equipment
- A significant need exists for laboratories equipped with contemporary technologies, in the fields of advanced manufacturing, eg. 3D printing, Computer Numerical Controlled equipment, and so forth
- Technology laboratories, equipped with industry relevant computer equipment and applications need to be put in place to offer courses, eg. Big Data/Smart Technology applications to solve complex and socially relevant optimisation problems, using methods that supersede those currently taught

Staffing

- Providing more lecturers and the subvention of existing lecturers' salaries
- Offering scholarships to existing academic staff to enhance their qualifications
- Developing approximately 80 to 100 new academics over the next five years, based on an average requirement of 7 to 12 additional lecturers, across 11 Schools of Industrial Engineering, two of which (University of the North West Province, and Unisa) are in the process of being established.
- Addressing the funding formula to ensure engineering departments are better funded and ensuring that the formula is linked to numbers graduating and not predominantly to numbers enrolling

Curriculum

- Realigning undergraduate courses to address specific skills shortages in specialist areas in Industrial Engineering is required
- A fundamental rethink of the B Tech and N Dip curricula is required, as a matter of urgency, to

be incorporated with the changeover to the new technical curricula

- The existing technical curriculum is based on that of the degree course, whereas it should be focused on the development of specialists in narrow fields, in at least seven to eight areas of specialisation, which could be introduced at undergraduate level
- There is a growing dissatisfaction in industry with the workplace readiness, and applicability of training of technical engineers. This needs to be addressed in the restructuring of the curricula
- Investigation is required to define courses along the following focus areas (engineering problems that are well-defined, or that could be solved using proven techniques) which could ultimately replace, or complement, the existing technical qualifications:
  - Operations, production, cost, variance, quality and maintenance management
  - Manufacturing techniques
  - Supply chain and logistics management
  - Project and programme administration and management
  - Process management and systems implementation
  - Systems analysis, design and optimisation
  - Business process optimisation
- The content of the BEng qualification needs revision to ensure that it caters to a more diversified set of industry needs, and the advancements that technology has enabled in many areas of application

WORKPLACE-BASED LEARNING

Develop structured workplace training and provide workplaces and mentorship for all graduates.

A significant shortage of mentors exists in the more contemporary areas of specialisation in Industrial Engineering, such as service delivery, fields where technology innovation has changed the way in which things are done and in the construction and engineering contracting space.

EXPERTISE

To ensure adequate capacity, there is a need to:

- Relax employment equity criteria when experience is required
- Consider attracting international expertise, and retirees to return to industry.
- Make mentoring and skills transfer a condition of contract for experienced staff
- Offer increased CPD points for mentoring

SPECIALISATION

- There are many specialist areas in which industrial engineers can contribute. Consider developing specialist short courses at postgraduate level.
- There are many individuals, without the required qualifications, undertaking roles which should otherwise have been fulfilled by Industrial Engineering practitioners. The need for short courses, to equip such individuals with the required skills is real and urgent.

EMPLOYMENT RELATED ISSUES

OFO

Redefine industrial engineering on the OFO.

PROJECTIONS

The output of graduates (BEng, BIng, BScEng.) has steadily increased over the past two decades. The output of diploma engineers has dramatically increased in the past decade. Considering the demand projections and the ratio of 1 Engineer to 3 Technologists and to 6 Technicians, it is evident that the bulk of the shortage lies in the domain of Technologists and Technicians.

PROJECTIONS

The OT has suggested that an average growth of at least 5% per annum is required as shown in Figure 42.

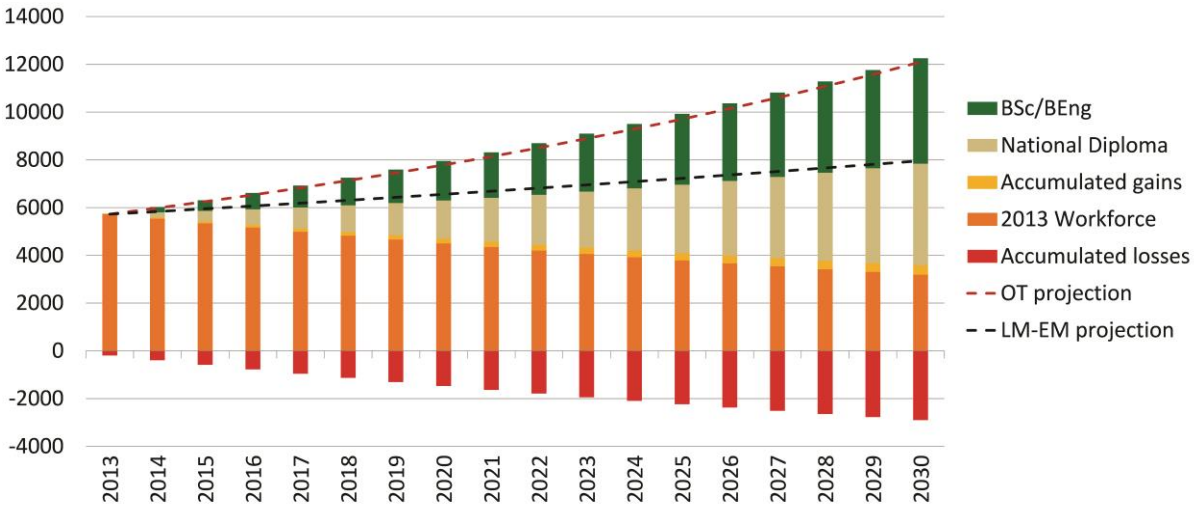


Figure 42: Projected demand for and supply of industrial engineer practitioner

MATERIALS ENGINEER, TECHNICIAN

OCCUPATIONAL DESCRIPTIONS

Materials engineer – Plans and directs the engineering and commercial application of materials, manufacturing processes, products and related technologies.

Materials engineering technician – Tests materials or carries out research into materials in support of materials engineers.

LEARNING PATHWAYS

For information on the learning pathway see the National Careers Advice Portal, http://ncap.careerhelp.org.za/occupation and select the occupation.

OVERVIEW AND CHALLENGES

ECSA does not recognise a specific category of engineer known as materials engineer. On investigation, it was found that there were several specialisations that were required for the delivery of the SIPs. The most important two specialisations recognised were those of Material and Non Destructive Testing (NDT) Engineer and engineering practitioners associated with road material testing.

NDT

Non-destructive testing makes use of non-invasive techniques to determine the integrity of materials, components or structures or measures characteristics of objects without rendering them unfit for use after testing. NDT is critical for checking for metal fatigue in pressure vessels, boilers, aeroplanes or even bridges for instance.

Engineers, outage managers and others responsible for large plants need a thorough understanding to ensure NDT techniques and procedures are in place. NDT forms part of a Master's degree at the University of Pretoria

and needs to be developed into a standalone qualification. In addition, qualifications for testers need to be developed. These are covered in the Elementary Chapter. NDT capacity will be required in SIPs 6,7,8,9,10,12,16 and 18.

ROAD MATERIALS

The selection and testing of road material is important to ensure the integrity of the road. A Road Materials National Diploma was offered at Pretoria Technikon until the late nineties but was subsequently discontinued. This now means that there are few young people in the field and many road material specialists are nearing retirement. Reinstatement of this qualification, or the development of a similar qualification, offered elsewhere must be considered.

Training of material testers has also been on the decline and must be reversed given the extent of road development and upgrading that is planned as part of the SIPs.

SOLUTIONS

THEORY

New qualifications

- **NDT** – An NDT Master's qualification needs to be considered
- **NDT** – A QCTO qualification is required for NDT testers which is being considered with the help of merSETA at present

- **Road materials** – A road materials national diploma or equivalent must be put in place
- **Road materials** – A QCTO qualification is required for road materials which is being considered with the help of CETA. There is a need to set up an AQP, which is costly. The National Laboratory Association (NLA) is the obvious choice, but needs capital to set up the entire system of accrediting laboratories, training assessors and training and employing moderators to ensure that the quality is maintained

Facilities

- **NDT** – Sophisticated testing equipment is required for research at Master's level and to ensure that students understand test methods and procedures
- **NDT** –Equipment will also be required by training providers offering the theory in relation to the QCTO qualification
- **Road materials** – Soils testing equipment will need to be upgraded and new equipment purchased when the new qualification is launched
- **Road materials** –Equipment will also be required by training providers offering the theory in relation to the QCTO qualification
- **Road materials** – To increase the numbers in the civil engineering master's course at the University of Stellenbosch, additional laboratory equipment is also required
- Funding is, or will be required, for all of the above equipment

Staffing

- In the short term, experienced academics and part-time lecturers from industry will be required
- In the medium to long term it will be necessary to develop young academics and expand research
- Laboratory technicians capable of calibrating and maintaining the equipment will also be key to the success of these qualifications.

Curricula

As with all new or extended curricula, funding will be required to develop or expand curricula and prepare new material.

WORKPLACE-BASED LEARNING

As with all professions, structured workplace training must be put in place.

ASSESSMENT

An area which will need attention is to determine registration categories for these occupations.

Consultation with ECSA will be required to ensure that there is sufficient engineering problem solving content in the road qualifications when they are redeveloped to ensure that road material technicians and technologists are able to achieve professional registration.

MECHANICAL ENGINEER, TECHNOLOGIST, TECHNICIAN

OCCUPATIONAL DESCRIPTIONS

Mechanical engineer – Plans, designs, organises and oversees the assembly, erection, operation and maintenance of mechanical and process plant and installations.

Mechanical engineering technologist – Analyses and modifies new and existing mechanical engineering technologies and applies them in the testing and implementation of mechanical engineering projects.

Mechanical engineering technician – Conducts tests of mechanical systems, collects and analyses data, and assembles and installs mechanical assemblies in support of mechanical engineers and engineering technologists.

LEARNING PATHWAYS

For information on the learning pathway see the National Careers Advice Portal, http://ncap.careerhelp.org.za/occupation and select the occupations.

OVERVIEW AND CHALLENGES

Mechanical engineering practitioners will be involved in all the projects associated with the 18 SIPs, and with most industrial projects following the enabling infrastructure.

They will have a significant role to play in the development of the engineering, design, estimating, planning, procurement, construction, commissioning operation, maintenance and de-commissioning of all the mechanical components of the SIPs, as well as the many projects that do not form part of the SIPs programme directly.

Mechanical engineering graduations have increased dramatically since the early 2000s, with engineers trebling from 2003 to 2012 and technicians increasing fivefold from 2000 to 2012. The numbers are still considered to be inadequate and further growth in graduate numbers and workplace support is considered essential.

SOLUTIONS

SCHOOL

- Attract more students with strong science and mathematics skills

THEORY

Facilities

- Expand lecturing, laboratory and workshop space
- Upgrade poor quality equipment in laboratories and workshops

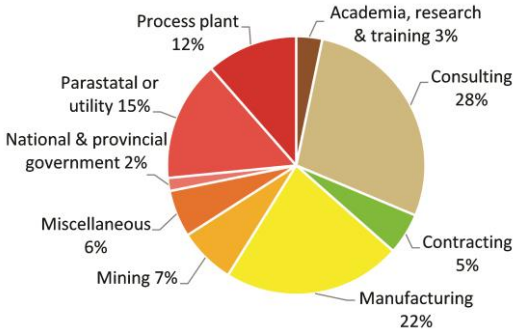


Figure 43: Sectors in which mechanical engineering practitioners are employed

Source: ECSA Industry Research 2013

Staffing

- Provide more lecturing capacity
- Develop academics and expand research

Student support

- Address the under-preparedness of students with poor maths and science schooling
- Provide a wider range of industry opportunities for industrial assignments during the undergraduate stage

WORKPLACE-BASED LEARNING

Graduates need to be immediately employed into structured candidate phase training programmes, thus reducing the number of unemployed graduates. This process will be ably assisted by the recently completed structure that has been developed by the ECSA Strategic Advisory Committee Working Group 1 and the participating VAs.

A necessary condition for resources to be optimally trained to meet mechanical engineering, is SETA based funding of Mentors and the administration role provided by the VAs. Mechanical engineering is characterised by a wide variety of skills and attributes specified by the employer to meet the specialised nature of the discipline. Crucial in meeting the mentoring role is the use of remunerated semi-retired and retired engineers who have acquired decades of experiential skills that need to be conveyed to the younger graduates moving into responsible functions in the industry.

PROJECTIONS

A 4.5% average growth per annum is suggested as shown in Figure 44. This can be achieved by improving higher education throughput rates.

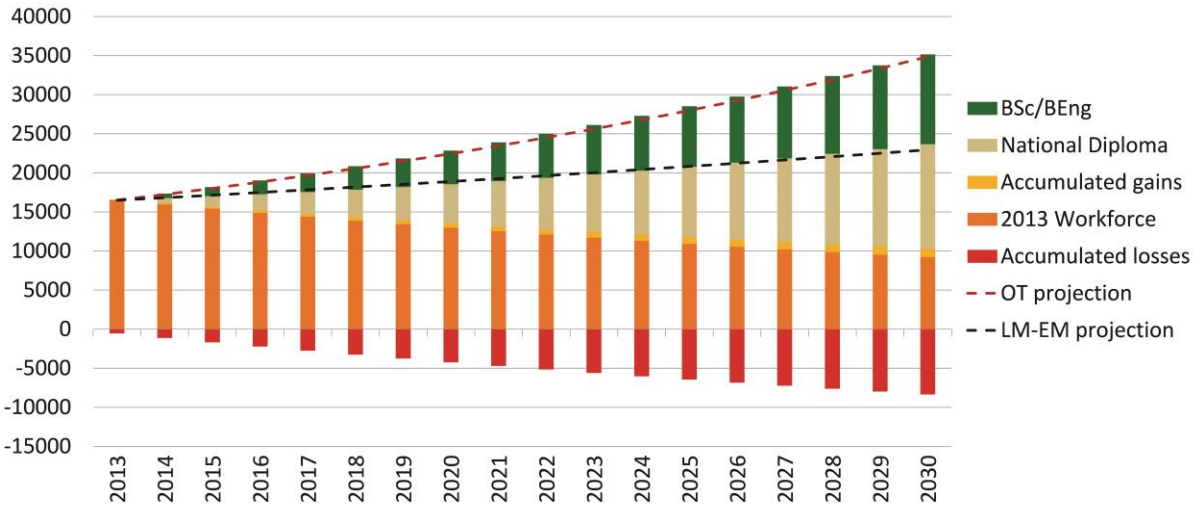


Figure 44: Projected demand for and supply of mechanical engineering practitioners

MINING ENGINEER, TECHNOLOGIST, TECHNICIAN

OCCUPATIONAL DESCRIPTIONS

Mining engineer – Plans and directs the mining engineering aspects associated with the location and extraction (exploitation) of minerals from the earth.

Mining engineering technologist – Plans analyses, modifies new and existing mining engineering technologies and applies them in the mining engineering discipline.

Certificated mining engineer – Manages and directs the diverse disciplines involved in the successful, safe and healthy operation of a mining operation in compliance with the relevant legislation.

Mining engineering technician – Operates the chosen mining engineering technologies relating to the location and extraction of minerals from the earth, oversees the health and safety of mining operations and supervises mining operations.

LEARNING PATHWAYS

For information on the learning pathway see the National Careers Advice Portal, http://ncap.careerhelp.org.za/occupation and select the occupations.

OVERVIEW AND CHALLENGES

Mining engineering is offered at the universities of Johannesburg, Pretoria, Witwatersrand and UNISA.

South Africa is one of the largest educators of mining engineers in the English-speaking world. The current numbers graduating should be increased to allow for substantial numbers who do not remain in South Africa after graduation, particularly when considering the local replacement demand.

Whist increasing enrolment and addressing throughput are essential, the most important element is workplace training and retention. Only 15% of mining engineers remain in the industry for a long-term career.[51]

Given the number of mining engineers employed by mining houses shown Figure 45 it is critical to retain young people to replace those due to retire soon.

Furthermore, mining engineers are mobile globally.

SOLUTIONS

INCREASING ENROLMENT

Student support

- Attract more students

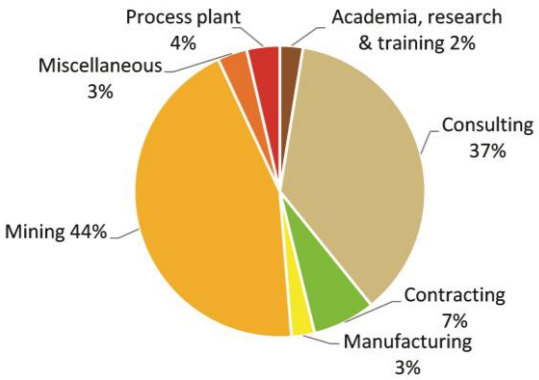


Figure 45: Sectors in which mining engineering practitioners are employed

Source: ECSA Industry Research 2013

- Address underpreparedness of students with poor maths and science schooling
- Bursaries with work-back programmes will increase enrolment and also retention for a period after graduation
- Develop structured training programmes with mentorship
- Develop career paths
- Ensure competitive remuneration

THEORY

- Provide more lecturing capacity
- Develop academics and expand research
- Expand lecturing, laboratory and workshop space
- Upgrade poor quality equipment in laboratories and workshops

WORKPLACE-BASED LEARNING

Workplace development opportunities are generally constrained by the size the organisation and the quantum of routine tasks which must be handled. The range of engineering activities and the opportunities to take increasing responsibility are often inadequate for overall development.

There is a need to develop and fund structured workplace training systems per sub-discipline and provide workplaces and mentorship for all graduates. Mining houses need to review their programme and work with SETAs to provide funding for mentorship, coaching and training support.

SCIENTISTS

A range of scientists were listed as scarce. They were:

- Database, network professionals and technicians
- Foresters and forestry technicians
- Specialist scientists such astronomers, geophysicists, nuclear physicists and electron microscopists

These occupations are small and little known but generally require high calibre matriculants with excellent marks in maths and science. Most of these qualifications are high tech and require sophisticated laboratory equipment which is expensive and dates quickly.

DATABASE AND NETWORK PROFESSIONALS

OCCUPATIONAL DESCRIPTIONS

Database and network professionals design, develop, control, maintain and support the optimal performance and security of information technology systems and infrastructure including databases, hardware and software, networks and operating systems.

The need for specialist data scientists, able to deal with large volumes of data, was identified by the SKA and various sub-disciplines within industrial and electrical engineering. The occupations are shown in Table 14

LEARNING PATHWAY

For information on the learning pathways see the National Careers Advice Portal, http://ncap.careerhelp.org.za/occupation and select the various occupations.

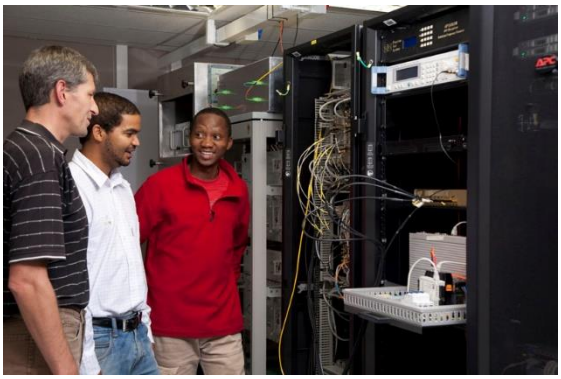


Table 14: IT Database and network team

OFO	Occupation
252101	Database Designer and Administrator
252201	Systems Administrator
252301	Computer Network and Systems Engineer
252302	Network Analyst
252901	ICT Security Specialist
252902	Technical (ICT) Support Services Manager
351301	Computer network technician

OVERVIEW AND CHALLENGES

Although the initial shortage identified was that of network technician, on investigation it was found that the shortage in the IT world also relates to network and database professions, as defined by OFO minor group, code 252. The occupational team cited inadequate levels of expertise as the biggest challenge on the demand side, and inadequate workplace development as the biggest challenge with respect to training.

Computer professionals research, analyse and recommend strategies for network, system and software or database architecture and develop, implement, manage, maintain and configure hardware and software, monitor, troubleshoot and optimise performance.

Computer technicians perform physical and investigative processes including technical support. Usually, experienced IT technicians specialise in a single area such as information systems, data recovery, network management or system administration.

In large installations, teams of computer practitioners are required to configure and manage systems, data and administration as shown in Figure 46.

Figure 46: The IT team

These are specialist occupations which require comprehensive theoretical and workplace training. The occupational team highlighted the need for curricula to be more relevant and academics to have more practical experience to ensure that graduates were prepared for the workplace. They also suggested that substantially more mentoring, coaching, and open learning should be available to support graduates in the workplace.

These sentiments were echoed by Adrian Schofield, manager of the JCSE's Applied Research Unit in a recent article where he explained that the ICT sector grapples with a number of wide-ranging issues; from the quality of education and the employability of graduates, the investment in training and development, to the job roles and retention practices of employers.

The JCSE's 2012/3 survey indicated that priority skills were in the fields of Software as well as Service/Cloud Computing, Network Infrastructure, Information Security and Application Development.[52]

SOLUTIONS

SCHOOL

Career guidance and the right subjects

Understanding the range of computer occupations and the appropriate subjects to take requires guidance. Community projects should be considered between industry, HEIs and schools to improve access to computer careers.

THEORY

Infrastructure

For qualifications to be relevant, departments require the latest computing technology, high speed connections, software and funding on an on-going basis to keep up to date. State of the art laboratories are also required and students must have their own computers and access to the internet.

Staffing

Lecturers with more hands-on ICT experience are required. Part-time lecturers from industry should be considered to bridge the gap between theory and workplace needs.

Curriculum

- In many cases curricula have not kept up with the rate of change of technology. Reviewing and updating curricula regularly is essential in ICT
- Existing material and methods of teaching need to be updated

- New curricula should be considered to address new technologies, systems and processes where necessary
- There must be interaction between institutions and industry to ensure that curricula are relevant for the workplace

Student support

Student support in terms of full bursaries, initial foundation support, tutoring, group work, mentoring to address underpreparedness is required and to prepare students for the world of work.

WORKPLACE-BASED LEARNING

Structured rotation through a range of different type of applications and configurations is considered essential.

Partnerships need to be developed between industries and the SETAs to accommodate and fund the development of candidates on structured workplace programmes, with adequate supervision and mentorship once they have graduated.

ASSESSMENT

Assessment is considered important in ICT due to the mission critical nature of installations. Mechanisms need to be put in place for assessment of the range of occupations and provision for RPL, top-up training for the existing workforce and training of assessors is required.

THE SPECIAL CASE OF DATA SCIENTISTS

OCCUPATIONAL DESCRIPTION

Data scientist – Formulates algorithms to handle data sets that are so large, and the data so messy, that traditional tools cannot make sense of them.

Data scientists are specialist IT practitioners needed for SIPs projects where large volumes of data must be handled and processed such as data streaming from the galaxies on the SKA project and service and financial data managed by telecommunications and electric utilities for the analysis and speedy restoration of faulty services and revenue assurance.

Data scientists need to understand the mathematical constructs behind machine learning algorithms, and be able to deal with the implementation aspects of these algorithms at scale, to build prototypes and run experiments on massive datasets. Unlike the tasks of a developer, whose main focus is on scaling algorithms, a data scientist has to formulate the algorithms.

LEARNING PATHWAY

- Undergraduate and honours studies must have a strong focus on computer science, mathematics, statistics, analytics, machine learning and application modelling.
- Master's degree with a focus on data science research

OVERVIEW AND CHALLENGES

Big data is a term for any collection of data sets so large and complex that it becomes difficult to process using traditional data processing applications. Due to the sheer volume of data, the challenges include data capture, storage, search, sharing, transfer, analysis and visualisation.

Scientists, in many areas (meteorology, genomics, astronomy, environmental research) regularly encounter limitations due to large data sets. The limitations also affect Internet search facilities, and finance and business informatics. Big data is difficult to work with using most relational database management systems and desktop statistics

and visualisation packages, requiring instead complex software running in parallel on tens, hundreds or even thousands of servers.

When fully operational, the volume of data which will be streaming into the SKA daily will exceed the daily volume of data on the internet.

There are very few South African lecturers with expertise in this field. Currently most are foreign and need to be harnessed to develop a new breed of local data scientists for this expanding field.

SOLUTIONS

THEORY

Staffing

Offering of scholarships to existing academic staff to enhance their qualifications would be valuable

Recruiting foreign lecturers to mentor and develop academics and researchers

SPECIALISTS

Make scholarships available for postgraduate studies.

FORESTRY SCIENTIST, TECHNICIAN

OCCUPATIONAL DESCRIPTIONS

Forester/forestry scientist – Studies, develops and manages forest areas to increase forest productivity, maintain commercial and recreational uses, conserve flora and fauna, and protect against fire, pests and diseases.

Forestry technician – Performs tests and experiments, and provides technical support to assist forestry scientists in areas such as research, production, servicing and marketing.

LEARNING PATHWAYS

For information on the learning pathway see the National Careers Advice Portal, http://ncap.careerhelp.org.za/occupation and select the occupations.

OVERVIEW AND CHALLENGES

Increased forestation is required to compensate for the increasing carbon footprint associated with many of the planned SIPs developments. Given the industrial expansion planned in many regions, forestry science will be important to counteract the ecological system disturbance.

Furthermore, forestry scientists will have a role to play with environmentalists and horticulturalists in translating environmental impact assessment plans into restoration plans. These may include restoring old mines, waterways, and planting and maintaining sustainable forests. They also have a role to play in restoring indigenous plants and preserving and commercialising forests.

The increased importance of sustainable biomaterials, sources of biofuels, and green buildings are also expected to increase the demand for forestry scientists. SIP 8 – green energy, SIP 9 – electricity generation and SIP 10 – electricity transmission, call for forestry

scientists and technicians in significant numbers.

Unfortunately, low and decreasing enrolment rates have long been a challenge at universities because students with the requisite maths and science ability gravitate towards well known occupations such as engineering, which offer substantial bursaries.

There is also an urgent need for equipment so that students are taught on the latest technology in the market. The number of technicians that can be enrolled at NMMU is also constrained by the availability of equipment.

Forestry scientists are employed in the Department of Agriculture, Forestry and Fisheries, the Department of Environmental Affairs, and in local municipalities which have afforested lands.

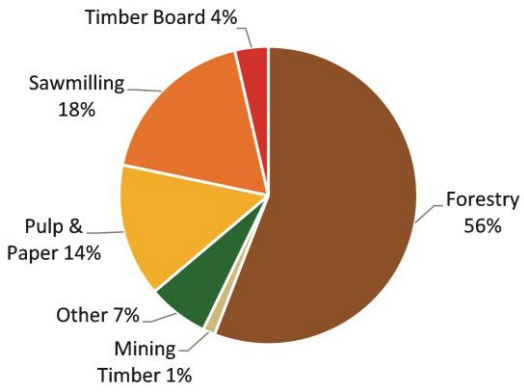


Figure 47: Employment per sub-sector in forestry

Source: ICFR 2013

They are also employed in the private sector by forestry companies to plan and manage the development of commercial forests. Forestry technicians generally find employment with contractors appointed to handle production for forestry companies. Employment in forestry across the board is shown in Figure 47.

SOLUTIONS

SCHOOL

Career guidance

Significantly increased career awareness is required. Universities need to work with NCAP to promote their careers.

The right subjects

Since a minimum of 50% for maths and physical science is a prerequisite, career guidance early in secondary school is essential.

THEORY

Equipment

State of the art equipment is required to prepare students for the high tech working environment. There is a need for:

- Electronic devices for example for wood testing and forest inventory
- Measuring equipment, borers, saws and the list continues
- Survey equipment
- Expanded forestry nursery facilities to support bigger classes.

Student support

Forestry is offered only at:

- University of Stellenbosch
- University of Venda
- Nelson Mandela Metropolitan University

There is a need to increase the numbers enrolling at the current institutions. This will require a combination of career guidance and bursaries to attract high calibre students.

The FP&M SETA has committed to contribute funding towards bursaries and equipment.

WIL

Students must spend time in industry doing analysis and reporting. Employers need to be encouraged to accommodate students and universities need funding to cover the logistics.

WORKPLACE-BASED LEARNING

Structured workplace training prescribed by the South African Council for Natural Scientific Professions (SACNASP) must be followed to ensure that candidates have varied experience and the necessary knowledge required for registering as professional natural scientists or technicians.

PHYSICIST

OCCUPATIONAL DESCRIPTION

In the context of the SIPs, the following physicists have been identified as needing development:

Astronomer – Studies celestial bodies such as black holes, moons, planets, starts, nebulae, galaxies and also Gamma-ray bursts and cosmic radiation

Electron Microscopist – Conducts research on the micro, nano and atomic scale. They study materials, develop new materials, investigate material behaviour, and can identify possible failure mechanisms

Geophysicist – Studies the earth using gravity, magnetic, electrical, and seismic methods for mineral exploration, to identify environmental hazards and evaluate areas for construction sites

Medical Physicist – Maintains and operates medical equipment

Nuclear Physicist – Studies the constituents and interactions of atomic nuclei. The most common applications are nuclear power engineering and nuclear weapons

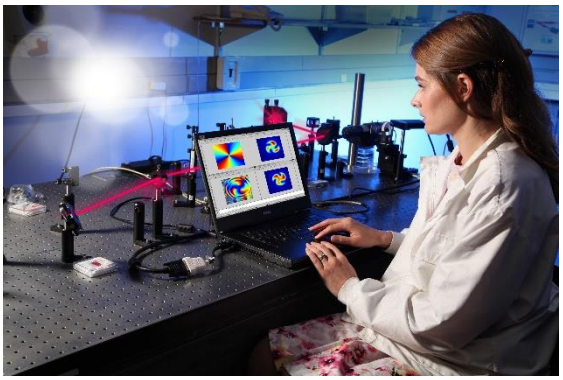
Physicist – Studies matter, energy, and the interaction between them

LEARNING PATHWAYS

For information on the learning pathway see the National Careers Advice Portal, http://ncap.careerhelp.org.za/occupation and select the various occupations.

OVERVIEW AND CHALLENGES

A range of physicists are required, including astronomers for the SKA, geophysicists for mineral exploration, nuclear physicists for the development of nuclear energy generation,



renewable energy, research facilities operations and maintenance, and electron microscopists for the development of new materials.

It is recognised that an increase in the number of physicists is required not only for the SIPs, but to address innovation, and enhance the teaching of physics in South Africa.

Throughput in science degrees is of the order of 60%. The limited numbers of graduates presents a challenge in terms of the Department of Science and Technology (DST) target to increase the number of PhDs fivefold.

SOLUTIONS

SCHOOL

Career guidance and the right subjects

The right subject choices and high marks in maths and science are essential which requires that career guidance is carried out before grade 10.

Physics teaching at schools

The lack of qualified physics teachers at school must be addressed for all occupations requiring a strong grounding in physics. There is a view that teacher training colleges should be reinstated and that university physics departments should be actively involved with teacher development.

THEORY

Student support and attraction

The overriding need in terms of physicists is to increase the enrolment of students. Awareness and bursaries are required to attract the right calibre of student. Physics students require the same entry criteria as engineers. Engineering bursaries are generally more generous, attracting eligible students away from physics.

Equipment

Physics is an experimentally based discipline. In many institutions the size of laboratories is inadequate and there is not enough equipment or it is old or in need of service. Laboratory and equipment upgrades will be necessary before enrolment can be increased.

Curriculum

Many curricula are considered to be weak or out of date and need attention, including the development of new, more user-friendly learning materials

Staffing and research

In order to support increase in graduate throughput, more well trained academics are required. These can be trained through post-doctoral studies.

National research facilities and industry also require experienced researchers so post-doctoral studies will be critical for physics to develop.

Teaching and learning

Throughput seems to be particularly challenging in physics, with some 47% graduating in five years[53] . Many institutions have introduced group sessions, tutors, clickers and other innovations to increase student engagement. An overall assessment of the most effective methods needs to be carried out to design system-wide approaches to improve throughput.

WORKPLACE-BASED LEARNING

There is a need to introduce a one year internship in industry to ensure that graduates are able to enter industry and prepare for a substantive position once they have had some experience.

EMPLOYMENT ISSUES

Industry generally does not understand the value of physicists and employ engineers in preference to physicists. As a result, many graduates do not get employed or, when employed, earn low salaries. There is a need to educate industry on the role and value of physicists.

THE SPECIAL CASE OF RADIO ASTRONOMERS

OCCUPATIONAL DESCRIPTION

Radio astronomer – Analyse the data received by the radio telescopes. Radio astronomers focus on research that is either theoretical or analytical.

- **Theoretical astronomers** – Focus on creating theories and rules that may be applied to the universe.
- **Analytical researchers** – Collect and analyse the various types of radio astronomical data.

LEARNING PATHWAY

- Undergraduate and honours with majors in physics and mathematics, or
- Bachelor's degrees in engineering, computer science or applied physics
- Master's degree
- Doctoral studies

OVERVIEW AND CHALLENGES

Radio astronomy is a subfield of astronomy (astronomy is the branch of science which

deals with celestial objects, space, and the physical universe as a whole).

Radio astronomy is conducted using radio telescopes which collect radio waves emitted by celestial bodies such as galaxies and stars. Radio telescopes can be used individually, or they can be linked together to create a telescope array known as an interferometer.

Radio astronomers are generally employed by universities, in teaching and research positions, and by radio astronomy observatories as researchers.

In South Africa, the largest employers of radio astronomers are the universities and the South African SKA Project (SKA SA). SKA SA is a project of the Department of Science and Technology, responsible for South Africa's involvement in the Square Kilometre Array, and for the design, construction and commissioning of the MeerKAT radio telescope.

The SKA will be the largest and most sensitive radio telescope in the world, and will consist of thousands of radio antennas. The SKA will be co-located in South Africa and Australia. MeerKAT, which is currently being built 90 km from the small Northern Cape town of Carnarvon, is a precursor to the SKA telescope. It will consist of 64 radio antennas, and will eventually be integrated into the mid-frequency component of SKA Phase 1.

There is a need for many radio astronomers to be trained for the SKA.

SOLUTIONS

THEORY

All elements outlined under the general physicist discussion need to be attended to. Furthermore, dedicated teaching staff and research positions need to be increased to support the SKA initiative.

Student support

Student support in terms of full bursaries, tutoring and mentoring would be advantageous.

PROJECTIONS

It is estimated that there are some 3000 to 4000 physicists in South Africa. The OT suggests that this should be grown to at least 6000 to meet diverse needs and drive innovation.

CHAPTER 6

Clerical and support workers

Figure 32 in Chapter 5 demonstrated the range of occupations required in the engineering team to deliver, operate and maintain infrastructure. While the majority of occupations relate to the professions, associate professionals, trades, operators and elementary workers, support personnel are no less important.

In the context of the SIPs, two support occupations were recognised which required specific attention. These were project administrators and storepersons.

The generic duties for clerical and support workers include:

- Supply information
- Carry out clerical duties
- Capture records and compute numerical data
- File documents
- Keep records

Such activities relate both to the project administrator and the storeperson, but in different contexts.

The project administrator is an indispensable member of the project management team. He or she supports the project manager to ensure successful completion of the project, the storeperson is critical to the efficient operation of a site and must ensure that all material and equipment is available at the right time and in the right condition.

STOREPERSON

OCCUPATIONAL DESCRIPTION

A storeperson is essential to any construction site as large quantities of material and equipment are held in stock.

Storeperson – Is responsible for stock and equipment and receives goods, handles inventory, maintains stockpiles, manages stock levels and dispatches goods in stores and warehouses.

LEARNING PATHWAY

For more information on the learning pathway see the National Careers Advice Portal http://ncap.careerhelp.org.za/occupations and select the occupation.

OVERVIEW AND CHALLENGES

The storeperson described in the OFO applies to stores and warehouses and does not really take the case of the materials storeperson on a construction site into account.

There are many elements to be considered when storing material on site. These include the identification of hazardous material, materials which needs to be stored in dry conditions, equipment requiring a dust-free environment and material to be stored out of

the sun to avoid UV degradation and the likes. In addition, the construction storeperson needs to know how to order, store and issue tools and associated consumables such as drill bits. He or she needs to be able to identify all stock, such as welding rod grades, to recognise incorrect labelling or delivery. It is essential that all stock is correctly labelled and stored in identified areas of the store for easy retrieval.

The storeperson should also be aware of the environmental aspects of storage and disposal of hazardous chemicals and how to manage spillages (by following the Environmental Management Plan required for the site). Shrinkage becomes a major problem on site if systems and good security measures are not in place. It is the storeperson's responsibility to institute stock control and security measures.

Good organisational skills are essential and storepersons should be computer literate and able to use software such as Microsoft Word and Excel. The storeperson needs to be able to use the documentation software of the procurement department to ensure recognition of low stock levels and place order immediately to maintain minimum stock level. This enables just-in-time stock maintenance to be established.

Currently there are no formal courses for training of entry level construction storepersons. They are generally trained in-house over a couple of weeks and may attend a NOSA course with respect to environmental and health and safety issues relating to materials.

Literacy and numeracy are considered to be major challenges, and it is thought that a formal qualification should be developed to cover the many aspects which storepersons should be managing.

SOLUTIONS

THEORY

New qualifications

A new qualification is clearly needed. It is suggested that a QCTO qualification be developed by the construction sector. This would include three months of theory, followed by six to nine months of workplace experience to learn the systems and processes required. The curriculum should include:

- Storage of materials
- Stock control
- Good housekeeping principles including managing security and limiting shrinkage
- Packaging
- Health and safety
- Management of fuels and other inflammable and hazardous materials and understanding manufacturers' data sheets
- Relevant legislation
- Basic accounting functions, value of goods, requisitions, orders, receipts and invoices
- Numeracy and literacy (grade 12)
- Use of computers and basic Excel to generate reports

It will be necessary to workshop this occupation widely, determine the exact need and then proceed with the development of a qualification.

EMPLOYMENT ISSUES

Funding, DQP and AQP

It will be necessary to raise funding to develop the qualification and identify and capacitate a suitable body that can act as the AQP.

OFO

The envisaged new occupation will need to be identified on the OFO as a specialisation of storeperson. Recognised as a new occupation.

PROJECT ADMINISTRATOR

OCCUPATIONAL DESCRIPTION

Project or Programme Administrator – Plans and undertakes administration of organisational programing, special projects and support services.

LEARNING PATHWAY

For more information on the learning pathway visit the National Careers Advice Portal http://ncap.careerhelp.org.za/occupations and see program or project administrator.

OVERVIEW AND CHALLENGES

The project administrator plays an important role in project control as follows:

- **Providing support to project managers** – This includes clerical and organisational duties such as making appointments, handling calls, messages, travel arrangements, equipment, liaising with stakeholders and providing logistical support
- **Providing project support** – This includes compiling and presenting reports, minutes, preparing resourcing, costing and other schedules, updating and maintaining project plans on MS Projects or equivalent, managing project filing and archiving system
- **Maintaining project documentation** – This includes electronic and hardcopies of project deliverables, managing version control of all documents, indexing, sharing and making documents available as required.

These functions can apply to construction projects, product development or even the roll out of new software. Project administrators therefore need to be conversant with the project management process, principles, estimating and cost control measures.

Project administrators are not normally technical, but would have a certificate or diploma in project management, or project

scheduling and administration of finances. Project administrators may have higher education qualifications, such as the UNISA Project Management Diploma or have entered the occupation with an IT, finance or commercial background. Alternatively, they may be NC(V) or N6 learners who have completed the SAQA qualification, ID 58800: Project Support Services through a TVET college. This qualification was developed through the Services SETA and is due to expire in March 2016. It must be redeveloped as a QCTO qualification with the associated workplace experience.

Currently there are many individuals with appropriate theoretical training but who have been unable to find employment. Without the opportunity of working under experienced project managers, their future prospects are limited. The occupational team considers that it is unnecessary to increase enrolments in the current courses but it is necessary to put mechanisms in place to ensure that all those who study eventually gain the practical experience required to become competent project administrators.

SOLUTIONS

THEORY

New qualifications

Initiate development of the QCTO Project Support Services qualification. Ensure that all

role players in the project management arena are involved in the community of expert practice (CEP) including but not limited to:

- Project Management South Africa (PMSA)
- Association of Project Managers (APM)
- Project Management Institute (PMI)
- The South African Council for Project and Construction Management Professionals (SACPCMP)

It will also be necessary to involve employers and the institutions who deliver the theoretical component of the training.

Staffing

It is critical that experienced project managers are harnessed to deliver the theoretical training associated with the delivery of projects. Industry needs to be called upon to provide practitioners as part-time lecturers.

Student support

Where increased numbers are required in certain localities, bursaries may be necessary to attract learners.

Workplace-based learning

Gaining experience in the workplace is essential. Employers need to be engaged to offer experiential and workplace experience after graduation. SETAs need to make funds available to support the workplace training phase and encourage employers to take such learners on. In addition, mentorship is required.

Since project administrators support project managers in administration, monitoring resources and project costs and assist with report development, project managers would be the most suitable mentors. Access to funding for mentoring through the SETAs needs to be considered.

Sector Education and Training Authorities with project administrator in their scope are as follows:

- Construction SETA
- Services SETA
- Transport SETA
- Local Government SETA
- Public Service SETA

EMPLOYMENT ISSUES

Funding, DQP and AQP

It will be necessary to raise funding to develop the qualification and identify and capacitate a suitable body that can act as the AQP.

CHAPTER 7

Trades

INTRODUCTION

When reviewing the trades, one of the key challenges that arises is the limited information on the comparative demand for specific trades as well as the skills currently available in the industry. This makes future planning very difficult.

It is envisage that the work of the Chief Directorate National Artisan Development will begin to provide this information in the future to enable effective skills planning.

For the many workers in the trades who are unqualified, recognition of prior learning will complementary top-up training will make an important contribution to enabling access to trade status and also assist with addressing skills shortages in the economy.

Skilled tradespeople are highly mobile and the possibility of increasing emigration from South Africa should be borne in mind, particularly in the light of major project developments within neighbouring SADC countries such as Mozambique.

THE DEMAND

If one takes a bird's eye view of the occupational demand for SIPs, the greatest demand is for the trades shown as the orange band in Figure 6.

In addition it is projected[54] that a significant proportion of the artisans currently on the South African labour market will need to be replaced by 2020 due to retirement or other reasons.

Altogether, if one combines the number of artisans needed for new jobs (expansion demand) and the number needed due to retirement or other reasons (replacement demand), then the demand for artisans is estimated to be considerable in many trades.

The underlying shortfall is the result of a range of factors, most significant of which is the commercialisation and privatisation of the state-owned companies, such as Eskom, Transnet and Telkom, in the late eighties and early nineties. These agencies used to train artisans for the country, but when they became subject to the rules of the market, they cut back massively on their training.

Addressing this projected shortfall of artisans has now become a national priority. Stretch targets were incorporated into the Minister of Higher Education and Training's performance agreement with the President in 2009 and have been aggressively driven ever since. Most recently, the White Paper for Post-School Education and Training – Building an Expanded, Effective and Integrated Post-School System, as approved by Cabinet on 20 November 2013, has reaffirmed that re-establishing a good artisan system is an urgent priority for South Africa.

The Medium Term Strategic Framework for 2014 – 2020 that has now been approved by Cabinet has brought forward the National Development Plan target of 30 000 qualified artisans per annum by 2030 to 2026.

HISTORICAL OVERVIEW

Apprenticeship, the traditional learning pathway to becoming a tradesperson or artisan, was first legislated in South Africa in 1922. However the system of the young learning from experienced people who already have the expertise was a system that

was operating for centuries before that. For instance, in the Xhoi-San communities, acquiring the skills of a hunter or a gatherer entailed an extensive apprenticeship-like induction of the young by the experienced.

The 1922 Apprenticeship Act introduced Apprenticeship Committees. They were charged with the responsibility of overseeing the contractual and workplace curricula prescriptions for each trade. These Committees collaborated with those responsible for the curriculum at the technical colleges and together they formulated the trade theory programmes that all apprentices were required to learn. This partnership became increasingly strained over the decades and in 1994 the partnership itself ended.

DEPARTMENT OF LABOUR

The Skills Development Act was passed under the Department of Labour, in 1998, closely followed by the Skills Development Levies Act, a year later. These laws introduced Sector Education and Training Authorities (SETAs) with oversight over the setting of standards of all sector-specific training, under the umbrella of the South African Qualification Authority (SAQA). The SETAs largely executed their mandate by introducing learnerships[55] – which were modelled on the apprenticeship system, but with some important differences:

- Firstly, while the traditional apprenticeship required a period at college followed by an extended period of structured workplace learning, learnerships integrated these two elements into a single whole, without prescribing where these should take place.
- Secondly, learnerships were designed with the industrial workforce in mind. Since the advent of Taylorisation of production in South Africa (from the 1930s onwards), the making of whole products was sub-divided into the performing of component tasks and simpler tasks were allocated to less trained people at lower rates of pay. This resulted in a layer of machine operators coming to form the bulk of the industrial workforce. Learnerships were intended to provide these workers with a chance to acquire trade or trade equivalent skills incrementally through completing a ladder of qualifications – one at a time.

Learnerships worked well from the perspective of learners gaining employment as was found in an independent study conducted by the Human Sciences Research Council (HSRC) in 2012. The study found that 86% of those who completed a learnership were employed, the majority immediately after completing the learnership. This was even higher than the 76% placement rate after an apprenticeship.[56]

However all was not well. Those who acquired skills through this learnership system did not always gain national recognition for their skills – they were frequently limited to the sector in which they had acquired their skills. For instance, there were seventeen different sectoral routes to becoming an electrician in terms of different conditions of apprenticeship. In the mining sector, for example, not recognising the artisans that had learned their trade in the local government sector. This also meant that there were a plethora of sectoral learnerships registered on the National Qualifications Framework (NQF).

There was another problem: tensions between the Departments of Education and Labour meant that the theoretical component of learnerships became private sector-driven. Procedural learning often replaced more theoretical learning resulting in learnerships becoming weak on theory. Employers increasingly called for a return to the traditional apprenticeship system.

THE DEPARTMENT OF EDUCATION

Under the then Department of Education, a different policy trajectory was followed after learnerships were introduced. They resolved to terminate the trade theory programmes, known as the N or NATED programmes, and replace them with college-only programmes known as the National Certificate (Vocational) or NC(V). The NC(V) programmes retained a weak link to the apprenticeship system with only one out of a seven-subject course being an optional trade theory subject, as is illustrated in the table below. No workplace learning was required for the completion of an NC(V).

Table 15: National Certificate (Vocational) qualification NQF levels 2,3 and 4

Matrix of subjects - Note: (O) = Optional Subjects

	Level 2 **SAQA ID NO: 50440**	**Level 3** **SAQA ID NO: 50442**	**Level 4** **SAQA ID NO: 50441**
Fundamentals *	▪ English/Afrikaans/IsiXhosa (First Additional language) ▪ Life Orientation ▪ Mathematics OR ▪ Mathematical Literacy	▪ English/Afrikaans/IsiXhosa (First Additional language) ▪ Life Orientation ▪ Mathematics OR ▪ Mathematical Literacy	▪ English/Afrikaans/IsiXhosa (First Additional language) ▪ Life Orientation ▪ Mathematics OR ▪ Mathematical Literacy
Civil Engineering and Building Construction	▪ Construction Planning ▪ Materials ▪ Plant and Equipment ▪ Carpentry and Roof Work (O)* OR ▪ Concrete Structures (O)* ▪ Masonry (O)* OR ▪ Physical Science(O)* OR ▪ Plumbing (O)* OR ▪ Roads (O)*	▪ Construction Planning ▪ Materials ▪ Plant and Equipment ▪ Carpentry and Roof Work (O)* OR ▪ Concrete Structures (O)* ▪ Masonry (O)* OR ▪ Physical Science (O)* OR ▪ Plumbing (O)* OR ▪ Roads (O)*	▪ Construction Planning ▪ Materials ▪ Construction Supervision ▪ Carpentry and Roof Work (O)* OR ▪ Concrete Structures (O)* ▪ Masonry (O)* OR ▪ Physical Science (O)* OR ▪ Plumbing (O)* OR ▪ Roads (O)*
Electrical Infrastructure Construction	▪ Electrical Principles and Practice ▪ Electronic Control and Digital Electronics ▪ Workshop Practice ▪ Electrical Systems and Construction (O)* OR ▪ Physical Science (O)*	▪ Electrical Principles and ▪ Practice ▪ Electronic Control and Digital Electronics ▪ Electrical Workmanship ▪ Electrical Systems and ▪ Construction (O)* OR ▪ Physical Science (O)*	▪ Electrical Principles and Practice ▪ Electronic Control and Digital Electronics ▪ Electrical Workmanship ▪ Electrical Systems and Construction (O)* OR ▪ Physical Science(O)*
Engineering and Related Design	▪ Engineering Fundamentals ▪ Engineering Systems ▪ Engineering Technology	▪ Engineering Practice and Maintenance ▪ Eng. Graphics and Design ▪ Materials Technology	▪ Engineering Processes ▪ Applied Eng. Technology ▪ Prof. Eng. Practice ▪ Automotive Repair and Maintenance(O)* OR ▪ Engineering Fabrication ▪ Boiler making (O)* OR

	Level 2 SAQA ID NO: 50440	Level 3 SAQA ID NO: 50442	Level 4 SAQA ID NO: 50441
	▪ Automotive Repair and Maintenance (O)* OR ▪ Engineering Fabrication (O)* OR ▪ Fitting and Turning(O) * OR ▪ Physical Science (O)* OR ▪ Refrigeration Principles (O)* OR ▪ Welding (O)*	▪ Automotive Repair and Maintenance(O)* OR ▪ Engineering Fabrication ▪ Boiler making (O)* OR ▪ Engineering Fabrication – Sheet Metal Work(O)* ▪ Fitting and Turning(O)* ▪ Physical Science (O)* OR ▪ Refrigeration Practice (O)* OR ▪ Welding (O)*	▪ Engineering Fabrication – Sheet Metal Work(O)* ▪ Fitting and Turning (O)* ▪ Physical Science (O)* OR ▪ Refrigeration and Air-conditioning Processes (O)* OR ▪ Welding (O)*

This situation left employers and learners confused and the call was raised to re-introduce the traditional apprenticeship system.

THE DEPARTMENT OF HIGHER EDUCATION AND TRAINING

The government responded to this call by creating the Department of Higher Education and Training in 2009, so bringing the two departments together under a single roof.

One consequence of this merger was the reversal of the decision to disband the engineering NATED courses, meaning that the NATED and the NC(V) programmes were both delivered by colleges; however learnerships were seen as an alternative, not a complement, to both – creating widespread confusion.

THE ARTISAN INITIATIVE

An early response to this confusion was the launching of a dedicated artisan initiative, driven by the Minister of Higher Education and Training under the 2008 amendments to the Skills Development Act.

A National Artisan Development team was established and, together with a wide range of social partners, it drove a revival of the artisan development system.

An early initiative of this team was the adoption of the following Seven Step process:

- Career guidance and management
- General/Vocational fundamental knowledge learning
- Learner agreement and registration contracting
- Occupational knowledge learning
- Workplace learning

Figure 48: The seven steps to become an artisan

- Trade testing and recognition of prior learning
- Quality assurance and certification

These steps were shown using the widely communicated seven step graphic shown in Figure 48.

However experience has shown that these seven steps themselves need revision.

Table 16 shows the changes that are proposed and that are currently being widely discussed.

Resolution of these matters is important for the SIPs.

Table 16: Issues with the seven steps

Issue with 7-steps	Solution focus
Step One: uncoordinated and not early enough	▪ DBE + DHET+ Private providers to coordinate ▪ Expansion of NCAP ▪ Student Support Services ▪ Social Media Leverage ▪ Expose Grade 7 to Grade 9 ▪ Grade 9 Split: Academic = Less, TVET = More ▪ Community Forums ▪ Parent Education ▪ Decade of Artisan Advocacy
Step Three must be before Step Two	▪ Every Workplace is a Training Space ▪ Workplace Based Learning Programme Agreement Regulations ▪ Industry = DHET Partner ▪ Maximum Grant Allocation ▪ Simple Grant Disbursement ▪ Simple, Clear Contracting ▪ Leverage Technology ▪ Local Community Focus
New Step Three must be knowledge and practical	▪ TVET Occupation Driven ▪ Occupational Integration ▪ New OQs + Curriculum ▪ Dedicated TVET Colleges ▪ PPP To Share Resources ▪ Lecturer/Trainer Development
	▪ Artisan Professional Body
New Step Four must be workplace	▪ ONLY Cost for INDUSTRY ▪ Learner, Not Employee Status ▪ Bargaining Councils Inputs ▪ BCEA + Sectoral Determination ▪ OHS, COIDA ▪ BBBEE
New Step Five is trade testing and RPL	▪ OQ Trade Tests ▪ Dedicated TVET Colleges ▪ PPP to Share Resources ▪ Competency based RPL ▪ MES System Management ▪ Skills Centres – Top Up ▪ Access and Employability
New Step Six is at source certification	▪ National Certificate ▪ Central National System Control ▪ Certificate at TT Centre ▪ Serious Security ▪ Red Seal Reputation Recovery
New Step Seven is national quality assurance	▪ QCTO + NAMB Merger ▪ Artisan professional body ▪ CPD System basis for QA ▪ Peer Drive CEP ▪ Industry Sets Standard

THE NATIONAL ARTISAN DEVELOPMENT SUPPORT CENTRE

The National Artisan Development team, has established a National Artisan Development Support Centre (NADSC) at an underutilised call centre facility at the Ekurhuleni East TVET College located in Kwa Thema. The NADSC is intended to be a one stop shop for all artisan related data and information and is where the first ever single, consolidated, verified artisan learner database is located.

The system being developed at the NADSC allows for tracking and tracing learners from the time they are apply for artisan programmes all the way through learning and assessment processes and beyond to monitoring employment and productivity in the workplace through interaction with employers. Reporting of access to and throughput on artisan programmes has improved with the reporting mechanism put in place at the NADSC. This reporting capability has not been available since the early 1980s when the artisan development system was decentralised initially through industry training boards and later Sector Education Training Authorities (SETAs) from 2000.

This data system has made it possible to report that artisan numbers have progressively increased from a low of 8238 in the year ending in March 2009 to a high of 18 110 in the year ending March 2014. A typical dashboard that can now be provided is shown below. Data on the individual trades is contained in the individual reports that follow.

REGISTRATION FY13-14		
	TARGETS	ACTUAL
Q1	3000	5917
Q2	5000	6095
Q3	5000	8208
Q4	13000	7450
APP Annual target	26000	27670

COMPLETIONS FY13-14		
	TARGETS	ACTUAL
Q1	2000	3114
Q2	3000	3291
Q3	3000	6551
Q4	4000	5154
APP Annual Target	**12000**	**18110**

PASS RATE FY13-14		
	TARGETS	ACTUAL
Q1	46%	44%
Q2	46%	44%
Q3	47%	48%
Q4	48%	47%
APP Annual target	60%	47%

NAMB AUDITS		
	TARGETS	ACTUAL
Q1	5	1
Q2	10	14
Q3	5	15
Q4	10	16
APP Annual Target	**30**	**46**

Figure 49: 54% wastage over 5 years

Source: NAMB 2014

TRADE QUALIFICATIONS AND THEIR IMPLEMENTATION

In spite of this pioneering work, the National Artisan Team has been dogged by poor throughput rates of students.

On average over the period April 2009 to March 2014, a total of 24 750 learners entered artisan programmes, however over the same period an average of only 13 845 successfully completed their programmes. This indicates a 54% wastage in the system over the five year period that equates to an estimated R4,5bn wastage. This is graphically illustrated in Figure 49.

The problem has many causes. These are discussed in relation to the learning pipeline phases as discussed in the Occupational Team chapter, Chapter Four, of this report, together with some of the steps that have been taken in the short term to address them:

THEORY

The pass rate of students entering college programmes is far too low.

There is a further challenge, and that is that many large employers are now demanding that apprentices must have passed mathematics and science at matric level prior to entry as a result of the sophistication of the trade.

Part of the problem is a consequence of poor preparation at school, and every effort needs to be made to improve this.

One remedial initiative that has begun at college is the General Trade Preparation Programme (GTPP) which gives learners who have previously failed and dropped out of college a second chance. It combines language, mathematics and science courses with one NATED trade theory course. If learners pass their GTPP with 50% or more, they are steered towards apprenticeships. This has been piloted in the Western Cape and is in the process of being rolled out country-wide. The GTPP is also being evaluated in collaboration with QCTO to possibly become a full year bridging programme for all people wanting to become artisans.

A number of the SIPs have initiated partnerships with colleges to work with them to meet their anticipated skill needs, using existing NATED, NC(V), learnerships and skills programmes. For example:

- Eskom has made significant investments in the Lephalale College as this college is ideally placed to assist with training for SIP 1
- PRASA (SIP 7) has sent learners to Tshwane South College for programmes on Electrical(Heavy Current) and to Coastal College for Mechanical Engineering
- The contractor appointed by PRASA to build its new rolling stock, GIBELA Pty (Ltd), has partnered with Ekurhuleni College
- SKA has entered into a partnership with Kimberley College

PRACTICAL TRAINING

For artisans this is a key step. Some colleges have workshops on site where practical, simulated training is provided. Others depend on using training workshops off-site, at the state-owned companies or at local government facilities or even at private companies.

Increasing attention will need to be paid to the capacity of colleges to provide this practical learning, individually or on a shared basis, on site.

WORKPLACE TRAINING

Historically college students have found it difficult to find workplace learning opportunities after they qualify. Research by the Joint Education Trust in 2006, for example, found that only half did so[57]. The research also found that learnerships featured as a prominent mechanism for gaining work experience. Where colleges were involved in learnerships, learners were at an advantage. However, learnerships were only available in a small number of instances. Of those who did get work experience during their studies, 43% secured the work experience on their own. A third of those who did get some work experience, were part of a learnership or apprenticeship.

These findings are summarized in Table 17.

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Table 17: Success at finding workplace-based learning experience

Form of work experience received	%
Part of a Learnerships/Apprenticeship	14%
In a company that has links with the campus	3.6%
In the campus	6.5%
I found work by myself	18%
No work experience	48%
Total	90.1%
Missing	9.9%
Total	**100%**

Source: JET

Together Turning Every Workplace into a Training Space

To address this challenge, the Minister of Higher Education and Training launched a campaign called Together Turning Every Workplace into a Training Space. The Minister of Public Service and Administration has promoted workplace learning, predominantly in the form of internships, in the state and the government, and together with its social partners, have signed a National Skills Accord through Nedlac, in which all parties have undertaken to increase their intake of learners for workplace learning or workplace exposure.

SETA support

The Minister of Higher Education and Training has also instructed all SETAs to give a single grant to employers who take on apprentices, the grant being R139 350. This has helped to streamline the grant system for trades and encourage is unintended to more employers to participate.

SETAs have also been encouraged to set up offices at the colleges to assist with learner placement. To date 40 such offices have been established.

Decade of the Artisan

Of particular relevance to the SIPs is the Decade of the Artisan initiative, where a campaign is being run to advocate apprenticeships to the young and to encourage employers to take on apprentices at an increased rate. Figure 49 shows the rate at which the numbers are slowly improving nationally as a consequence of these interventions.

Figure 50: Deputy Minister Mr Mduduzi Manana of Higher Education and Training launching the Decade of the Artisan at Ekurhuleni East College, Kwa-Thema Campus on 3 February 2014

These developments have been undertaken even whilst the broader challenges facing the college system are being addressed, as is briefly described in the next section.

College Turnaround Strategy

The qualification and curriculum challenges highlighted earlier are not the only challenges being faced by the colleges.

Another significant challenge is the shift of their oversight from the Provincial Education Departments (PEDs) to the national Department of Higher Education and Training (DHET) which will take effect from 1 April 2015. This shift brings with it a plethora of governance, management, funding and administrative challenges. Both these and the qualification/curriculum issues need to be simultaneously addressed.

To plot a path from where they are to where they need to be, the Department of Higher Education and Training has adopted a Turnaround Strategy for the colleges which highlights seven areas of college functionality that require attention. In order of priority these are:

1. Institutional Management and Governance
2. Financial Management, Human Resource Management and other Corporate Services
3. Curriculum Delivery
4. Professional Development of Academic Staff
5. Student Support Services during pre-entry, on-programme and exit
6. Infrastructure, Facilities and Equipment Management
7. Partnerships, Linkages and Relationships

Implementation of these steps is planned to take place in the following incremental phases:

- A strategy for managing the migration of colleges to DHET
- Immediate interventions to stabilise the institutions in light of the function shift

- Detailed diagnosis of the intervention requirements of the 50 colleges in each of the seven areas of functionality
- Institutional development which is geared to short-term gains but focuses on discernible and sustained impact
- Differentiated support to colleges for medium-term outcomes based on identified needs, ranging from intensive hands-on and generalised interventions in all seven areas, to specific interventions in particular areas.

Under the fourth item, the following detailed interventions are planned:

- Improved career guidance at entry at college level to assist students to make the correct choices
- Improved on-programme academic support for college students
- Increasing the number of workplace learning opportunities for college students
- Improved utilisation of resources (timetabling, classroom and workshop allocations) to maximise teaching and learning delivery
- Improved systems for recruitment, selection and placement of students in 2013
- Implement a refurbishment strategy to prepare colleges to expand delivery of occupational programmes through SETA partnerships
- Effective management of assessment processes to minimise delays in the issuing of results
- Developing and implementing a data management standard to ensure more reliable data reporting.

In order to achieve functionality, the turnaround strategy integrates the seven programmatic areas into three intervention streams. This integration is captured in the Figure 51.

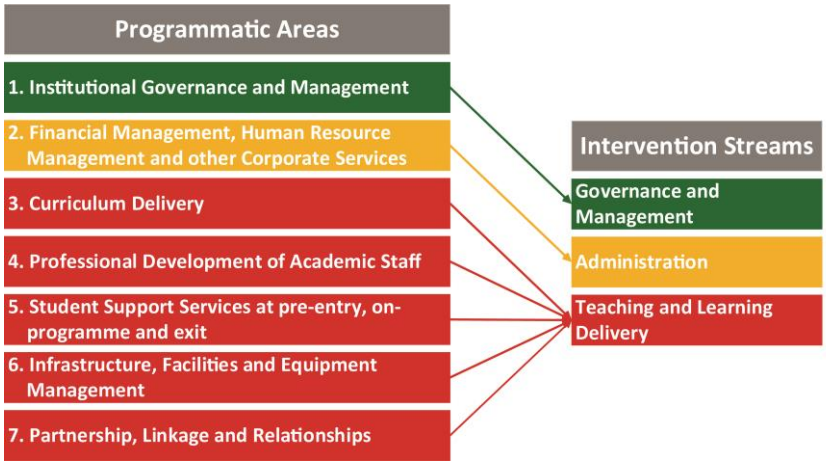


Figure 51: The college turnaround strategy

ARTISAN DEVELOPMENT STRUCTURES AND THE TVET COLLEGE SYSTEM

To integrate national artisan development into the national college system, a process has also been initiated through a formal Memorandum of Understanding between DHET and each of the fifty colleges in the country to establish a Provincial Artisan Development Committee (PADC) in each province. The PADCs include all the colleges in the province. By 31 August 2014 all nine provincial committees would have been established and become more and more

operational as capacity is built up over the next year. The functions of these committees and activities related to each function may change over time subject to the specific needs of each province, but the initial set of functions are listed below.

ROLES AND RESPONSIBILITIES

- Participate in all Steering Committee meetings
- Ensure that all necessary Policies, Criteria and Guidelines (PCGs) for functions for each TVET College and /or the Provincial steering committee are developed, distributed, monitored and evaluate.
- Schedule and implement artisan development capacity building processes in each Province for all TVET colleges in that province on a regular basis.
- Convene a multi-steering committee best practice workshop annually.
- Participate in all Steering Committee meetings
- Implement all national Policies, Criteria and Guidelines provided by the NAMB
- Annually analyse, evaluate and report on economic demand for artisan development within TVET college footprint as set by the steering committee.
- Based on annual economic demand analysis for artisan development within the TVET college footprint, develop and implement an artisan development strategy for the TVET college that is integrated into a provincial and national artisan dev. strategy.
- Participate in and support the Trades Occupational Teams for all artisan trade theory and practical learning as offered by all colleges in the province.
- Submit every quarter of an academic year all engineering learner details in a predetermined format to the National Artisan Development Support Centre.
- Provide support to all candidates who wish to apply for national trade test.

ROLES AND RESPONSIBILITIES

- Support Recognition of Prior Learning (RPL) candidates through RPL administrators (not advisors) located at respective TVET Colleges
- Implement national criteria and guidelines for external moderation and performance monitoring of all accredited listed trade test centres within the TVET college footprint;
- Implement national criteria and guidelines for listed trade testing complaints and irregularities within the TVET college footprint
- Coordinate and implement a provincial artisan development conference and open day once a year at a TVET college in the province on a rotational basis as agreed by the Steering Committee but supported by all the colleges in the province.
- Implement a Decade of the Artisan (DoA) event as part of the national flagship advocacy programme
- Implement artisan career advisory services in terms of the national criteria.

THE TRADE QUALIFICATION CONUNDRUM

The above steps do not directly address the trade qualification issues highlighted earlier as this problem falls outside the scope of the Turnaround Strategy.

The Minister of Higher Education and Training has however highlighted the problem in his White Paper for Post-School Education and Training, Building, Expanded, Effective and Integrated Post-School System, published in 2014, in which he stated that:

'The programmes and qualifications for vocational training in South Africa have developed over many years in disparate circumstances and in various processes. This has resulted in a situation where there is much confusion in the minds of prospective students, their parents and employers as to the merits and demerits of the various programmes. There are conflicting and uneven quality assurance

mechanisms and articulation possibilities and complex funding systems. … The entire gamut of vocational programmes and qualifications will therefore be reviewed and rationalised into a coherent and simple framework that fits easily into the NQF and makes learning pathways clear to school-leavers and employers.' (WP:14)

SIMPLIFYING THE TRADE LEARNING PATHWAY

A first step towards generating a coherent and simple framework for trade qualifications has begun using the new Quality Council for Trades and Occupations (QCTO) qualifications.

The QCTO trade qualifications consolidate all the sectoral learnerships and the relevant components of the NATED and NC(V) programmes into one integrated qualification per trade – each with a theoretical, practical and workplace component.

QCTO trade qualifications have been developed and registered on the National Qualifications Framework (NQF) for many of the trades on the SIP Scarce Skill List (not yet all as indicated in the individual trade reports that follow).

The Intermediate Body for the Trades resolved to initiate a process to ensure that the implementation of these new qualifications should be fast-tracked, starting with a pilot trade, which was selected to be that of Electrician. The Occupational Team for Electricians was therefore requested to assist with this task.

Given that the new QCTO qualification for electricians had already been developed and registered, the Intermediate Body was able to focus its energy on all the consequential elements needed for implementation, such as curriculum statements, lecturer upgrading, materials development, and the like.

A plan has been developed to address each of these implementation components, called an Implementation Milestone Plan, shown in Figure 52. The Milestone Plan Elements are explained in detail in Table 18.

It should be noted that once this pioneering process for Electricians is complete, a similar process will be followed for each of the other trades. Hence an Implementation Milestone Plan for each of the SIP priority trades is shown in each of the individual trade reports that follow.

QCTO QUALIFICATIONS REGISTERED

Since its inception in 2011, the QCTO has spent long hours configuring a new qualification system, identifying and working with communities of expert practice to develop qualifications, and finalising a number of trade qualifications. Progress per trade is shown in Table 19 under each occupation.

In conclusion it can be noted that these initiatives by the Trade Intermediate Body in general and the Electrician Occupational Team in particular, are contributing to the implementation of the college Turnaround Strategy, by working PER TRADE rather than PER COLLEGE. By working in this way it is possible that national communities of expert practice can be established across colleges which can become self-sustaining over time and become engines of innovation for their respective trades together with their Occupational Teams to provide a forum for interaction with employers – both public and private. This is illustrated in Table 19.

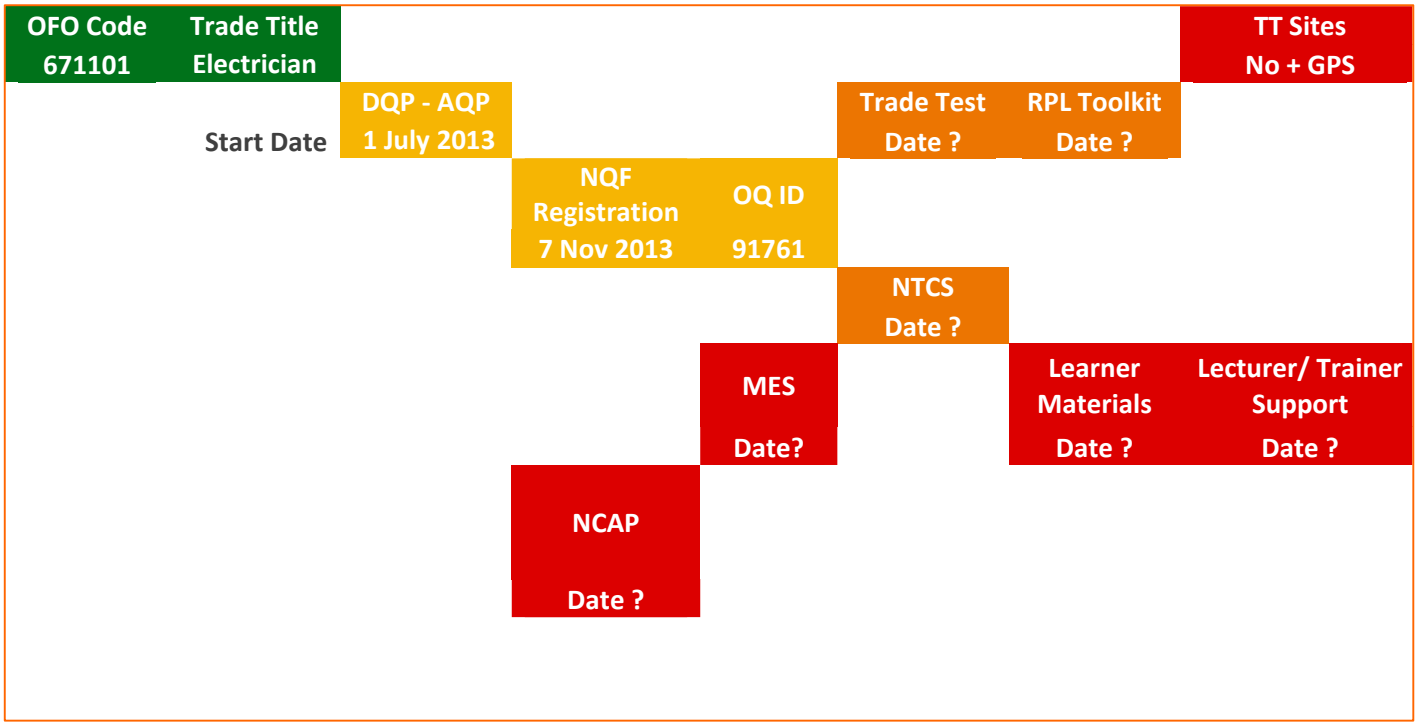


Figure 52: Artisan Trade Occupational Qualification Implementation Milestone Plan: Electrician

Each of the milestone blocks is explained in the legend on the next page using the following colour coding system:

Green = Standardised /Codified Processes

Yellow = Completed Processes

Orange = Work in Progress

Red = Work still to Start

Table 18: Legend for Artisan Trade Occupational Qualification Implementation Milestone Plan

Milestone Plan Element	Description
OFO Code	Occupational Code as per Organising Framework for Occupations
Trade Title	Occupational Title as per Organising Framework for Occupations
DQP - AQP	This is the date that the Development Quality Partner (DQP) is appointed by the QCTO to coordinate and fund the development of an occupational qualification that includes an Assessment Quality Partner (AQP) for each occupation or groups of occupations such as trades where the NAMB is the AQP for 125 trade occupations.
NQF Registration	This is the date the occupational qualification is registered on the National Qualifications Framework by the South African Qualifications Authority
OQ ID	This is the ID Number allocated to the occupational qualification when it is registered on the National Qualifications Framework by the South African Qualifications Authority
Trade Test	This is the date that the occupationally based national trade test (also known as the external integrated summative assessment) is completed and registered with NAMB
RPL Toolkit	This is the date that the occupationally based national recognition of prior learning (RPL) toolkit is completed and registered by NAMB and will allow for a single national standard and process for RPL of persons who developed artisanal competencies both in informal and formal sectors of the economy.
Trade Test (TT) Sites	This is the number of accredited trade test centres and sites across the country linked to a listed trade. At present there 630 of these centres/sites. Each centre/site is being located with GPS coordinates and will be linked in collaboration with Google to an interactive map for Trade Test Centres
National Trade Curriculum Content (NTCC)	This is the date that the National Trade Curriculum Content (NTCC) is completed for the occupational trade qualification. The NTCC is a detailed syllabus that is based on detailed CAPS curriculum utilised by Technical High Schools in the DBE, but adjusted to accommodate occupational trade qualifications. The NTCC details the learning for each module and set of topics per module for all three components of the occupational qualification. It forms the basis for balance of the milestone delivery plan. The trade test and the NTCC must be developed in tandem to ensure that formative assessments detailed in the NTCC is aligned to and supports the summative assessment or trade test.
Modules of Employable Skills (MES)	This is the date that all the modules of employable skills (MES) and relevant part qualifications for applicable occupational trade qualifications are completed and registered with NAMB. An MES is workplace-based skills programme that leads to a part qualification of at least 25 credits (two months) that articulates to a full artisan trade qualification. These shorter programmes are designed to allow persons to gain enough competence to be employable for jobs available in the labour market. A person will be given credit accumulation for each MES that is successfully completed.
National Career Advice Portal (NCAP)	This is the date that the National Career Advisory Portal (NCAP) is updated and fully aligned to the occupationally based qualification route to become a qualified artisan in the relevant trade. The occupationally route will become the standardised route, although all previous historic routes will be kept on the NCAP for record purposes.
Learner Materials	This the date that learner materials that are fully aligned to the occupationally based qualification route to become a qualified artisan in the relevant trade are completed. The learner materials will include standard text books but an open learning policy is also being implemented through a partnership with Google to allow for e-based learning materials to facilitate a range of leaning methodologies over and above face to face learning processes.
Lecturer/Trainer Support	This is the date that lecturer and/or trainer support materials that are fully aligned to the occupationally based qualification route to become a qualified artisan in the relevant trade are completed. The materials will include standard text books but an open learning policy is also being implemented through a partnership with Google to allow for e-based learning materials to facilitate a range of leaning methodologies over and above face to face learning processes. The process must be followed by lecturer/trainer training which can include placement in industry for workplace experience.
TVET Sites	This is the number of accredited learning sites that will offer knowledge and/or practical leaning components of the occupational qualification. A site may deliver only knowledge (classrooms) or only practical (workshops) or both. However an integrated approach where learners are rotated between knowledge and practical training processes will be preferred. Each site is being located with GPS coordinates and will be linked in collaboration with Google to an interactive map for Learning Centres.
Work Places (Mentors)	This is the number of approved workplaces that will offer the workplace learning components of the occupational qualification. A workplace may be approved for range of trades subject to the workplace having qualified artisans in relevant trades that act as mentors for the artisan learners. . Each site is being located with GPS coordinates and will be linked in collaboration with Google to an interactive map for Learning Centres.

CENTRES OF SPECIALISATION AND THE ROLE OF THE PROVINCES

Following the logic of the above, discussions have begun with representatives of the Premiers' Offices responsible for skills development for the SIPs in provinces on the desirability of targeting certain colleges in each province to become Centres of Specialisation for particular trades.

The motivation for this is that if all institutions are to try and teach all trades then it will be difficult to address all their capacity shortfalls. It has been noted that Western Cape colleges have already followed this dedicated route with some considerable success. Having a network of trade specific Centres of Specialisation (at least for a first phase) will help direct interventions of the Turnaround Strategy.

To inform this discussion, the geographical spread of the SIP demand for each trade is shown in the individual trade reports which follow this general trade introduction.

It is envisaged that each province would discuss this proposal with the colleges in their provinces and provinces will revert with input at the following meeting – which is anticipated to take place quarterly with SIP Skill Coordinators.

Figure 53: Delegates at the meeting between SIP Skill Coordinators and representatives from the provinces held at the IDC on 21 May 2014

Table 19: Turnaround Strategy

Turnaround Strategy / **Trades**	**Trade 1**	**Trade 2**	**Trade 3**	**Trade ..**
Management and governance	x	x	x	x
Finance and HR	x	x	x	x
Curriculum delivery	↕	↕	↕	↕
Professional development of academic staff	↕	↕	↕	↕
Student support services during pre-entry, on-programme and exit	↕	↕	↕	↕
Infrastructure, facilities and equipment management	↕	↕	↕	↕
Partnerships, linkages and relationships				

BRICKLAYER

OCCUPATIONAL DESCRIPTION

Bricklayer – OFO Code 641201: Lays bricks, pre-cut stone and other types of building blocks in mortar to construct and repair walls, partitions, arches and other structures.

LEARNING PATHWAYS

For information on the learning pathway see the National Careers Advice Portal, http://ncap.careerhelp.org.za/occupation and select the occupation.

OVERVIEW AND CHALLENGES

- The raw material that bricklayers use is fast becoming unregulated and cheap cement imported from the Far East
- Use made of non-SABS-approved material affects the quality and sustainability of the finished product
- New composite materials (e.g. polystyrene impregnated interlocking bricks) are challenging the traditional bricklayers' role
- Qualified bricklayers are vulnerable to competition from those who are not qualified

- Poor quality work often depresses wages and open the market for expats to be imported
- Bricklayers who start their own business may earn more than those working for established companies.

SOLUTIONS

In addition to the national drive to improve the capacity of colleges and to secure workplaces for apprentices, there is a need to replace the multiple, sectoral pathways with a single pathway. The Implementation Milestone Plan for Bricklayers is shown in Table 20.

Table 20: Bricklayer

Plan Element	Progress	Anticipated Timeframe
DQP - AQP	Completed	August 2014
NQF Registration	Submitted to SAQA	August 2014
OQ ID	Submitted to SAQA	August 2014
Trade Test	Pending Registration of Qualification on NQF	August 2015
RPL Toolkit	Pending Registration of Qualification on NQF	August 2015
TT Sites	Sites details being consolidated from SETAs	December 2014
NTCC	Pending Registration of Qualification on NQF	August 2015
MES	Pending Registration of Qualification on NQF	August 2015
NCAP	Completed for legacy qualifications.	October 2015
Learner Materials	Pending NTCC + MES.	February 2016
Lecturer/Trainer Support	Pending NTCC + MES.	February 2016
TVET Sites (K + P)	Public and Private Colleges, Training Centres and Schools being identified	December 2014
Work Places (Mentors)	Workplaces per Sector being identified.	December 2014

Private sector partners and qualified college lecturers are invited to 'adopt this trade' to help inform and resource the development work above. Nominations to Trade Intermediate Body (see CD)

PROJECTIONS

Figure 55 shows that the demand for bricklayers is largely in the building and construction sectors. Given that the majority of the SIPs are construction projects, bricklayers are required nationwide as shown in Figure 54. Should the current rate of qualifications continue this would be cause for concern as seen in Figure 57. However, the increased number of apprentices registering is to be welcomed provided that throughput rates can be improved. RPL should also be implemented as there are a number of partially trained bricklayers in the labour market.

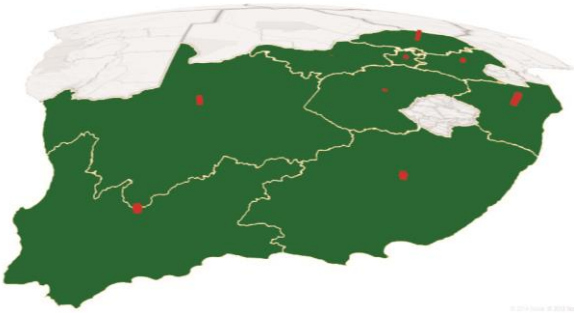


Figure 54: Need for bricklayers per province

Figure 55

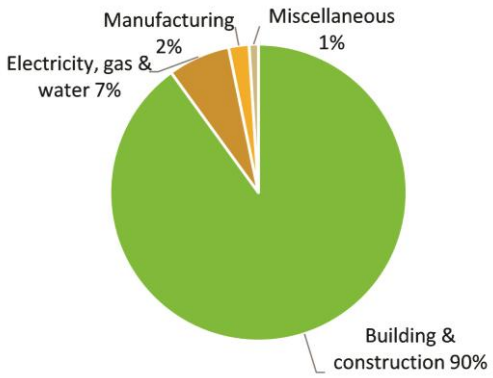


Figure 55: Sectors in which bricklayers are employed

Source: QLFS 2009 – 2013

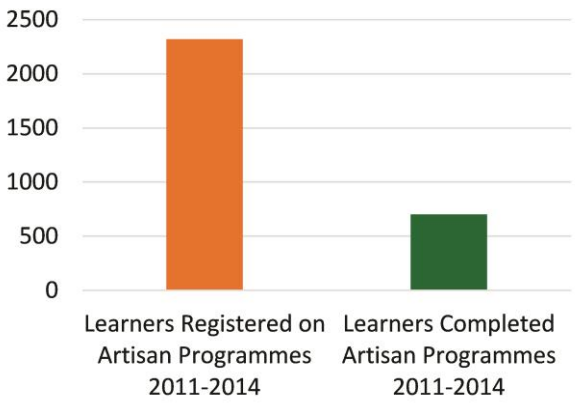


Figure 56: Bricklayer enrolment and trade tests passed

Source: DHET Kwa-Thema database 2014

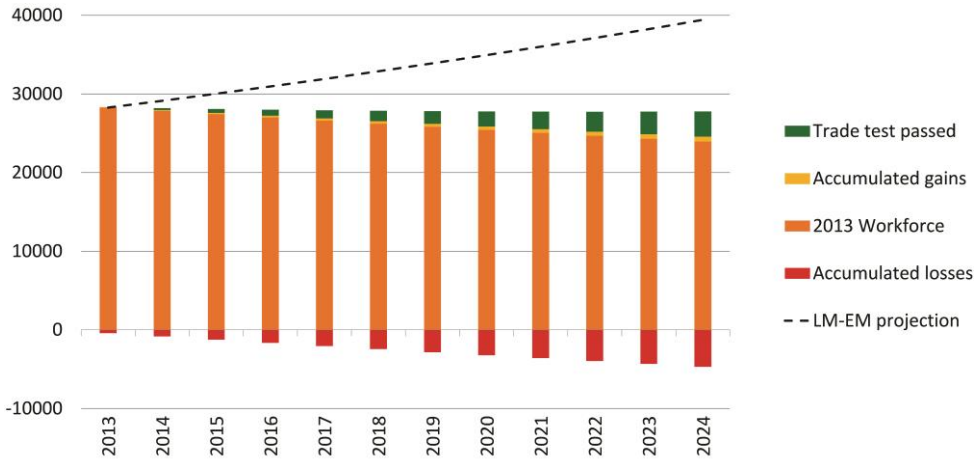


Figure 57: Projected demand for and supply of bricklayers

ELECTRICIAN

OCCUPATIONAL DESCRIPTION

Electrician – OFO Code 671101 - Installs, tests, connects, commissions, maintains and modifies electrical equipment, wiring and control systems.

LEARNING PATHWAYS

For information on the learning pathway see the National Careers Advice Portal, http://ncap.careerhelp.org.za/occupation and select the occupation.

OVERVIEW AND CHALLENGES

- Electricians are in strong demand across all sectors of the economy
- They are becoming increasingly multi-skilled and integrated into ICT technologies that were traditionally the domain of the electrical engineering and instrumentation technicians
- Energy management principles and applications are in increasing demand
- Renewable energy projects are expanding and require specialised training
- Health and safety is a major issue so full qualifications are important

- The electrical contracting industry requires licensed electricians as a legal requirement to sign off a range of legally prescribed tasks
- High tension electricians are required in municipalities

SOLUTIONS

In addition to the national drive to improve the capacity of colleges and to secure workplaces for apprentices, there is a need to replace the multiple, sectoral pathways with a single pathway. The Implementation Milestone Plan for Electricians is shown Table 21.

Table 21: Electrician

Plan Element	Progress	Timeframe
DQP – AQP	Completed	Completed
NQF Registration	Completed	Completed
OQ ID	91761	91761
Trade Test	Working Group of CEPs Established	September 2014
RPL Toolkit	Working Group of CEPs Established	September 2014
TT Sites	Site details being consolidated from SETAs	December 2014
NTCC	Tender in process to appoint Technician.	December 2014
MES	Process initiated with QCTO.	December 2014
NCAP	Completed for legacy qualifications.	January 2015
Learner Materials	Pending NTCC + MES.	June 2015
Lecturer/Trainer Support	Pending NTCC + MES.	June 2015
TVET Sites (K + P)	Public and Private Colleges, Training Centres and Schools being identified	December 2014
Work Places (Mentors)	Workplaces per Sector being identified.	December 2014

Private sector partners and qualified college lecturers are invited to 'adopt this trade' to help inform and resource the development work above. Nominations to Trade Intermediate Body (see CD)

PROJECTIONS

Figure 59 and Figure 60 show that the extent of demand for electricians is across a wide range of sectors and the SIPs. The numbers currently passing trade tests bode well for rebuilding the stock of qualified electricians, as can be seen in Figure 61.

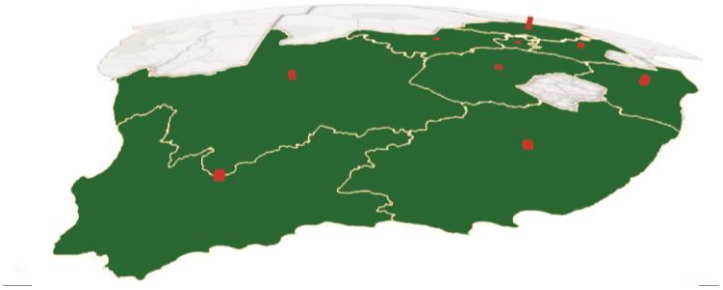


Figure 58: Need for electricians per province

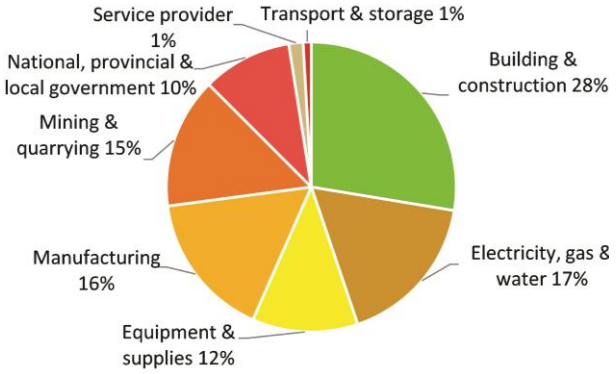


Figure 59: Sectors in which electricians are employed

Source: QLFS 2009 – 2013

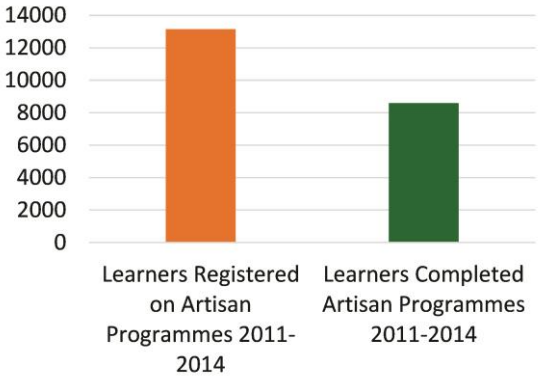


Figure 60: Electrician enrolment and trade tests passed

Source: DHET Kwa-Thema database 2014

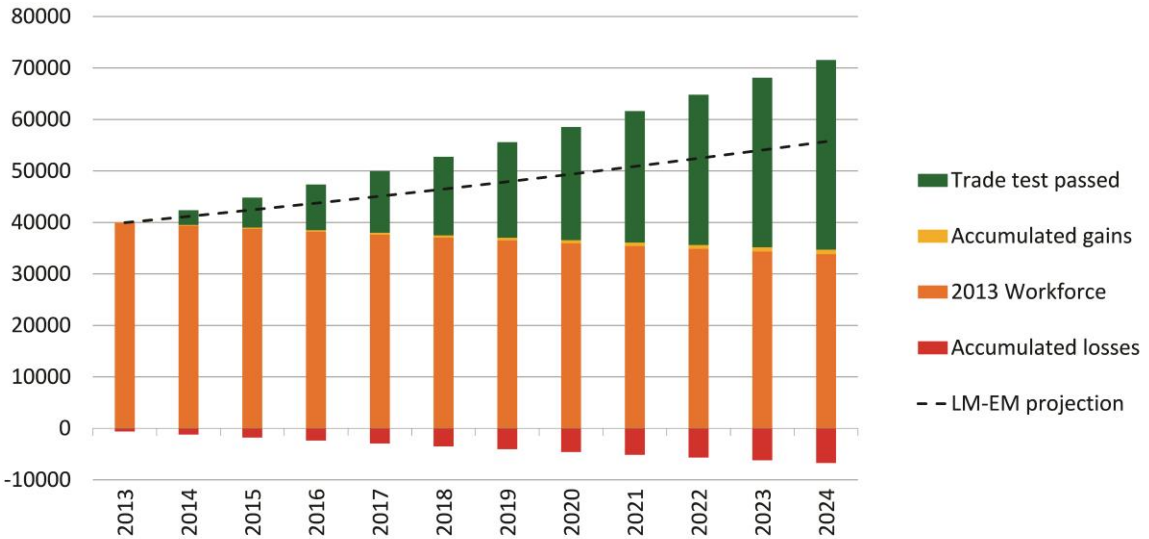


Figure 61: Projected demand for and supply of electricians

MILLWRIGHT

OCCUPATIONAL DESCRIPTION

Millwright – OFO Code 671202 - Installs, maintains, troubleshoots and repairs stationary industrial machinery and electromechanical equipment.

LEARNING PATHWAYS

For information on the learning pathway see the National Careers Advice Portal, http://ncap.careerhelp.org.za/occupation select your occupation.

OVERVIEW AND CHALLENGES

- There is a strong demand for millwrights
- Millwright is a highly skilled dual trade encompassing both mechanical and electrical skills
- They require a thorough knowledge of the load-bearing capabilities of the equipment used including an understanding of the principles of rigging and automation
- The training period is generally longer than that of a conventional trade

- It is a trade that is not as familiar as many others and work is needed to enhance career guidance on the many opportunities available for skilled millwrights

SOLUTIONS

In addition to the national drive to improve the capacity of colleges and to secure workplaces for apprentices, there is a need to replace the multiple, sectoral pathways with a single pathway. The Implementation Milestone Plan for Millwrights is shown Table 22.

Table 22: Millwright

Plan Element	Progress	Timeframe
DQP - AQP	Work in Progress	October 2014
NQF Registration	Pending completion of DQP-AQP Process	October 2014
OQ ID	Pending completion of DQP-AQP Process	October 2014
Trade Test	Pending Registration of Qualification on NQF	October 2015
RPL Toolkit	Pending Registration of Qualification on NQF	October 2015
TT Sites	Sites details being consolidated from SETAs	December 2014
NTCC	Pending Registration of Qualification on NQF	October 2015
MES	Pending Registration of Qualification on NQF	October 2015
NCAP	Completed for legacy qualifications.	November 2015
Learner Materials	Pending NTCC + MES.	April 2016
Lecturer/Trainer Support	Pending NTCC + MES.	April 2016
TVET Sites (K + P)	Public and Private Colleges, Training Centres and Schools being identified	December 2014
Work Places (Mentors)	Workplaces per Sector being identified.	December 2014

Private sector partners and qualified college lecturers are invited to 'adopt this trade' to help inform and resource the development work above. Nominations to Trade Intermediate Body (see CD)

PROJECTIONS

Millwrights are strongly associated with manufacturing, maintaining and repairing equipment as shown in Figure 63. There is a particular demand for them associated with heavy engineering, which suggests that one or more Centres of Specialisation should be considered in the proximity of such projects. The numbers currently passing trade tests bode well for rebuilding the stock of qualified millwrights, as can be seen in Figure 64, however the level of new registrations is a concern.

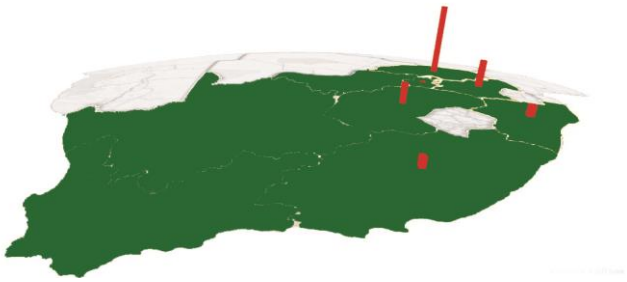


Figure 62: Need for millwrights per province

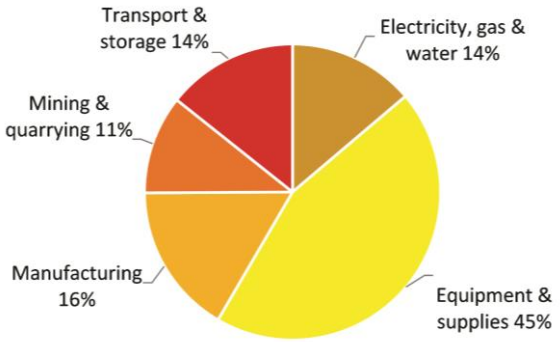


Figure 63: Sectors in which millwrights are employed

Source: QLFS 2009 – 2013

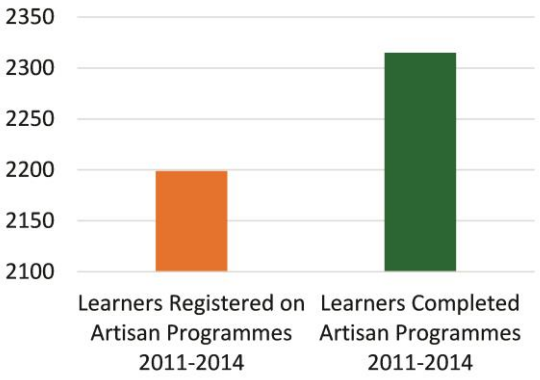


Figure 64: Millwright enrolment and trade tests passed

Source: DHET Kwa-Thema database 2014

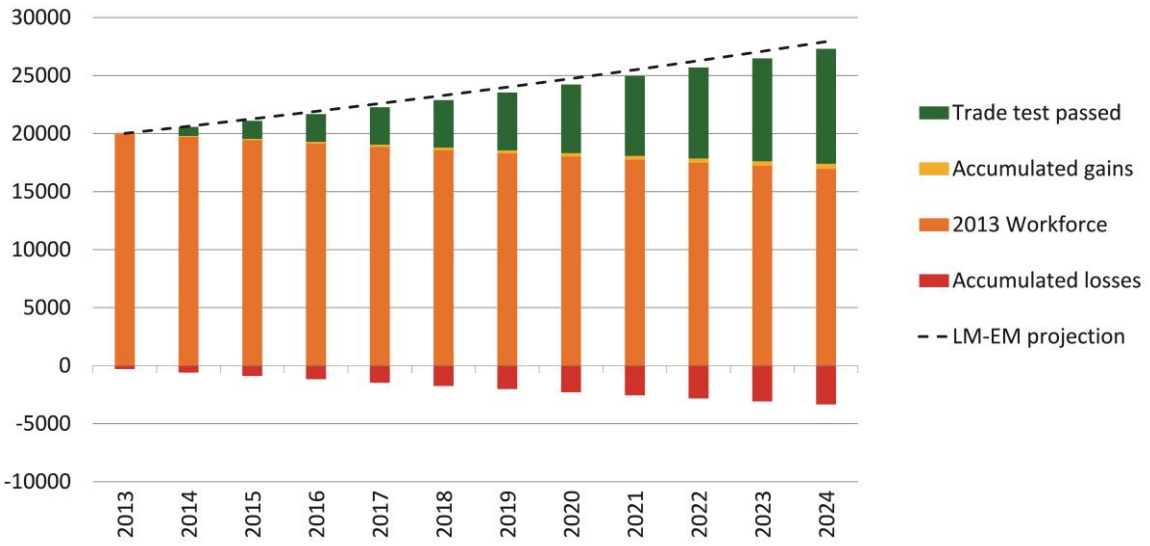


Figure 65: Projected demand for and supply of millwrights

BOILERMAKER

OCCUPATIONAL DESCRIPTION

Boilermaker – OFO Code 651302 - Makes and repairs boilers and pressure vessels.

LEARNING PATHWAY

For information on the learning pathway see the National Careers Advice Portal, http://ncap.careerhelp.org.za/occupation and select the occupation.

OVERVIEW AND CHALLENGES

- Boilermakers are in high demand in a number of traditional industry sectors including the mining, petrochemical and nuclear sectors
- Regulatory requirements on the manufacturing of pressure vessels are extremely stringent requiring the employment of highly skilled boilermakers
- Updated equipment is needed by training centres and employers in their workplaces to ensure that high quality practical and workplace training can be offered

SOLUTIONS

In addition to the national drive to improve the capacity of colleges and to secure workplaces for apprentices, there is a need to replace the multiple, sectoral pathways with a single pathway. The Implementation Milestone Plan for Boilermakers is shown Table 23.

Table 23: Boilermaker

Plan Element	Progress	Anticipated Timeframe
DQP - AQP	Completed	August 2014
NQF Registration	Submitted to SAQA	August 2014
OQ ID	Submitted to SAQA	August 2014
Trade Test	Pending Registration of Qualification on NQF	August 2015
RPL Toolkit	Pending Registration of Qualification on NQF	August 2015
TT Sites	Sites details being consolidated from SETAs	December 2014
NTCC	Pending Registration of Qualification on NQF	August 2015
MES	Pending Registration of Qualification on NQF	August 2015
NCAP	Completed for legacy qualifications.	October 2015
Learner Materials	Pending NTCC + MES.	February 2016
Lecturer/Trainer Support	Pending NTCC + MES.	February 2016
TVET Sites (K + P)	Public and Private Colleges, Training Centres and Schools being identified	December 2014
Work Places (Mentors)	Workplaces per Sector being identified.	December 2014

Private sector partners and qualified college lecturers are invited to 'adopt this trade' to help inform and resource the development work above. Nominations to Trade Intermediate Body (see CD)

PROJECTIONS

Boilermakers are strongly associated with energy, mining, manufacturing and equipment as shown in Figure 67 and are widely in demand for the SIPs. The current rate of qualifications are not adequate. However, the increased number of apprentices registering is to be welcomed provided that the throughput rates can be improved.

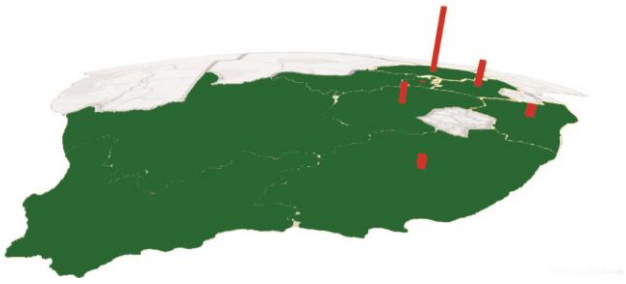


Figure 66: Need for boilermakers per province

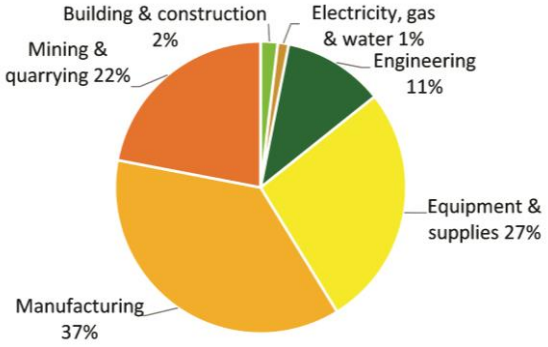


Figure 67: Sectors in which boilermakers are employed

Source: QLFS 2009 – 2013

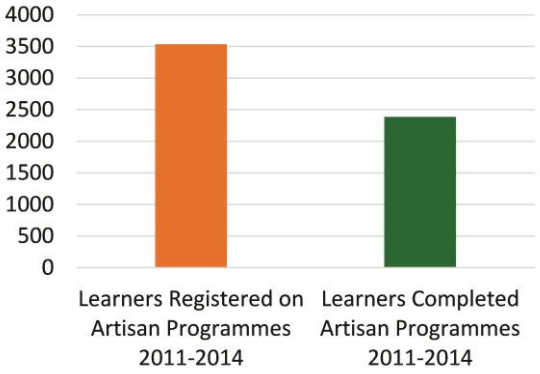


Figure 68: Boilermaker enrolment and trade tests passed

Source: DHET Kwa-Thema database 2014

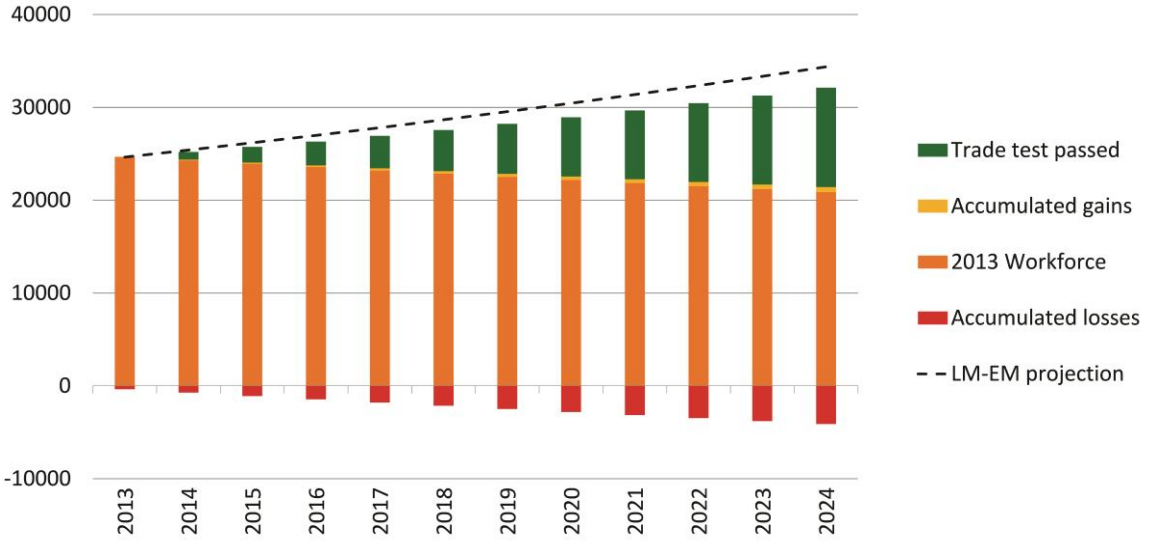


Figure 69: Projected demand for and supply of boilermakers

CARPENTER AND JOINER

OCCUPATIONAL DESCRIPTION

Carpenter and Joiner – OFO Code 641501 - Constructs and installs structures and fixtures of wood, plywood, and wallboard and cuts, shapes and fits timber parts to form structures and fittings.

Carpenter - OFO Code 641502 - Constructs, erects, installs, renovates and repairs structures and fixtures of wood, plywood, wallboard and other materials.

LEARNING PATHWAY

For information on the learning pathway see the National Careers Advice Portal, http://ncap.careerhelp.org.za/occupation and select the occupation.

OVERVIEW AND CHALLENGES

- Plumbers are in demand across many sectors including within municipalities
- A concerted campaign is required to address the challenge of public sector shortages that have a negative effect on service delivery
- The installation of renewable energy devices is a strategic national objective and this new drive will require the development of new curricula and training courses i.e. heat pump and solar system installation and maintenance
- Plumbers often start their own businesses or emigrate and are lost to the industry resulting in skills shortages

SOLUTIONS

In addition to the national drive to improve the capacity of colleges and to secure workplaces for apprentices, there is a need to replace the multiple, sectoral pathways with a single pathway. The Implementation Milestone Plan for Carpenters and Joiners is shown Table 24.

Table 24: Carpenter and Joiner

Plan Element	Progress	Anticipated Timeframe
DQP - AQP	Completed	August 2014
NQF Registration	Submitted to SAQA	August 2014
OQ ID	Submitted to SAQA	August 2014
Trade Test	Pending Registration of Qualification on NQF	August 2015
RPL Toolkit	Pending Registration of Qualification on NQF	August 2015
TT Sites	Sites details being consolidated from SETAs	December 2014
NTCC	Pending Registration of Qualification on NQF	August 2015
MES	Pending Registration of Qualification on NQF	August 2015
NCAP	Completed for legacy qualifications.	October 2015
Learner Materials	Pending NTCC + MES.	February 2016
Lecturer/ Trainer Support	Pending NTCC + MES.	February 2016
TVET Sites (K + P)	Public and Private Colleges, Training Centres and Schools being identified	December 2014
Work Places (Mentors)	Workplaces per Sector being identified.	December 2014

Private sector partners and qualified college lecturers are invited to 'adopt this trade' to help inform and resource the development work above. Nominations to Trade Intermediate Body (see CD)

PROJECTIONS

Figure 73 shows that the demand for carpenters, as well as carpenters and joiners, straddles two main sectors being manufacturing and construction. In terms of the SIPs the primary need is for carpenters in construction nationwide as seen in Figure 70. This demand greatly exceeds the supply as can be seen in Figure 73. Increased enrolments, improved throughput and attention to RPL will be necessary to address this gap.

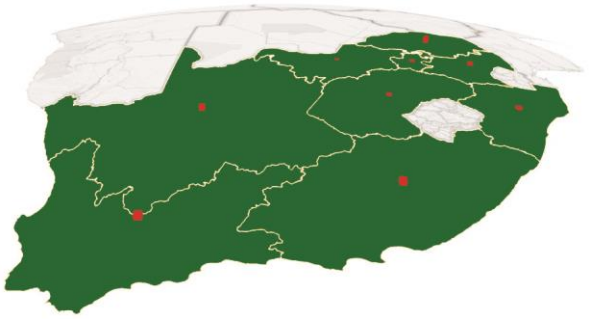


Figure 70: Need for carpenters per province

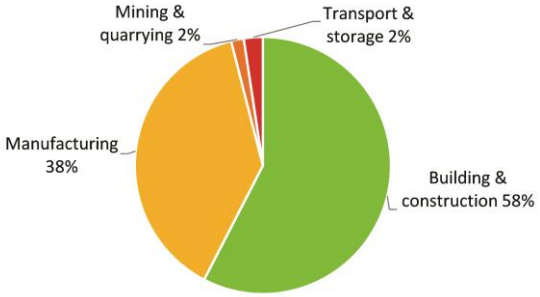


Figure 71: Sectors in which carpenters and joiners are employed

Source: QLFS 2009 – 2013

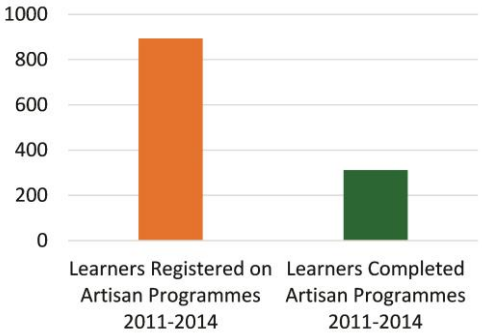


Figure 72: Carpenters enrolment and trade tests passed

Source: DHET Kwa-Thema database 2014

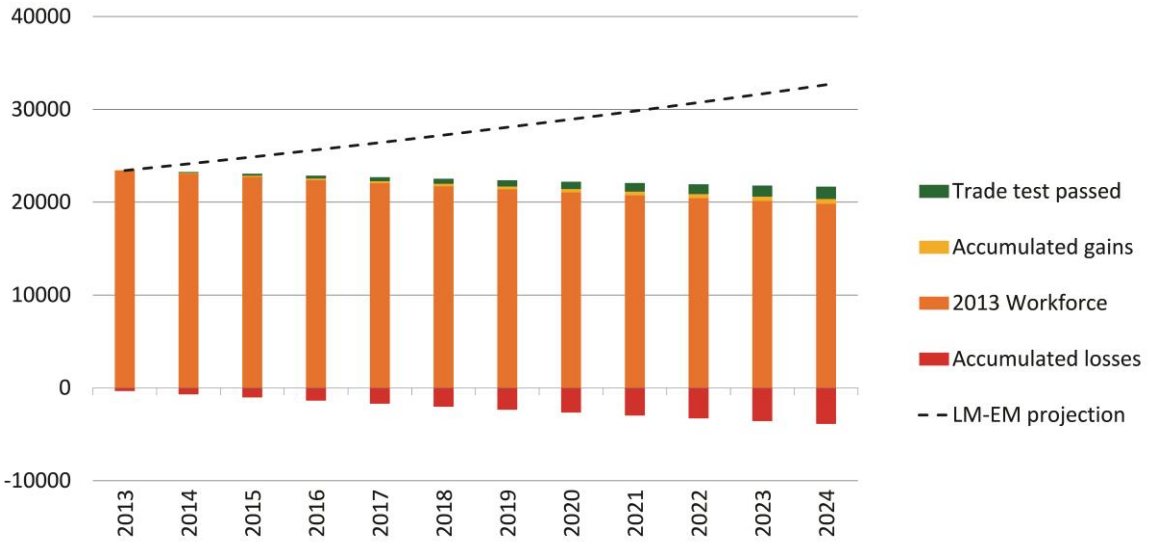


Figure 73: Projected demand for and supply of carpenters and joiner

INDUSTRIAL MACHINERY MECHANIC

OCCUPATIONAL DESCRIPTION

Industrial Machinery Mechanic – OFO Code 653301 - Fits, installs, examines, services and repairs engines, agricultural and industrial machinery and mechanical equipment (except motor vehicle, aircraft, tractors and electric motors).

LEARNING PATHWAY

For information on the learning pathway see the National Careers Advice Portal, http://ncap.careerhelp.org.za/occupation and select the occupation.

OVERVIEW AND CHALLENGES

- There is a shortage of qualified industrial machinery mechanics
- They often need to be ready for regular call-out duty and to work extensive overtime
- Skills shortages often result in organisations having to contract out this work
- Adherence to safety procedures and use of protective equipment is a key requirement for this trade

SOLUTIONS

In addition to the national drive to improve the capacity of colleges and to secure workplaces for apprentices, there is a need to

replace the multiple, sectoral pathways with a single pathway. The Implementation Milestone Plan for Industrial Machinery Mechanics is shown Table 25.

PROJECTION

The need for industrial machinery mechanics is spread across mining, manufacturing and engineering. There are substantial shortages and currently the Kwa-Thema database shows that only two industrial machinery mechanics have passed their trade tests in the last three years. This clearly indicates that attention needs to be paid to this trade at every point along the learning pathway – from enrolments to work placements through to the trade test.

Private sector partners and qualified college lecturers are invited to 'adopt this trade' to help inform and resource the development work above. Nominations to Trade Intermediate Body (see CD)

Table 25: Industrial Machinery Mechanic

Plan Element	Progress	Anticipated Timeframe
DQP - AQP	Not Commenced - QCTO to Prioritise	July 2014
NQF Registration	Pending completion of DQP-AQP Process	January 2015
OQ ID	Pending completion of DQP-AQP Process	January 2015
Trade Test	Pending Registration of Qualification on NQF	January 2016
RPL Toolkit	Pending Registration of Qualification on NQF	January 2016
TT Sites	Sites details being consolidated from SETAs	December 2014
NTCC	Pending Registration of Qualification on NQF	January 2016
MES	Pending Registration of Qualification on NQF	January 2016
NCAP	Completed for legacy qualifications.	February 2016
Learner Materials	Pending NTCC + MES.	June 2016
Lecturer/Trainer Support	Pending NTCC + MES.	June 2016
TVET Sites (K + P)	Public and Private Colleges, Training Centres and Schools being identified	December 2014
Work Places (Mentors)	Workplaces per Sector being identified.	December 2014

PLUMBER

OCCUPATIONAL DESCRIPTION

Plumber – OFO Code 642601 - Installs and repairs water, drainage and sewerage pipes and systems.

LEARNING PATHWAY

For information on the learning pathway see the National Careers Advice Portal, http://ncap.careerhelp.org.za/occupation and select the occupation.

OVERVIEW AND CHALLENGES

- Plumbers are in demand across many sectors including within municipalities
- A concerted campaign is required to address the challenge of public sector shortages that have a negative effect on service delivery
- The installation of renewable energy devices is a strategic national objective and this new drive will require the development of new curricula and training courses i.e. heat pump and solar system installation and maintenance

- Plumbers often start their own businesses or emigrate and are lost to the industry resulting in skills shortages

SOLUTIONS

In addition to the national drive to improve the capacity of colleges and to secure workplaces for apprentices, there is a need to replace the multiple, sectoral pathways with a single pathway. The Implementation Milestone Plan for Plumbers is shown Table 26.

Table 26: Plumber

Plan Element	Progress.	Anticipated Timeframe
DQP - AQP	Completed	Completed
NQF Registration	Completed	Completed
OQ ID	91761	91761
Trade Test	Working Group of CEPs Established	September 2014
RPL Toolkit	Working Group of CEPs Establishd	September 2014
TT Sites	Sites details being consolidated from SETAs	December 2014
NTCC	Tender in process to appoint Technician.	December 2014
MES	Process initiated with QCTO.	December 2014
NCAP	Completed for legacy qualifications.	January 2015
Learner Materials	Pending NTCC + MES.	June 2015
Lecturer/Trainer Support	Pending NTCC + MES.	June 2015
TVET Sites (K + P)	Public and Private Colleges, Training Centres and Schools being identified	December 2014
Work Places (Mentors)	Workplaces per Sector being identified.	December 2014

Private sector partners and qualified college lecturers are invited to 'adopt this trade' to help inform and resource the development work above. Nominations to Trade Intermediate Body (see CD)

PROJECTIONS

Figure 75 shows that the demand for plumbers is largely required in the construction sector and consequently will be needed in the SIPs nationwide as seen in Figure 74. The demand for plumbers and pipe fitters greatly exceeds the supply as can be seen in Figure 77. Increased enrolments, improved throughput and attention to RPL will be necessary to address this gap.

Early indications show that this demand will increase once the figures for local government are included in the model. When these are added, attention will need to be given to specialist top up training to address the distribution functions that local government performs.

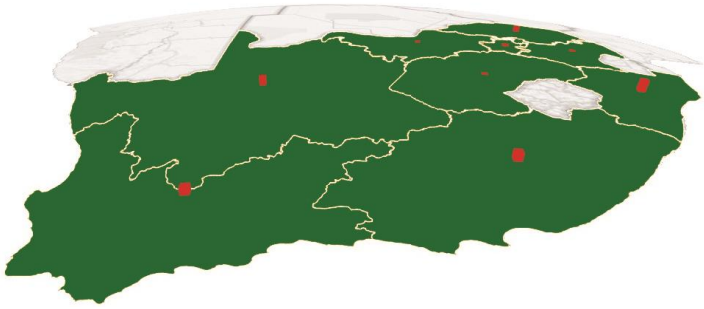


Figure 74: Need for plumbers per province

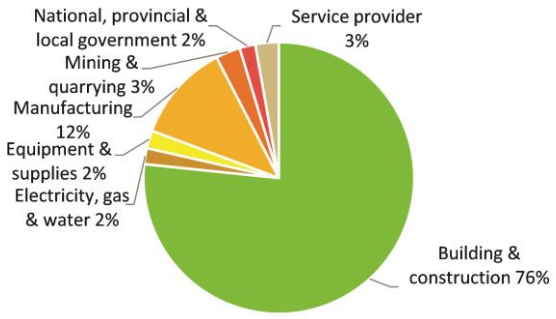


Figure 75: Sectors in which plumbers are employed

Source: QLFS 2009 – 2013

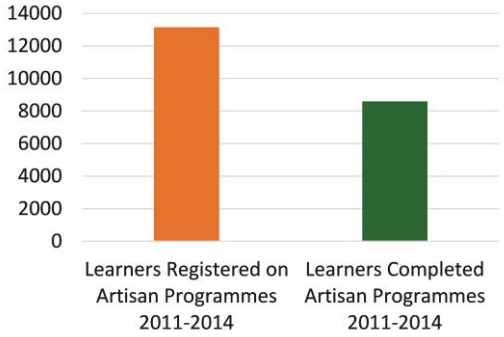


Figure 76: Plumber and pipe fitter enrolments and trade tests passed

Source: DHET Kwa-Thema database 2014

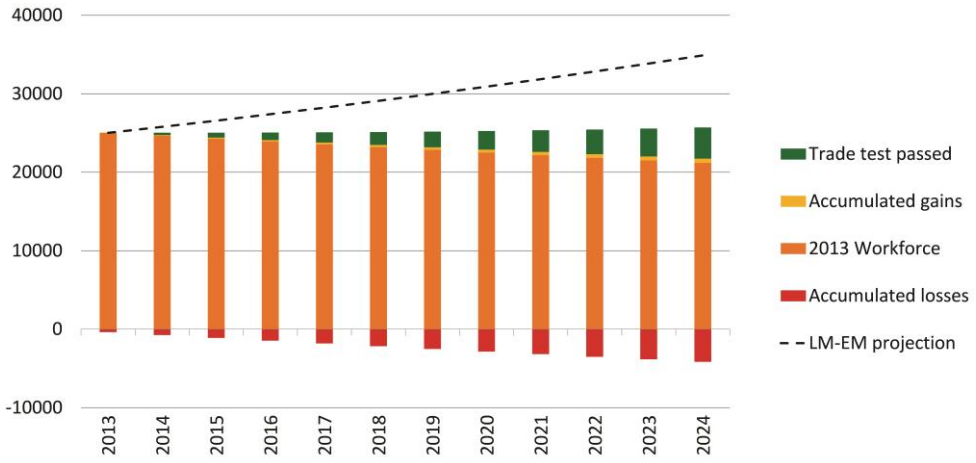


Figure 77: Projected demand for and supply of plumbers

PIPE FITTER

OCCUPATIONAL DESCRIPTION

Pipe Fitter – OFO Code 642607 - Assembles, installs, repairs and maintains pipe systems, fittings and fixtures for water, gas, drainage, sewerage systems.

LEARNING PATHWAY

For information on the learning pathway see the National Careers Advice Portal, http://ncap.careerhelp.org.za/occupation and select the occupation.

OVERVIEW AND CHALLENGES

- Pipe fitters are in high demand across many industry sectors as the reticulation systems for water, gas and liquid fuels is increasing exponentially
- The technology used for continuous welding and seam welding poses a challenge for traditional pipe welders (seems applicable to welders)
- Future career options include working on oil rigs, deep exploration drilling using pipe drills, jacks and sleeves

- Safety is a critical aspect particularly in line systems
- Any industrial development requires skilled pipe fitters due to the prevalence of hydraulic systems in industry equipment

SOLUTIONS

In addition to the national drive to improve the capacity of colleges and to secure workplaces for apprentices, there is a need to replace the multiple, sectoral pathways with a single pathway. The Implementation Milestone Plan for Pipe Fitters is shown Table 27.

Table 27: Pipe Fitter

Plan Element	Progress	Anticipated Timeframe
DQP - AQP	Not Commenced - QCTO to Prioritise	July 2014
NQF Registration	Pending completion of DQP-AQP Process	January 2015
OQ ID	Pending completion of DQP-AQP Process	January 2015
Trade Test	Pending Registration of Qualification on NQF	January 2016
RPL Toolkit	Pending Registration of Qualification on NQF	January 2016
TT Sites	Sites details being consolidated from SETAs	December 2014
NTCC	Pending Registration of Qualification on NQF	January 2016
MES	Pending Registration of Qualification on NQF	January 2016
NCAP	Completed for legacy qualifications.	February 2016
Learner Materials	Pending NTCC + MES.	June 2016
Lecturer/Trainer Support	Pending NTCC + MES.	June 2016
TVET Sites (K + P)	Public and Private Colleges, Training Centres and Schools being identified	December 2014
Work Places (Mentors)	Workplaces per Sector being identified.	December 2014

Private sector partners and qualified college lecturers are invited to 'adopt this trade' to help inform and resource the development work above. Nominations to Trade Intermediate Body (see CD)

PROJECTIONS

The distribution shown on the pipe fitter map in Figure 78 is incomplete as limited information is currently available on the proposed SIPs water projects. As seen in Figure 75 and Figure 77 in the plumber section, there is a strong demand and weak supply for this pair of trades. The high demand already evident in some provinces suggests that one or more Centres of Specialisation should be considered for developing this trade.

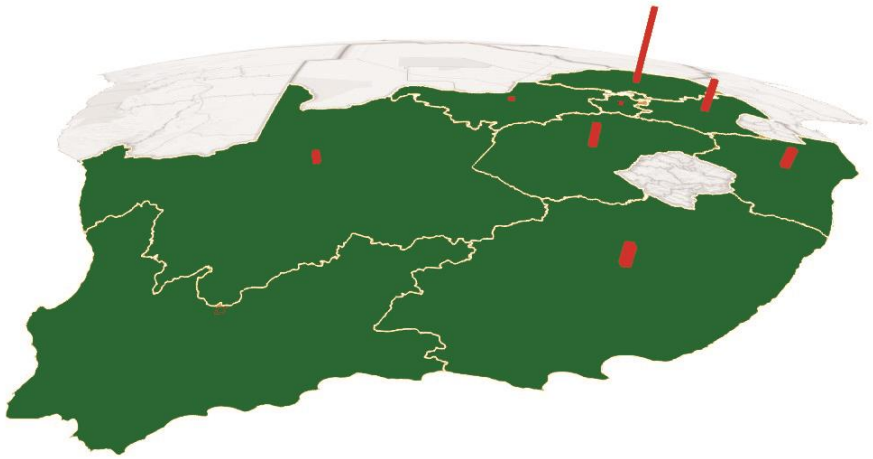


Figure 78: Need for pipe fitters per province

PAINTER

OCCUPATIONAL DESCRIPTION

Painter – OFO Code 643101 - Applies paint, varnish, wallpaper and other finishes to protect, maintain and decorate the surfaces of buildings and structures.

LEARNING PATHWAY

For information on the learning pathway see the National Careers Advice Portal, http://ncap.careerhelp.org.za/occupation and select the occupation.

OVERVIEW AND CHALLENGES

- Relatively few painters are formally trained to trade test level
- The paint contracting sector is generally reluctant to train their applicators as a result of time constraints and the poaching of trained staff by other organisations
- Trained painters contribute to good quality, durable finishes resulting from correct preparation and application procedures with accompanying cost savings
- A major marketing drive is needed to encourage training for this trade

SOLUTIONS

In addition to the national drive to improve the capacity of colleges and to secure workplaces for apprentices, there is a need to replace the multiple, sectoral pathways with a single pathway. The Implementation Milestone Plan for Painters is shown Table 28.

Table 28: Painter

Plan Element	Progress	Anticipated Timeframe
DQP – AQP	Not Commenced – QCTO to Prioritise	July 2014
NQF Registration	Pending completion of DQP-AQP Process	January 2015
OQ ID	Pending completion of DQP-AQP Process	January 2015
Trade Test	Pending Registration of Qualification on NQF	January 2016
RPL Toolkit	Pending Registration of Qualification on NQF	January 2016
TT Sites	Sites details being consolidated from SETAs	December 2014
NTCC	Pending Registration of Qualification on NQF	January 2016
MES	Pending Registration of Qualification on NQF	January 2016
NCAP	Completed for legacy qualifications.	February 2016
Learner Materials	Pending NTCC + MES.	June 2016
Lecturer/Trainer Support	Pending NTCC + MES.	June 2016
TVET Sites (K + P)	Public and Private Colleges, Training Centres and Schools being identified	December 2014
Work Places (Mentors)	Workplaces per Sector being identified.	December 2014

Private sector partners and qualified college lecturers are invited to 'adopt this trade' to help inform and resource the development work above. Nominations to Trade Intermediate Body (see CD)

PROJECTIONS

Figure 80 shows that the demand for plumbers is largely required in the construction sector and consequently in the SIPs nationwide as seen in Figure 79. The demand for painters greatly exceeds the supply as can be seen in Figure 82. Increased enrolments, improved throughput and attention to RPL will be necessary to address this gap.

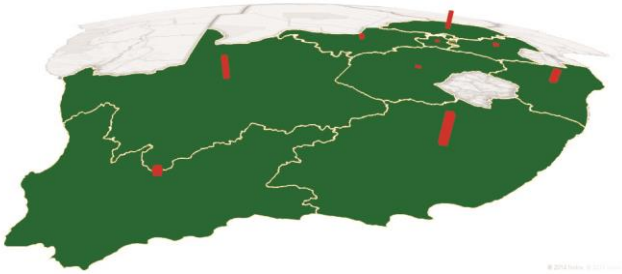


Figure 79: Need for painters per province

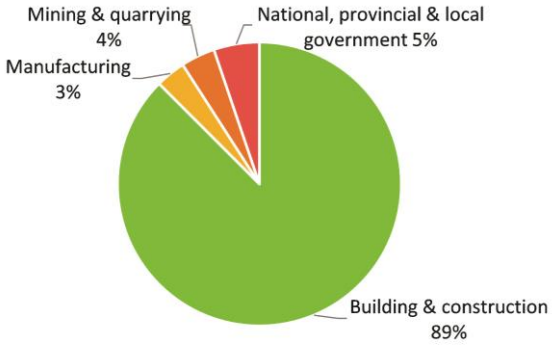


Figure 80: Sectors in which painters are employed

Source: QLFS 2009 – 2013

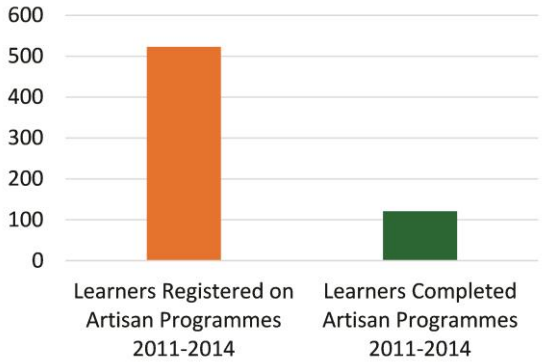


Figure 81: Painter enrolment and trade tests passed

Source: DHET Kwa-Thema database 2014

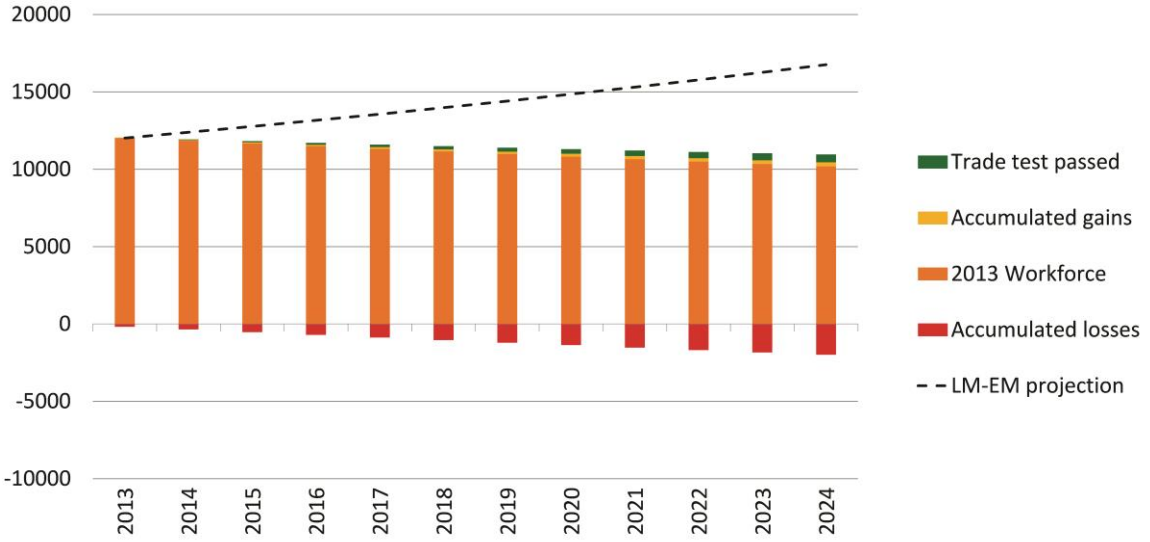


Figure 82: Projected demand for and supply of painters

PLASTERER

OCCUPATIONAL DESCRIPTION

Plasterer – OFO Code 642302 - Applies decorative and protective coverings of plaster, cement and similar materials to the interiors and exteriors of structures.

LEARNING PATHWAY

For information on the learning pathway see the National Careers Advice Portal, http://ncap.careerhelp.org.za/occupation and select the occupation.

OVERVIEW AND CHALLENGES

- The role of the plasterer has developed as more exotic wall finishes have become common
- New building materials make use of composite materials like polystyrene impregnated bricks to achieve specified plaster finishes
- Qualified plasterers are not currently registered so they are vulnerable to competition from those who are not qualified

- Plasterers often earn better wages when they work for themselves rather than for established building and construction companies although the work may be seasonal

SOLUTIONS

In addition to the national drive to improve the capacity of colleges and to secure workplaces for apprentices, there is a need to replace the multiple, sectoral pathways with a single pathway. The Implementation Milestone Plan for Plasterers is shown Table 29.

Table 29: Plasterer

Plan Element	Progress	Anticipated Timeframe
DQP - AQP	Not Commenced - QCTO to Prioritise	July 2014
NQF Registration	Pending completion of DQP-AQP Process	January 2015
OQ ID	Pending completion of DQP-AQP Process	January 2015
Trade Test	Pending Registration of Qualification on NQF	January 2016
RPL Toolkit	Pending Registration of Qualification on NQF	January 2016
TT Sites	Sites details being consolidated from SETAs	December 2014
NTCC	Pending Registration of Qualification on NQF	January 2016
MES	Pending Registration of Qualification on NQF	January 2016
NCAP	Completed for legacy qualifications.	February 2016
Learner Materials	Pending NTCC + MES.	June 2016
Lecturer/Trainer Support	Pending NTCC + MES.	June 2016
TVET Sites (K + P)	Public and Private Colleges, Training Centres and Schools being identified	December 2014
Work Places (Mentors)	Workplaces per Sector being identified.	December 2014

Private sector partners and qualified college lecturers are invited to 'adopt this trade' to help inform and resource the development work above. Nominations to Trade Intermediate Body (see CD)

PROJECTIONS

Plasterers are required almost exclusively in building and construction and are consequently in demand for SIPs projects nationwide as seen in Figure 83. There are substantial shortages and currently the Kwa-Thema database shows that only 24 plasterers have passed their trade tests in the last three years and another 162 are currently registered. This clearly indicates that attention needs to be paid to this trade at every point along the learning pathway – from enrolments to work placements through to trade testing.

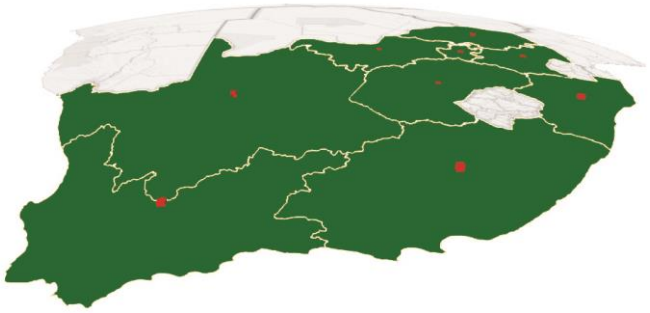


Figure 83: Need for plasterers per province

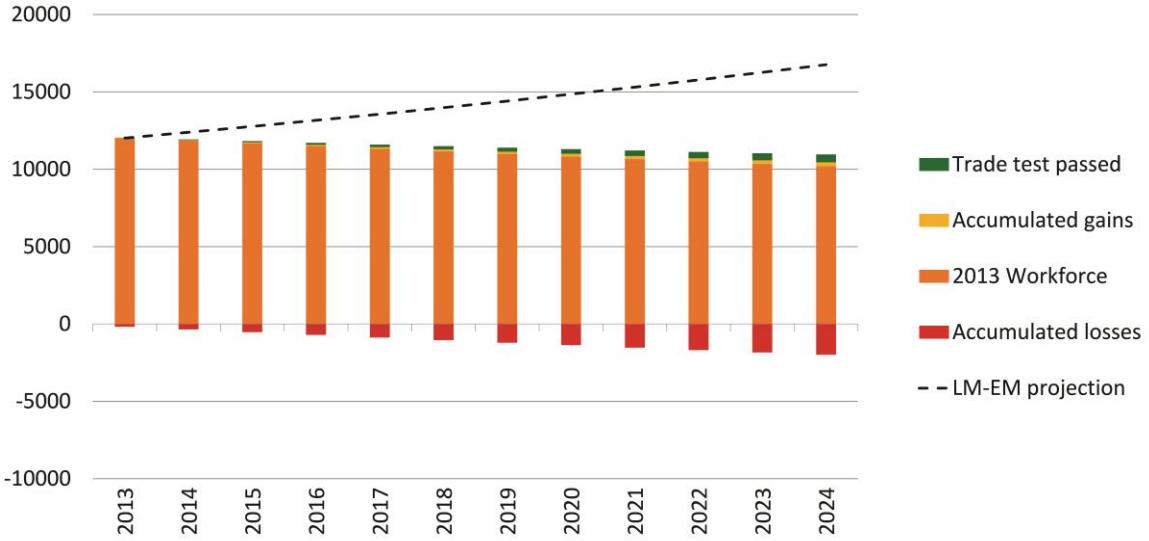


Figure 84: Projected demand for and supply of plasterers

WELDER

OCCUPATIONAL DESCRIPTION

Welder – OFO Code 651202 - Fabricates and repairs metal products using various welding techniques.

LEARNING PATHWAY

For information on the learning pathway see the National Careers Advice Portal, http://ncap.careerhelp.org.za/occupation and select the occupation.

OVERVIEW AND CHALLENGES

- There is a severe shortage of experienced coded welders in the country and a plethora of different career opportunities available
- Offshore work and underwater welding poses numerous challenges to traditional welders
- Informal welders often offer basic welding services in local communities and would benefit from further training

- Coded welders trained to international standards are required to construct and install wind turbines and power stations and foreign skills are often contracted to satisfy sign-off requirements due to skills shortages

SOLUTIONS

In addition to the national drive to improve the capacity of colleges and to secure workplaces for apprentices, there is a need to replace the multiple, sectoral pathways with a single pathway. The Implementation Milestone Plan for Welders is shown Table 30.

Table 30: Welder

Plan Element	Progress	Anticipated Timeframe
DQP - AQP	Completed	August 2014
NQF Registration	Submitted to SAQA	August 2014
OQ ID	Submitted to SAQA	August 2014
Trade Test	Pending Registration of Qualification on NQF	August 2015
RPL Toolkit	Pending Registration of Qualification on NQF	August 2015
TT Sites	Sites details being consolidated from SETAs	December 2014
NTCC	Pending Registration of Qualification on NQF	August 2015
MES	Pending Registration of Qualification on NQF	August 2015
NCAP	Completed for legacy qualifications.	October 2015
Learner Materials	Pending NTCC + MES.	February 2016
Lecturer/Trainer Support	Pending NTCC + MES.	February 2016
TVET Sites (K + P)	Public and Private Colleges, Training Centres and Schools being identified	December 2014
Work Places (Mentors)	Workplaces per Sector being identified.	December 2014

Private sector partners and qualified college lecturers are invited to 'adopt this trade' to help inform and resource the development work above. Nominations to Trade Intermediate Body (see CD)

PROJECTIONS

Welders are critical for manufacturing, fabrication and installation on construction sites and are required nationally for many SIPs. While the number of those passing trade tests has increased recently, the rate is not yet sufficient to meet the projected demand. In addition attention must also be given to specialisation associated with coded welding.

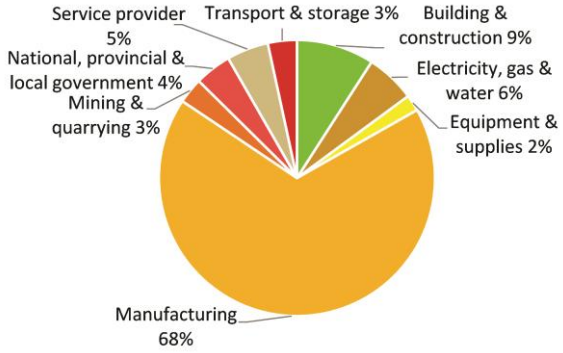


Figure 85: Sectors in which welders are employed

Source: QLFS 2009 – 2013

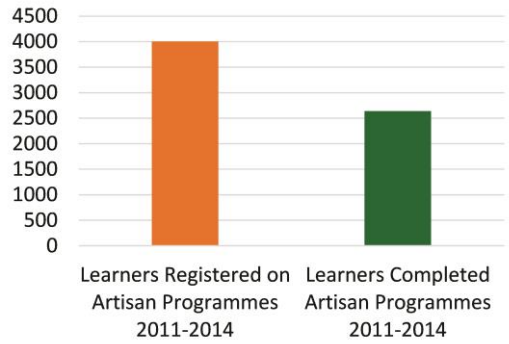


Figure 86: Welder enrolment and trade tests passed

Source: DHET Kwa-Thema database 2014

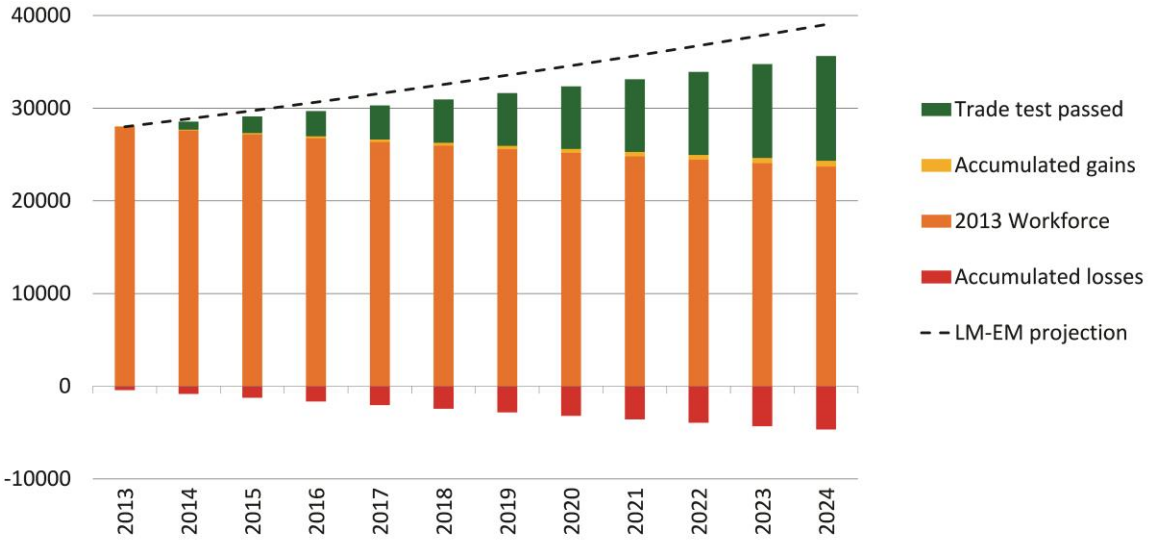


Figure 87: Projected demand for and supply of welders

RIGGER

OCCUPATIONAL DESCRIPTION

Rigger – OFO Code 651501 - Assembles and installs rigging gear such as cables, ropes, pulleys and winches to lift, lower, move and position equipment, structural steel and other heavy objects.

LEARNING PATHWAY

For information on the learning pathway see the National Careers Advice Portal http://ncap.careerhelp.org.za/occupation and select the occupation.

OVERVIEW AND CHALLENGES

- Riggers work in the industrial and commercial sectors such as oil, gas, mining, ship building, construction, manufacturing, power and telecommunications
- Risks to personnel and expensive equipment require expert knowledge of lifting and handling techniques and equipment
- Health and safety requirements require a full rigging study to be performed and signed off for heavy lifts
- Working at heights poses serious health and safety challenges such as live line workers

suspended from helicopters working on 400 000 volt power lines to riggers erecting 100m wind turbines

- Rigging is a highly specialised skill requiring specialised training, regulatory certification as well as expertise in specific project requirements

SOLUTIONS

In addition to the national drive to improve the capacity of colleges and to secure workplaces for apprentices, there is a need to replace the multiple, sectoral pathways with a single pathway. The Implementation Milestore Plan for Riggers is shown Table 31.

Table 31: Rigger

Plan Element	Progress	Anticipated Timeframe
DQP - AQP	Work in Progress	October 2014
NQF Registration	Pending completion of DQP-AQP Process	October 2014
OQ ID	Pending completion of DQP-AQP Process	October 2014
Trade Test	Pending Registration of Qualification on NQF	October 2015
RPL Toolkit	Pending Registration of Qualification on NQF	October 2015
TT Sites	Sites details being consolidated from SETAs	December 2014
NTCC	Pending Registration of Qualification on NQF	October 2015
MES	Pending Registration of Qualification on NQF	October 2015
NCAP	Completed for legacy qualifications.	November 2015
Learner Materials	Pending NTCC + MES.	April 2016
Lecturer/Trainer Support	Pending NTCC + MES.	April 2016
TVET Sites (K + P)	Public and Private Colleges, Training Centres and Schools being identified	December 2014
Work Places (Mentors)	Workplaces per Sector being identified.	December 2014

Private sector partners and qualified college lecturers are invited to 'adopt this trade' to help inform and resource the development work above. Nominations to Trade Intermediate Body (see CD)

PROJECTIONS

Qualified riggers are critical for all major projects and are in demand throughout the SIPs. The projections given in Figure 91are misleading since the current workforce figures extracted from the QLFS are clearly understated. The Kwa-Thema database shows that some 840 riggers have qualified over the past three years and the number of registered apprentices is showing a promising increase. It is essential that the throughput is addressed to ensure the necessary level of graduations is achieved.

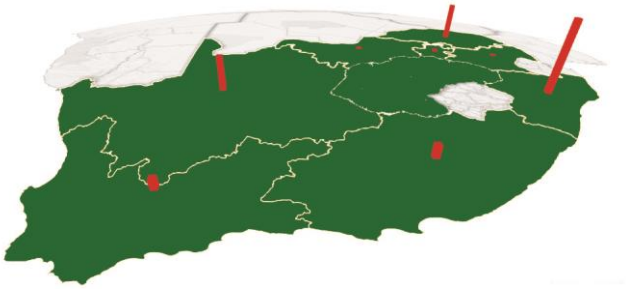


Figure 88: Need for riggers per province

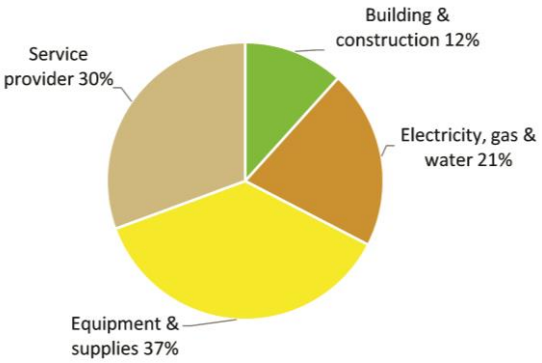


Figure 89: Sectors in which riggers are employed

Source: QLFS 2009 – 2013

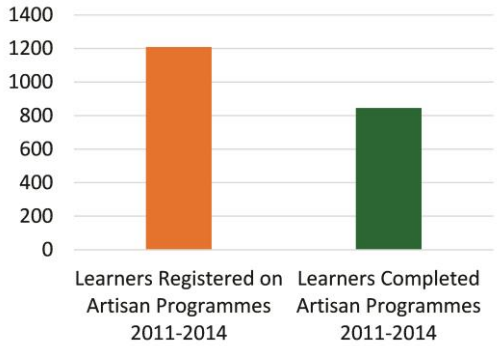


Figure 90: Rigger enrolment and trade tests passed

Source: DHET Kwa-Thema database 2014

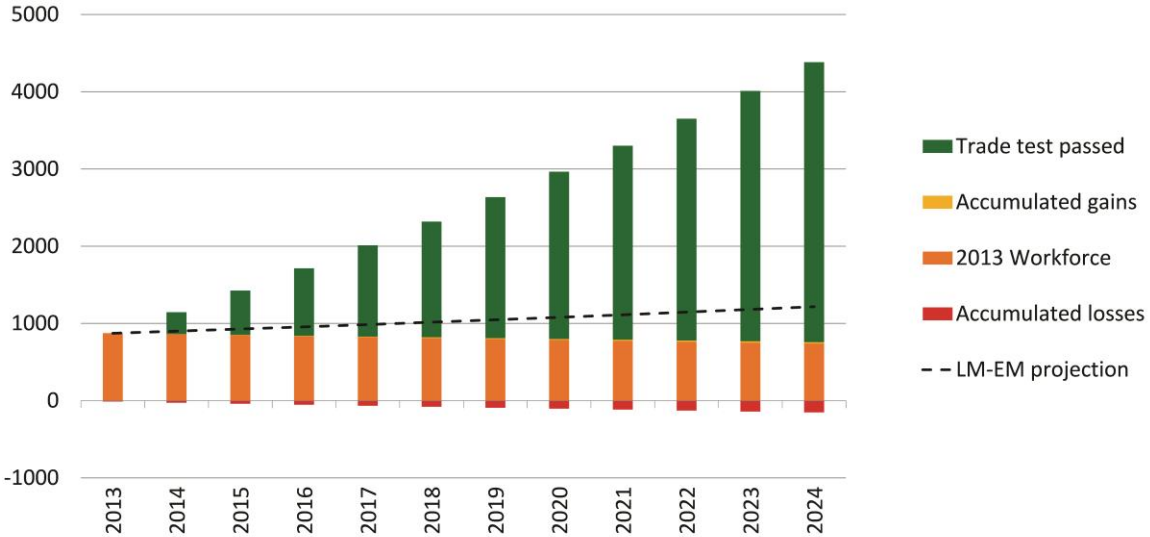


Figure 91: Projected demand for and supply of riggers

MOULDER

OCCUPATIONAL DESCRIPTION

Moulder – OFO Code 651101 - Casts metal into moulds and cores for the production of metal products.

LEARNING PATHWAY

For information on the learning pathway see the National Careers Advice Portal, http://ncap.careerhelp.org.za/occupation and select the occupation.

OVERVIEW AND CHALLENGES

- There is a demand for skilled moulders particularly in smaller foundries but a shortage of candidates because of the dirty, labour intensive nature of the work
- Companies often use assistants and labourers who lack the literacy skills to read drawings
- As a result of low candidate numbers, the TVET colleges are not geared to offer the theory component
- Some older foundries have closed or outsourced some of the remaining work internationally

- The QCTO has revamped and registered the qualification and work is under way to develop the trade test
- The Institute of Foundrymen has used learnerships to try and increase the number of moulders

SOLUTIONS

In addition to the national drive to improve the capacity of colleges and to secure workplaces for apprentices, there is a need to replace the multiple, sectoral pathways with a single pathway. The Implementation Milestone Plan for Moulders shown Table 32.

Table 32: Moulder

Plan Element	Progress	Anticipated Timeframe
DQP - AQP	Completed	Completed
NQF Registration	Completed	Completed
OQ ID	91782	91782
Trade Test	Working Group of CEPs Established	September 2014
RPL Toolkit	Working Group of CEPs Established	September 2014
TT Sites	Sites details being consolidated from SETAs	December 2014
NTCC	Pending standard format from Electrician	June 2015
MES	Process initiated with QCTO.	December 2014
NCAP	Completed for legacy qualifications.	July 2015
Learner Materials	Pending NTCC + MES.	December 2015
Lecturer/Trainer Support	Pending NTCC + MES.	December 2015
TVET Sites (K + P)	Public and Private Colleges, Training Centres and Schools being identified	December 2014
Work Places (Mentors)	Workplaces per Sector being identified.	December 2014

Private sector partners and qualified college lecturers are invited to 'adopt this trade' to help inform and resource the development work above. Nominations to Trade Intermediate Body (see CD)

PROJECTIONS

Moulders are critical for manufacturing much of the local equipment and components required for the SIPs and for manufacturing in general. Figure 92Figure 95 shows that the demand is widespread and Figure 93 shows that the projected demand outstrips the supply at current rates of graduation. The increase in registration in Figure 94 is insufficient and needs to be addressed. The fact that colleges do not currently provide foundation theory programmes for this trade needs to be addressed at one or more Centres of Specialisation.

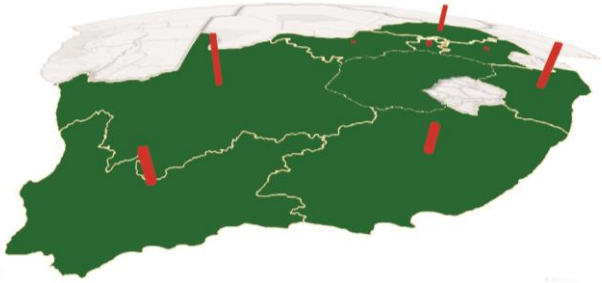


Figure 92: Need for moulders per province

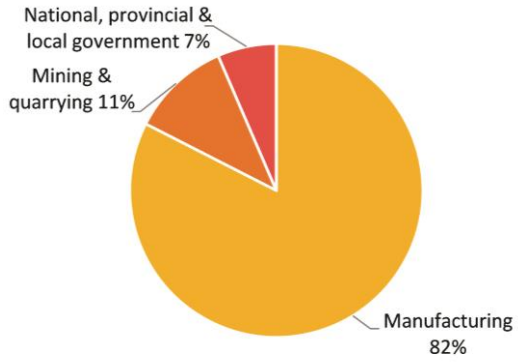


Figure 93: Sectors in which moulders are employed

Source: QLFS 2009 – 2013

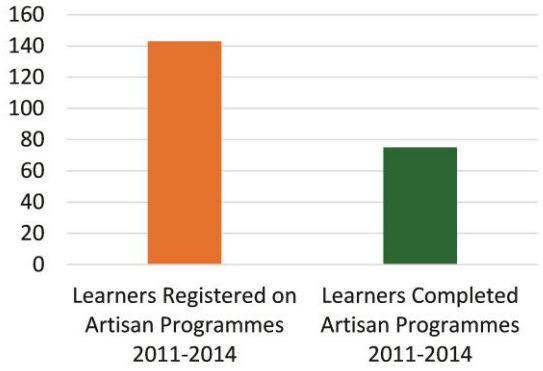


Figure 94: Moulders enrolment and trade tests passed

Source: DHET Kwa-Thema database 2014

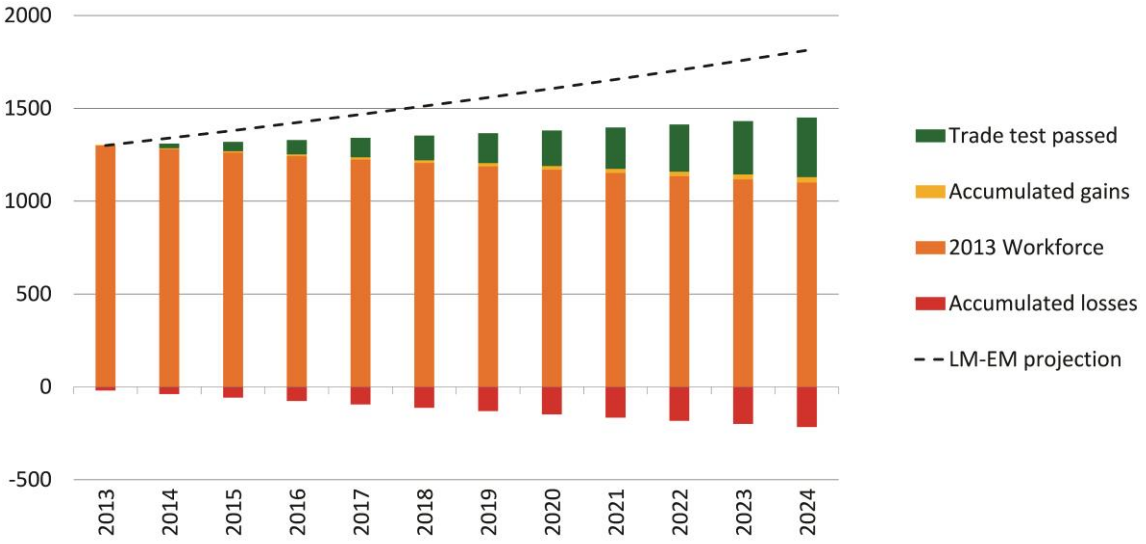


Figure 95: Projected demand for and supply of moulders

STRUCTURAL PLATER

OCCUPATIONAL DESCRIPTION

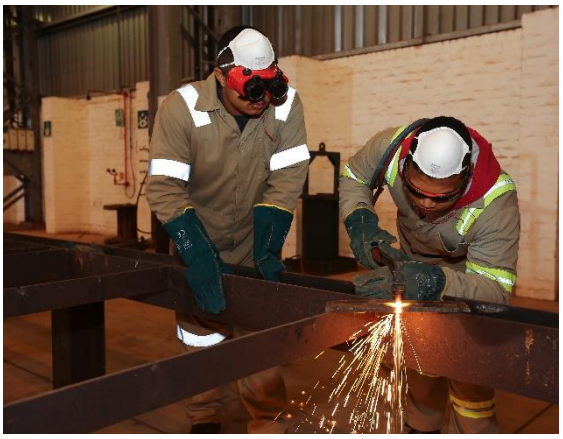
Structural Plater - Sets up, operates, or tends plating or coating machines to coat metal or plastic products with chromium, zinc, copper, cadmium, nickel, or other metal to protect or decorate surfaces.

LEARNING PATHWAY

For information on the learning pathway see the National Careers Advice Portal http://ncap.careerhelp.org.za/occupation and select the occupation.

OVERVIEW AND CHALLENGES

- Structural platers have a key role to play in any fabrication environment
- There is considerable overlap between the work of a boilermaker and a structural plater
- The theory component for this trade is not offered at colleges
- Structural platers are involved with the pre-fabrication of complex steel sections in a fabrication workshop



- The downturn in the construction industry impacted on job opportunities for a period

SOLUTIONS

In addition to the national drive to improve the capacity of colleges and to secure workplaces for apprentices, there is a need to replace the multiple, sectoral pathways with a single pathway. The Implementation Milestone Plan for Structural Platers is shown Table 33Figure 41.

Table 33: Structural Plater

Plan Element	Progress	Anticipated Timeframe
DQP - AQP	Not Commenced - QCTO to Prioritise	July 2014
NQF Registration	Pending completion of DQP-AQP Process	January 2015
OQ ID	Pending completion of DQP-AQP Process	January 2015
Trade Test	Pending Registration of Qualification on NQF	January 2016
RPL Toolkit	Pending Registration of Qualification on NQF	January 2016
TT Sites	Sites details being consolidated from SETAs	December 2014
NTCC	Pending Registration of Qualification on NQF	January 2016
MES	Pending Registration of Qualification on NQF	January 2016
NCAP	Completed for legacy qualifications.	February 2016
Learner Materials	Pending NTCC + MES.	June 2016
Lecturer/Trainer Support	Pending NTCC + MES.	June 2016
TVET Sites (K + P)	Public and Private Colleges, Training Centres and Schools being identified	December 2014
Work Places (Mentors)	Workplaces per Sector being identified.	December 2014

Private sector partners and qualified college lecturers are invited to 'adopt this trade' to help inform and resource the development work above. Nominations to Trade Intermediate Body (see CD)

PROJECTIONS

Structural platers are required for SIPs as well as construction and manufacturing in general. Figure 98 shows that the projected demand far outstrips the supply at current rates of graduation. The increase in registrations in Figure 97 is insufficient to make up the deficit and needs to be addressed. The fact that colleges do not currently provide foundation theory programmes for this trade needs to be addressed at one or more Centres of Specialisation.

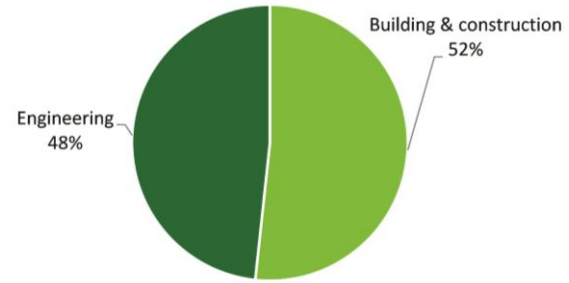


Figure 96: Sectors in which structural platers are employed

Source: QLFS 2009 – 2013

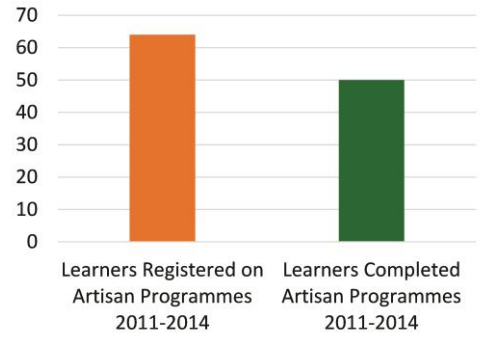


Figure 97: Structural plater enrolment and trade tests passed

Source: DHET Kwa-Thema database 2014

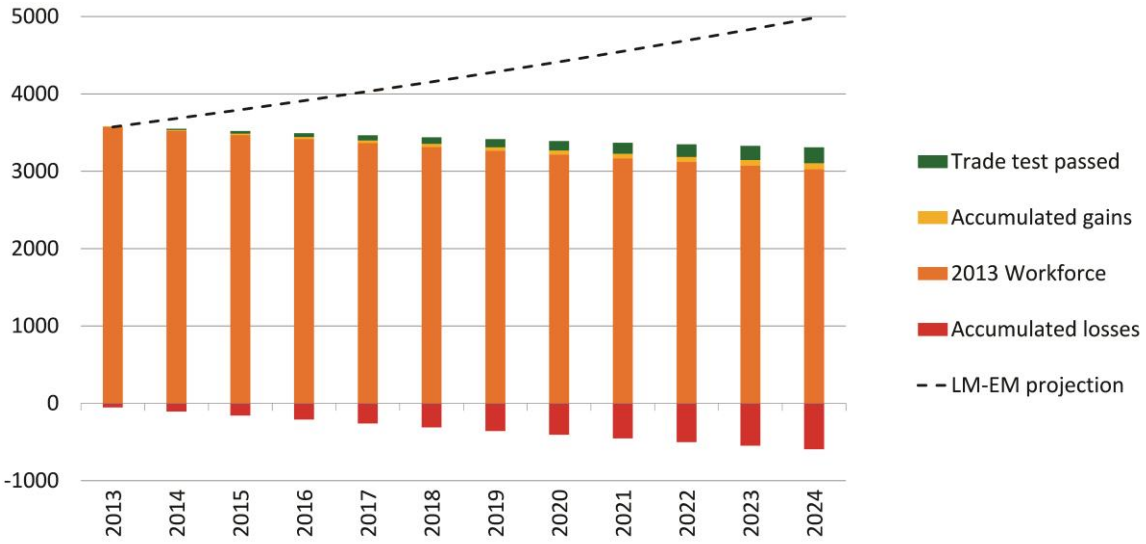


Figure 98: Projected demand for and supply of structural platers

SHEET METAL WORKER

OCCUPATIONAL DESCRIPTION

Sheet Metal Worker – OFO Code 651301 - Makes, installs and repairs articles and parts of articles made out of sheet metal such as sheet steel, copper, tin, brass, aluminium, zinc, galvanised iron or other substitutes.

LEARNING PATHWAY

For information on the learning pathway see the National Careers Advice Portal, http://ncap.careerhelp.org.za/occupation and select the occupation.

OVERVIEW AND CHALLENGES

- Work of the sheet metal worker tends to be focused on workshop production
- It covers construction and mining requirements such as air ducting through to equipment cowlings, cladding and insulation of steam pipes

- The demand for this skill is dependent on industrial and mining activity.

SOLUTIONS

In addition to the national drive to improve the capacity of colleges and to secure workplaces for apprentices, there is a need to replace the multiple, sectoral pathways with a single pathway. The Implementation Milestone Plan for Sheet Metal Workers is shown Table 34.

Table 34: Sheet Metal Worker

Plan Element	Progress	Anticipated Timeframe
DQP - AQP	Not Commenced - QCTO to Prioritise	July 2014
NQF Registration	Pending completion of DQP-AQP Process	January 2015
OQ ID	Pending completion of DQP-AQP Process	January 2015
Trade Test	Pending Registration of Qualification on NQF	January 2016
RPL Toolkit	Pending Registration of Qualification on NQF	January 2016
TT Sites	Sites details being consolidated from SETAs	December 2014
NTCC	Pending Registration of Qualification on NQF	January 2016
MES	Pending Registration of Qualification on NQF	January 2016
NCAP	Completed for legacy qualifications.	February 2016
Learner Materials	Pending NTCC + MES.	June 2016
Lecturer/Trainer Support	Pending NTCC + MES.	June 2016
TVET Sites (K + P)	Public and Private Colleges, Training Centres and Schools being identified	December 2014
Work Places (Mentors)	Workplaces per Sector being identified.	December 2014

Private sector partners and qualified college lecturers are invited to 'adopt this trade' to help inform and resource the development work above. Nominations to Trade Intermediate Body (see CD)

PROJECTIONS

Sheet metal workers are utilised in similar sectors to boilermakers – see Figure 99. There are currently insufficient registering or qualifying which requires attention as they are important in the manufacturing process.

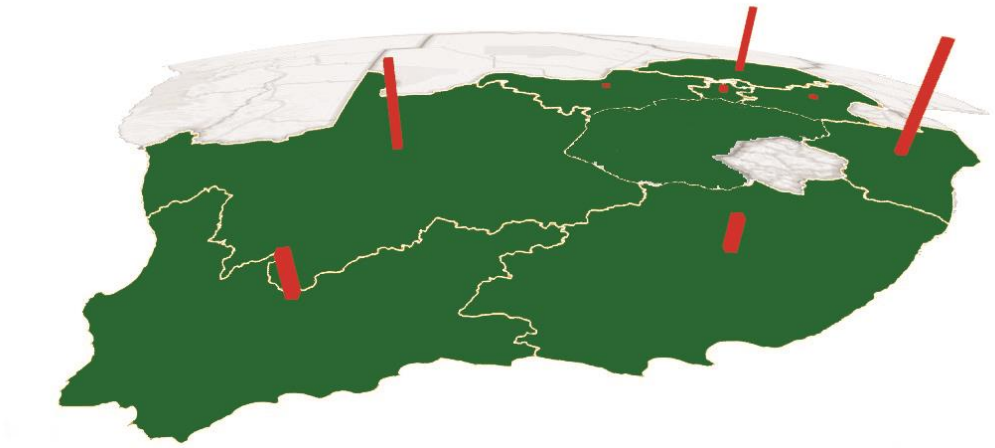


Figure 99: Need for sheet metal workers per province

CHAPTER 8

Operators

OVERVIEW

Yellow machines are a vital part of any construction site. Often the magnitude of tasks is so great that they cannot be done by hand and the range of equipment from earthmoving machinery to tower and mobile cranes and heavy duty trucks is required.

A number of these operators have been listed as scarce with respect to delivering the SIPs. These include earthmoving equipment operators, with grader operators being singled out as critical. The scarcity articulated by industry refers largely to experienced operators, the bulk of whom appear to be over 45. In addition, crane operators and drivers of the large articulated trucks, such as those delivering coal to power stations are also considered to be in short supply.

The capital cost for each piece of equipment is high and to minimise the risk of damaging the equipment or endangering the lives of others in the workplace, comprehensive training and licencing of competent operators has become a requirement.

TRAINING IN THE PAST

IN-HOUSE TRAINING

Before the introduction of the Skills Development Act, training was carried out in-house by major construction companies and plant hire companies. In addition, prior to the advent of outsourcing, major state departments that were fleet owners such as the national and provincial roads departments, large municipalities, the Department of Water Affairs and others provided the training ground for operators. There was no structured training in place but young operators started on lighter equipment under the guidance of an experienced operator and progressed to heavier and more complex equipment in time. Knowledge was passed on from one operator to another.

STRUCTURED TRAINING

As the opportunities for in-house training throughout the state reduced and with the advent of SAQA and the introduction of registered qualifications, the industry was engaged to develop qualifications. The first registered qualification was the National Certificate: Construction: Plant Operators – Level 2 ID48940. This qualification would lay the basis for further learning towards the National Certificate: Construction: Advanced Plant Operations – NQF Level 3. The new qualifications recognised the need for theory, practical and workplace training.

Construction companies fall under the CETA, and the qualifications were registered with the CETA. In the case of the Hire Industry the relevant SIC Codes fall within the Hire Chamber which falls under the SSETA. Due to limited resources coming from the CETA, the Hire Chamber at SSETA wrote the training material for plant operators on all 23 machines which they hire out.

The use of simulators

In recognition of the increasing complexity and cost of the equipment, the use of simulators was pioneered in the mid-2000s which made available the most advanced and risk-free training methods. Simulators allow learners to experience real-world situations, including difficult manoeuvres, teaching safe operating techniques, machine controls, how to do daily service checks, start-up, operations and also maintenance in a virtual jobsite.

Not only does the use of simulators allow safe and stress free operator training, but it reduces the costs for plant owners in that their actual equipment is available for production, and will have longer engine life and reduced maintenance due to reduced operator usage.

Since simulators are expensive, training providers could not afford to purchase their own. The Contractors Plant Hire Association (CPHA), which has been in existence since 1970 to promote the development of the plant hire industry, recognised the need to provide simulator facilities for all training providers to use and set up simulators at Imbali Training Centre in Benoni, Coega in Port Elizabeth, the IDZ in East London and a fourth simulator in KwaZulu-Natal in 2008. These were funded with the help of the SSETA. For a period, industry used these simulators, but funding has not been available to update the simulators to match current yellow machine operations and new training requirements

NEW QUALIFICATIONS

Given the move from learnerships to QCTO qualifications, it is necessary to redevelop all existing qualifications. As operator work straddles several sectors, a multi-sectoral approach is required, involving a range of industries and several SETAs including CETA, MerSETA, SSETA and the TETA among others. Work is under way on several of the qualifications, as discussed under each occupation. Once they are registered, industry will be able to train against these qualifications, and apply to claim the commensurate grants from their respective SETAs to cover this training.

Grants have unfortunately not been received for operator training for the past five years resulting in the huge backlog that has caused these skills to be in short supply.

In line with the QCTO model, qualifications will be composed of a theoretical training component, a practical component in a simulator and in the yard at a training centre, and a workplace component in which the trainee operates the equipment under supervision for a period until fully competent to operate independently. In the practical phase, both simulator and machine time needs to be hired and learners must be equipped with PPE.

Entrance criteria will be set per qualification, Development Quality Partners (DQPs) must be set up, Assessment Quality Partners (AQPs) must be appointed and training providers must be accredited.

Training providers

There are a limited number of well-established providers that offer comprehensive training by experienced operators. There are many small operators that offer only limited theoretical training and certify trainees without their ever having operated the equipment for which they are certified. Companies are loathe to employ these trainees who have not spent adequate hours using the equipment under supervision. Many certificates awarded to trainees are of little value as trainees report limited job opportunities after they have completed only short duration operator training. Certification is at times simply bought. One of the biggest challenges identified by the occupational teams was that of illegal licences which needs to be addressed under the new more rigorous system.

New simulators

The advancement of technology over the past 10 years means that new simulators need to be designed and made available for training providers to use for future training.

Entrance criteria

Operation of much of this equipment is becoming more complex as a result of computerised controls and improved hydraulics and electronics, requiring more skill to operate. Global Positioning System (GPS) technology also is being used to help with grading and levelling activities. In addition to controlling the equipment, operators also set up and inspect the equipment, make adjustments, and perform some maintenance and minor repairs.

- Academic requirements

Operators need an understanding of mechanics and electronics and new qualifications generally require grade 11 or equivalent with maths, science and engineering drawing for entry.

- Driver's licences

For several of the earthmoving machines, it is necessary not to only be licenced to operate the equipment, but code 10 driver's licences are also required for use on normal roads. The backlog at testing grounds and associated delays with getting driver's licence appointments needs to be addressed. Consideration should be given to accrediting approved training centres in conjunction with local authorities.

- Medical fitness

Operators need to be in good physical condition. Medical examinations are thus required and a certificate of fitness must be issued by an OHS practitioner.

- Coordination and dexterity

Operators must have a good sense of balance, the ability to judge distance, and eye-hand-foot coordination. Learners are called upon to complete coordination and dexterity tests known as a LAB test (learning ability battery test) before being taken on for operator training. Furthermore, some operators require the ability to work at heights.

Setting up DQPs

There is a need to set up and fund Development Quality Partners (DQPs) representing all interest groups and sectors to develop the required qualifications. The composition required will be discussed per occupation.

ASSESSMENT

Setting up AQPs and licencing

The philosophy of QCTO qualifications is to appoint a single assessment body per occupation to ensure that consistent assessments are carried out nationwide. Where registration or licensing is not in place at present, setting up a professional body, or expanding the scope of a professional body's mandate to perform as an AQP is onerous.

Assessing and accrediting training providers and monitoring their delivery is demanding and costly. It is necessary to ensure that all have facilitators, assessors and moderators who comply with the requirements of the industry e.g. a facilitator must be suitably qualified to instruct a learner on how to operate the relevant machine. Training providers must always have access to actual machines for practical training.

Seed funding is required to develop AQPs.

Technology changes and health and safety concerns are such that it is considered necessary for operators to be relicensed every two or three years. This will require that operators have updated simulator training and medicals to ensure that they are fit and up to date.

Re-licensing however poses a logistical problem. When the industry is quiet, operators become unemployed and, when spending picks up, it is difficult to return as there is currently no funding and limited capacity and facilities to handle the process to update training, assessment and relicensing.

Capacity to handle relicensing must also be developed.

NUMBERS REQUIRED

Actual numbers of operators required are based on the fleet in the field. Construction and Mining Equipment South Africa (COMESA) represents all the OEMs, and offer a fairly accurate estimate of the amount of equipment supplied and maintained. Based on the number of shifts per type of equipment, it is possible to determine the demand. As infrastructure continues to develop, the need for more maintenance and delivery of supplies continues to grow, so there is considerable requirement not only for replacement demand, but to address growth.

CONCRETE BATCHING PLANT OPERATOR

OCCUPATIONAL DESCRIPTION

Operates mixing plant to produce batches of concrete from cement, sand, aggregate, water and other ingredients.

CAREER PROGRESSION

- Batcher/Plant operator
- Plant Supervisor/Laboratory Manager
- Plant Manager

LEARNING PATHWAY

TRAINING AND DEVELOPMENT

Enrolment can take place at any time as it is based on a skills programme which starts with a day-day training course on the introduction to concrete and nominal site experience. Informal training may take place onsite. Training can progress all the way to a formal qualification similar to the Advanced Concrete Technology course by City and Guilds. Career progression comes with a combination of on-site training, experience and aptitude. Critical knowledge areas include:

- Execute sampling of concrete and materials for testing
- Execute elementary tests on concrete and materials
- Interpret elementary results and visually assess slump
- Operate automated batching plants and stock controls
- Transportation, placing and compacting

TRAINING PROVIDERS

- Currently non-accredited training providers and in-house training

OVERVIEW AND CHALLENGES

- No standardised training programmes
- No standardised training material
- No industry standardisation of the various grades

- Very little knowledge of production of quality concrete

PROJECTIONS AND SOLUTIONS

SHORTAGE

The concrete industry needs more people to be trained in the use of concrete and the use of readymix concrete. As readymix concrete is of a higher quality and cheaper than site mixed concrete, the training will ensure better quality buildings and infrastructure. More money will be available if construction is done right first time, instead of having to repair shoddy workmanship. The implementation of the cidb Standard for Developing Skills through Infrastructure Contracts provides further opportunity to contribute to a pool of competent workers including foreman development.

NEW QUALIFICATION

There is a need to develop an industry standardised training programme. The CETA/SAQA registered qualifications will expire by 2015 and needs to migrate to the QCTO model. A three year progressive qualification was written and submitted in 2012, but has not yet been registered by the CETA. Once the qualification is registered there will be a need to develop standardised learning material and logbooks for models of employable skills (MES) for the concrete industry and further funding will be required.

CRANE OR HOIST OPERATOR

OCCUPATIONAL DESCRIPTION

Crane or hoist operator - Operates stationary and mobile cranes, hoists, lifts and winches to lift, move and place materials, equipment and people in areas such as building sites, factories, mines, sawmills, wharves and shipyards.

LEARNING PATHWAY

For information on the learning pathway see the National Careers Advice Portal, http://ncap.careerhelp.org.za/occupation and select the occupation.

OVERVIEW AND CHALLENGES

Crane and hoist operators are essential to the delivery of any type of infrastructure. This occupation covers the operation of tower, mobile and fixed rail cranes. Such operators are required not only in infrastructure delivery, but in mining, harbours, manufacturing and warehouses as can be seen in Figure 100.

At present there is no agreed industry standard in terms of qualifications or recognised workplace training but a qualification is under development through the QCTO.

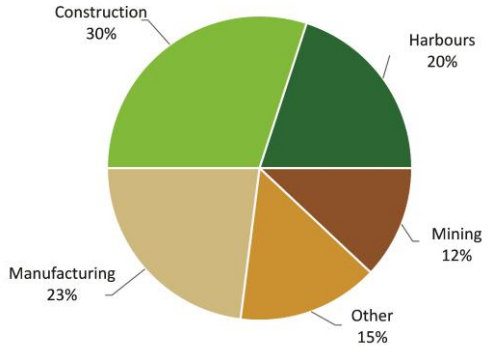


Figure 100: Sectors in which crane or hoist operators are employed

Source: QLFS

It has however been found that the content is not general enough to address tower cranes and other requirements of the construction industry.

The numbers in the industry are shown in Table 35.

Table 35: Crane operators in construction

Operator	Stock	Demand	Gap
Crawler Crane Operator	1 250	1 400	150
Lattice Boom Operator (Tower Crane)	2 750	3 100	350
Truck Mounted Boom Operator	6 300	7 245	945
Mobile Crane Operator	9 900	11 385	1 485
Total	**20 200**	**23 130**	**2 930**

Source: COMESA 2014

SOLUTIONS

SCHOOL

Career guidance

Awareness is considered to be a major problem, with insufficient numbers of people entering the occupation.

Of particular importance is the need for entrants to meet the literacy and numeracy entry level requirements as defined under the Foundational Learning Competence (FLC).

The FLC requires learners to be able to read adequately to learn and to perform mathematical calculations between NQF 2 and 4 levels.

THEORY

Infrastructure

There is a need to increase enrolment but there are insufficient training facilities, both in terms of the number of institutions offering training and the resources available for training, such as simulators. Those training providers who have invested in, or developed their own simulators report good results and success with placement of their learners.

Figure 101: Inside a simulator

New qualification

The biggest challenge at present is the lack of an industry standard qualification. The current qualifications are National Certificate: Construction: Crane Operations at NQF Level 2 and the ID49080 National Certificate: Construction: Advanced Crane Operations at NQF Level 3. These certificates are however not awarded on a national basis but by individual training providers, as per the current SETA model. These must be replaced with QCTO qualifications.

There is a need for diverse crane operator qualifications. Harbour, mobile and tower crane operators require largely similar training, but there are differences in terms of extensions, stability calculations work has commenced on a qualification through the QCTO to replace SAQA ID 64829 National Certificate: Lifting Machine Operations. The new qualification is to be known as Occupational Certificate: Crane and Hoist Operator but substantial extensions to this qualification are required for tower and mobile cranes. The DQP needs to include representation from the construction, manufacturing and freight sectors or parallel qualifications must be developed for the requirements of each sector.

In developing the new qualification(s) modules on working at heights must be included.

Learner support

In order to give learners the opportunity to enter this occupation, it is envisaged that professional bodies will manage the process of enrolling them in theoretical and practical training. Once they have completed their practical training, they will be recognised as crane assistants and will only then be introduced to employers. This will take the pressure off employers to train them from novice to crane assistant. This process will take two to three months.

Funding

Funding is required to develop the appropriate qualification(s). TETA is currently funding the development of the first qualification which is in draft form.

WORKPLACE-BASED LEARNING

As with all occupations, the industry is anxious to employ only experienced personnel, given the expense of the equipment being operated. A structured training approach needs to be developed, and trainees need to be funded for the workplace component of training. An

industry standard for workplace experience needs to be agreed upon as part of the development of the new qualification.

The crane assistant as described above should be taken through various crane configurations. On completion of specific standards of learning and the submission of a relevant logbook and Portfolio of Evidence (POE) the learner is awarded a part or full qualification. The benefit of final training being in the workplace is that the costs are borne by the employer.

ASSESSEMENT

AQP

An AQP must be appointed to handle national assessments. Funding to develop such AQP capacity will be necessary.

- Relicensing/RPL/CPD

Not only will it be necessary for the AQP to assess the achievement of outcomes towards a qualification, but licensing is important, as crane operators need to be retrained every few years as equipment advances. There is a need for top up training and putting a system in place for relicensing every two years.

As it is costly to attend a training centre for the relicensing process and several days of production may be lost, there is also a requirement for on-site assessments to be carried out or for recognition of the submission of logbooks signed off by experienced supervisors.

- Database

Relicensing will enable the AQP to keep a record of all operators in the industry and will facilitate the placement of operators.

EARTHMOVING EQUIPMENT OPERATOR

OCCUPATIONAL DESCRIPTION

Earthmoving plant operators operate machines to excavate, grade, level, smooth and compact earth or similar materials. The occupations are as follows:

Earthmoving Plant Operator - Operates a range of earthmoving plant to assist with the building of roads, rail, water supply, dams, treatment plants and agricultural earthworks.

Backhoe Operator (TLB) - Operates a backhoe and attachments to excavate, break, drill, level and compact earth, rock and other material.

Bulldozer Operator - Operates a bulldozer using blades and other attachments to gouge out, level and move materials in construction, forestry, mining and other projects.

Excavator - Operates heavy excavation plant to excavate, move and load earth, rock and rubble.

Grader Operator - Operates a grader to spread and level materials in construction projects.

LEARNING PATHWAY

For information on the learning pathway see the National Careers Advice Portal,

http://ncap.careerhelp.org.za/occupation and select the occupation.

OVERVIEW AND CHALLENGES

Earthmoving plant operators are essential to the delivery and maintenance of civil engineering infrastructure and are used extensively in mining operations. In civil engineering they are used not only in construction but by all three tiers of

government in the construction and maintenance of roads, as can be seen in Figure 102.

The range of equipment falling under each OFO code is shown in Table 35. As can be seen, the numbers to be trained are substantial.

SOLUTIONS

SCHOOL

Career guidance

Awareness is considered to be a major problem, with insufficient numbers of people entering the occupation. Grade 9, a code 10 licence and a health certificate is required for entering.

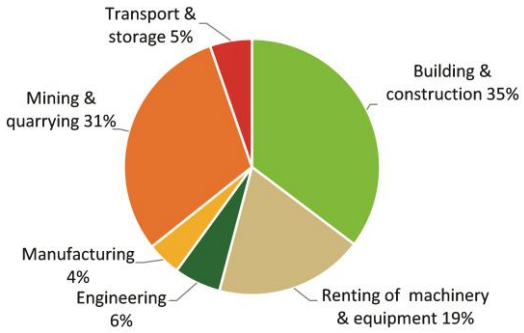


Figure 102: Sectors in which earth moving plant operators are employed

Source: QLFS

Table 36: Earthmoving equipment

Types of Machines	Abbrev	OFO	Total number of machines	Total operators	To be trained
Articulated Dump Truck	AT	734214	8 600	15 791	2 369
Back Hoe Loader (TLB)	BHL	734202	20 000	36 724	5 509
Compaction-Roller		734213	4 000	7 345	1 102
Hydraulic Excavator	HEX	734204	12 000	22 034	3 305
Motor Grader	MG	734205	3 500	6 427	964
Rigid Dump Truck	OHT	734214	200	367	55
Skid Steer Loader	SSL	734206	4 000	7 345	1 102
Tele Handler	TH	734201	1 500	2 754	413
Track Type Loader	TTL	734206	20	37	6
Dozer	TTT	734203	3 000	5 509	826
Wheeled Excavator	WEX	734204	250	459	69
Front End Loader	WLS	734206	9 000	16 526	2 479
Hydraulic Hammeral	WTT	734201	200	367	55
Total			**66 270**	**121 685**	**18 254**

Source: COMESA CPHA

THEORY

Infrastructure

There is a need to increase enrolment but there are insufficient training facilities in rms of the number of institutions offering training, and capacity to deliver in terms of lecturers, equipment, simulators. Currently there are only seven providers registered with SAQA on the qualification ID 48940 and none on the qualification ID 65789.

New qualification

The biggest challenge at present is the lack of an industry standard qualification. With two conflicting qualifications in place, and only seven providers that each issue their own certificates, it is clear that industry wide consultation is required across the construction and mining sectors to develop a new QCTO qualification.

The current qualifications include core modules and electives per machine. The earthmoving qualifications are registered through the CETA. Qualification ID48940 is the preferred qualification as it includes all three components of an occupational qualification. Qualification ID65789 which was registered later, offers equivalent certification, but requires considerably fewer hours of training under supervision, and assumes that final-cut training can be included in the certification without workplace experience. This level of precision in terms of grader operation can only be achieved by experience. In the opinion of the industry, this takes a minimum of five years. Operators who have been trained through ID65789 attest to the fact that the industry will not employ them to operate many of the machines for which they were notionally trained.

Although the content and approach of the current qualification, ID48940 is acceptable recommended, it will be necessary to consult widely to agree on the form of a new QCTO qualification to ensure that the standard of training is uniform throughout the country and all operators are trained to the same standard. The Construction and Hire sector are prepared to form a DQP and the CPHA has recently been recognised as a professional body with the authority to licence operators so it would be the logical choice as an AQP. However, developing qualifications and setting up an AQP is costly and funding is required to initiate the process.

Funding

Funding is required to develop the appropriate qualification(s). The MQA, CETA and SSETA need to be involved as a start.

WORKPLACE-BASED LEARNING

As with all occupations, the industry is anxious to employ only experienced personnel, given the expense of the equipment being operated. A structured training approach needs to be developed and trainees need to be funded for the workplace component of training. An industry standard for workplace experience needs to be agreed upon as part of the development of a new qualification. A concerted campaign needs to be mounted to attract retired earthmoving plant operators, and particularly grader operators back into the industry to supervise, coach and mentor trainees and also offer their services to deliver the theory component.

ASSESSEMENT

AQP

An AQP must be appointed to handle national assessments. Seed funding to develop such AQP capacity will be necessary. In this instance, it is suggested that the Construction Plant Hire Association (CPHA) be appointed to perform this role.

- Relicensing

Not only will it be necessary for the AQP to assess the achievement of outcomes towards a qualification, but licensing is important as earthmoving operators need to be retrained every few years to be kept up to date with the latest techniques as equipment advances. It will also ensure that operators are still medically fit to carry out their respective duties safely.

The current practice of the issuing of illegal certificates, due to non-regulated training is totally unacceptable and is causing major concern to all industries particularly in terms of safety and the high cost of accidents and replacement of equipment.

- Database

Relicensing will allow the AQP to keep a record of all operators in the industry. The AQP would be in constant contact with the industry as far as numbers of operators required for growth and replacements are concerned. In this way the AQP would ensure that operators would be fully optimised.

PROJECTIONS

The earthmoving contractors consider that there is an overall shortage and replacement demand of some 18 000 operators. It will take several years, once qualifications, simulators and accredited trainers have been put in place to catch up on this backlog. For the first year, assuming that simulators can be purchased, provision is made for training of 1 500 new operators over a period of 12 months, and relicensing a further 1 500 previously licensed operators.

TRUCK DRIVER

OCCUPATIONAL DESCRIPTION

The shortage of truck drivers relates to earthmoving vehicles discussed in an earlier section, crane mounted trucks, water trucks, tipper trucks, buses, services trucks, tractors, ready mix trucks and lowbeds for transporting earthmoving equipment and articulated delivery trucks such as those delivering coal to power stations

Truck driver - OFO 722201 - drives a heavy truck requiring a specially endorsed class of licence to transport bulky goods.

LEARNING PATHWAY

For information on the learning pathway see the National Careers Advice Portal, http://ncap.careerhelp.org.za/occupation and select the occupation.

OVERVIEW AND CHALLENGES

Due to the capital cost of heavy or articulated vehicles, employers seek only experienced drivers. Advertisements generally call for at least three years of experience. To achieve this, licensed drivers need to progress from lighter to heavier vehicles over time. Training of drivers is expensive and there are only a limited number of trainees covered under discretionary grant funding.

Grants are also require for drivers to advance from code 10 (C1) to code 14 (EC).

There are a limited number of training facilities and land for learners to practice in a safe environment. A further challenge is the difficulty in getting driving test appointments due to substantial backlogs at testing stations.

Medicals have also become an issue with regard to employees renewing their public driving permits.

SOLUTIONS

THEORY

Infrastructure and material

Increase the number of training facilities and develop easier methods of teaching the theory, particularly for learners with limited literacy capabilities.

There are no public institutions which provide driver training. This is a major weakness that should be addressed.

Funding

Increased funding is required. Currently the Discretionary Grant is set at R 25 000, but it is considered that at least R 30 000 to R 40 000 is required to complete the training.

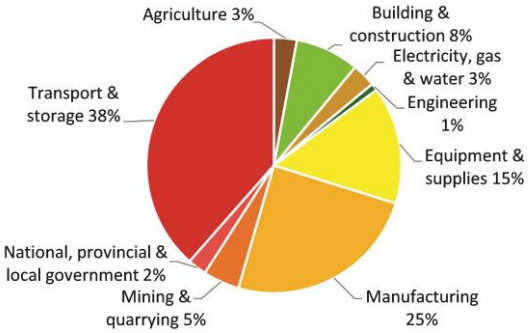


Figure 103: Sectors in which truck drivers are employed

Source: QLFS

WORKPLACE-BASED LEARNING

The availability of open land for training purposes is required along with experienced drivers who are able to spend many more hours coaching learner drivers.

ASSESSEMENT

The number of testing facilities needs to be increased and more assessors need to be trained.

EXPERTISE

The Occupational Team has suggested that in the short term, foreign drivers with appropriate licences and experience should be harnessed for specialist heavy vehicles where required.

Relicensing

Relicensing also presents a problem, as drivers need to take time off to attend tests. Assessors should also be available to test drivers in the workplace.

CHAPTER 9

Elementary Occupations

INTRODUCTION

Elementary and non-trade production workers cover occupations which require elementary knowledge and experience to perform routine tasks using hand tools and considerable physical effort. Elementary construction occupation workers perform a variety of general labouring and construction duties to assist building, civil engineering and related trade workers in the performance of their tasks. Training is typically provided in informal workbased settings and formal short courses or skills programmes. Elementary occupations in the construction sector can be viewed as an entry point to the industry which can allow for career progression to the trades and to supervisory positions.

ELEMENTARY OCCUPATIONS IN THE CONSTRUCTION INDUSTRY

The construction industry operates on a project basis and work is commonly allocated through a process of tendering by client departments. A project is then awarded to the successful bidder who is referred to as the main contractor. It is the responsibility of the main contractor to ensure successful completion of the project on time within budget and according to specification. The majority of main contractors do not employ all the skills necessary to complete their projects. As a result, subcontracting, including specialist, generalist, trade and labour-only subcontractors who comprise of the bulk of the labour force undertaking elementary occupations, has become an integral component of the construction industry and its importance has been increasing over the last two to three decades both locally and internationally.

Elementary or semi- skilled occupations are a vital component within the construction industry, accounting for the majority of the workforce. The impact of elementary occupation shortages has a knock-on effect as a whole because lack of skills leads to inefficiencies, low production, poor quality of work, project delays and ultimately an increase in the construction cost. It is imperative that all industry stakeholders pledge their support to address skills shortages through quality training and coaching.

TRAINING CHALLENGES AND SCARCITY

The project-based nature of construction activity is an aspect that poses difficulties for the industry. The complexity of construction work, the fragmented and geographically dispersed nature of construction organisations are noted by Bresnen et al[58] as impediments to change because these features mitigate against longer-term learning at the level of the organisation. This challenge is further compounded when contractors are obliged to source their unskilled and semi-skilled elementary workers locally. Where this happens, it is impossible to create a training pipeline and develop the skills levels as new people are recruited for each construction site. This seriously hampers cross-project learning and such discontinuities between projects can make long-term learning across projects problematic[59]

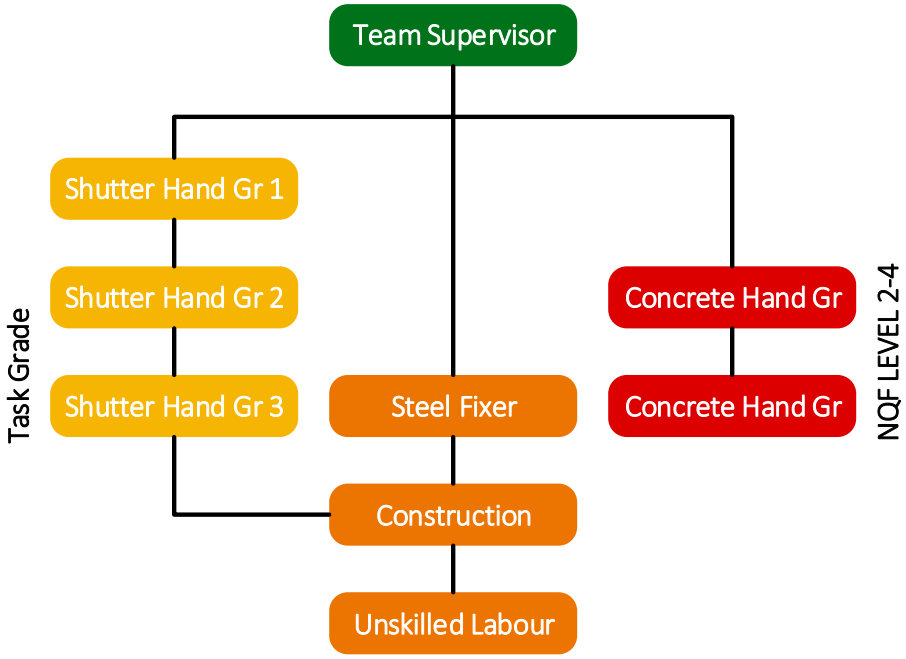


Figure 104: Typical career path for a Shutter Hand

BASIC ELEMENTARY CAREER PATH

Elementary occupations are highly specialised with training taking place over a shorter time period in the form of informal or job-company specific training. This has led to a breakdown in the traditional skills pipeline that resulted in qualified artisans and foremen because the lack of structured, standardised and continuous training hinders the progression of potential candidates to supervisory level.

With increasing levels of competition in the industry and narrow profit margins, contractors argue that they are unable to afford structured training for a long duration. Further, they face the problem of poaching of well-trained or skilled labour by competitors and so there has been the proliferation of company specific informal training that meets company requirements without providing for the development of portable skills. The passing on of skills through informal/in-house training is often only recognised within the company and is not necessarily recognised outside the company as it may be diluted to suit company-specific production systems

A crucial concern of the construction industry is a dysfunctional Construction Education Training Authority (CETA) to manage the construction training system and support the development of skills required by the industry. The poor turnaround time to issue certificates, respond to enquiries and lack of capacity to perform quality assurance are all mentioned as hindrances to training and skills development. There are a number of SAQA registered qualifications that are about to expire and need to migrate to the newly introduced QCTO format. A further concern with employers pertains to the bureaucracy and paperwork required to access funding, certification, and claim grants from the CETA. Consequently, many large employers have had to resort to funding their own training to meet their business imperatives which exacerbates the skills shortages in the elementary occupations as small contractors

are generally excluded from the system. The cyclical pattern of construction output adds to the problem – nobody wants to train in a recession and nobody has time to train in a boom (Philips, 2000).

RECOMMENDATIONS

Addressing the skills shortages in the elementary occupations may be overcome in a relatively short period of time provided there is adequate support in the following areas:

STANDARDISATION OF QUALIFICATIONS

- Need to develop QCTO aligned qualifications
- Ensure SETAs and others fund development of QCTO qualifications
- Need to identify and fund AQPs to ensure nationally agreed standards
- Ensure QCTO prioritises the development and registration of new qualifications
- Develop modules of employable skills (MES) within existing artisan qualifications
- Develop standardised learning material and logbooks

TRAINING PROVISION

The majority of elementary skills training is informal and on-the-job and therefore takes place within the environment of a construction project in the private sector. Most companies use private training providers because of their flexibility, ability to develop or tailor learning programme to the needs of industry and their ability to travel to construction sites ensuring minimal disruptions to work progress. In many cases training takes place in the form of skills programmes of approximately two to five days of classroom or simulated training.

There is a need to develop Public-Private Partnerships to better manage the skills shortages across the country especially in rural areas. There is potential for collaboration for sharing of resources, equipment, re-training of TVET college lecturers, technology and information transfer, among other interventions. The construction industry has the potential to create a large number of employment opportunities for unskilled and semi-skilled workers. The short-term training creates the ideal opportunity to provide a platform for entry into the industry.

WORK-INTEGRATED LEARNING (WIL)

The Construction Industry Development Board (cidb) has gazetted the *cidb Standard for Developing Skills* through Infrastructure Contracts, (referred to here as the *Skills Standard*) which establishes a minimum contract skills development goal on all construction contracts above R40m. The Skills Standard makes provision for workplace training opportunities which lead to a part or full occupational/trade qualification. The Skills Standard is an ideal vehicle for the development of elementary and non-trade occupations on projects through the funding of short term programmes for workers in fulltime employment. In order to optimise training, the Standard provides for the development of Skills Development Agencies (SDAs), which will organise and manage structured workplace learning opportunities to ensure the needs of learners and employers are better addressed.

CEMENT AND CONCRETE PLANT WORKER

OCCUPATIONAL DESCRIPTION

Cement and Concrete Plant Worker –

- Operates plant and machines which weigh and mix sand, gravel, cement, water and other ingredients to make concrete
- Operates plant and machinery which assembles and fills moulds with concrete and artificial stone mixtures, removes castings from moulds and finishes surfaces of precast products
- Cuts, grinds, drills, sandblasts and polishes concrete products and stone blocks, slabs and products to the specifications for the job.

CAREER PROGRESSION

- Cement and concrete plant worker
- Cement and concrete plant operator

LEARNING PATHWAY

For information on the learning pathway see the National Careers Advice Portal, http://ncap.careerhelp.org.za/occupation and select the occupation.

TRAINING AND DEVELOPMENT

Enrolment can take place at any time as it is based on a three month skills programme which is offered by CETA accredited training providers. Informal training may take place on-site. Training is based on SAQA registered unit standards and career progression comes with a combination of on-site training, experience and aptitude:

- Execute sampling of concrete material for testing
- Identify and describe different materials used in construction
- Batch and mix concrete by volume
- Conduct routine site tests for fresh and hardened concrete

Training Providers

- CETA accredited training providers

OVERVIEW AND CHALLENGES

- No standardised programmes or materials
- No industry standardisation of the various grades

PROJECTIONS AND SOLUTIONS

SHORTAGE

The SIPs co-ordinators identified a shortage of approximately 250 concrete hands. CETA has pledged R220 000 to support training and development in response to the scarcity identified. The implementation of the cidb Standard for Developing Skills through Infrastructure Contracts provides an opportunity to contribute to the development of a competent workforce.

NEW QUALIFICATION

There is a need to develop an industry standardised training programme. The CETA/SAQA registered qualifications will expire by 2015 and need to migrate to the QCTO model. SAFCEC has been appointed as the Development Quality Partner (DQP) and is in the process of developing a QCTO qualification. Once the qualification is registered, there will be a need to develop standardise learning material and logbooks for models of employable skills (MESs) for the Concrete hand occupations so, further funding will be required.

CONCRETE HAND

OCCUPATIONAL DESCRIPTION

Concretors place, spread, compact, finish and cure concrete for buildings, roads, tunnels, bridges and marine structures, using hand tools, vibrators, pumps, trowelling machinery and other power tools.

CAREER PROGRESSION

- Concrete hand grade 2
- Concrete hand grade 1
- Structural worker
- Structural team leader
- Team Supervisor

LEARNING PATHWAY

For information on the learning pathway see the National Careers Advice Portal, http://ncap.careerhelp.org.za/occupation and select the occupation.

TRAINING AND DEVELOPMENT

Enrolment can take place at any time as it is based on a three month skills programme which is offered by CETA accredited training providers. Training is based on three to six month skills programmes using SAQA registered unit standards and career progression comes with a combination of on-site training, experience and aptitude.

TRAINING PROGRAMMES

Concrete Hand C2

- Identify, describe and utilise materials in construction
- Batch and mix concrete by volume
- Batch and mix concrete by volume
- Use and maintain hand tools on a construction site
- Use and maintain power tools on a construction site
- Identify, describe and use materials in civil engineering construction

- Identify and use protective clothing and equipment in general construction
- Batch and mix concrete by volume

Concrete Hand C1

- Establish and prepare a work area
- Use and maintain small plant and equipment on a construction site
- Demonstrate knowledge of an apply basic concrete construction practice
- Supervise the batch and mixing of concrete by mass using a concrete mixer
- Conduct routine site tests to fresh concrete and hardened concrete
- Read and interpret construction drawings and specifications
- Apply health and safety to a work area

Registered service providers

- CETA accredited training providers
- Public /Private TVET Colleges

OVERVIEW AND CHALLENGES

The concrete hand plays a crucial role in the construction industry. They are required in large teams as in the case of most elementary occupations. Shortages of competent concrete hands will result in compounded increases in costs and delays in infrastructure contracts as they form part of the integral structural workers' team.

- No standardised training programmes
- No standardised training material

- No industry standardisation of the various grades
- Poor communication of career opportunities and progress

PROJECTIONS AND SOLUTIONS

SHORTAGE

The SIPs co-ordinators identified a shortage of approximately 2 500 concrete hands. CETA has pledged R220 000 to support training and development in response to the scarcity identified. The implementation of the cidb Standard for Developing Skills through Infrastructure Contracts provides an opportunity to contribute to the development of a pool of concrete hands. This provides an entry point into the industry and allows for progression to the Construction Artisan qualification.

NEW QUALIFICATION

There is a need to develop an industry standardised training programme. The CETA/SAQA registered qualifications will expire by 2015 and needs to migrate to the QCTO model. SAFCEC has been appointed as the Development Quality Partner (DQP) and is currently in the process of developing the Structural Worker QCTO aligned qualification. Once the qualification is registered, there will be a need to develop standardised learning material and logbooks for models of employable skills (MES) for the Concrete hand occupation so further funding will be required.

CONSTRUCTION SUPERVISOR/OPERATIONS FOREMAN (NON-MANUFACTURING)

OCCUPATIONAL DESCRIPTION

The Construction foreman plans, directs and coordinates the construction of civil engineering projects, buildings and dwellings. The duties may include:

- Coordinating labour resources, and procurement and delivery of materials, plant and equipment
- Ensuring adherence to building legislation and standards of performance, quality, cost and safety
- Ensuring the efficient use of resources
- Interpreting architectural drawings and specifications
- Negotiating with building owners, property developers and subcontractors involved in the construction process to ensure projects are completed on time
- Operating and implementing coordinated work programmes for sites
- Overseeing the selection, training and performance of the team

CAREER PROGRESSION

- Junior Foreman
- Foreman
- Senior Foreman
- Site Agent

LEARNING PATHWAY

For information on the learning pathway see the National Careers Advice Portal, http://ncap.careerhelp.org.za/occupation and select the occupation.

TRAINING AND DEVELOPMENT

There are various learning pathways and levels for the construction foremen based on their years of site experience. (Junior foremen, foremen and senior foremen). The

enrolment can take place at any time in the case of a learnership or full qualification which is offered by CETA accredited training providers. The NC(V)4 qualification is offered by TVET Colleges and enrolment usually takes place at the beginning of every year.

TRAINING PROGRAMMES

- National Certificate: Construction Supervisory (NQF Level 2)
- National Certificate: Supervision of Construction Processes
- National Certificate: Management of Building Construction Processes
- National Diploma: Management of Civil Engineering Construction Processes
- National Certificate (Vocational): Building and Civil Engineering (NV(C) 4)

Registered service providers

- Public TVET Colleges
- CETA accredited training providers

OVERVIEW AND CHALLENGES

There a scarcity of senior foremen with more than six to ten years of industry related experience. The make-up of supervisory and management has changed previously people worked on construction through apprenticeship training and made their way up the ranks through a combination of education, training and experience to management levels. Now there are college graduates who have studied the theory of construction and are well-versed in theory yet lack practical experience. Older supervisors

who have that practical knowledge and experience are moving on and retiring and the industry has not addressed the passing on of their expertise and skill sets to the younger generation in a sustainable way.(Patricia Kagerer & Grace Gandarilla). Several challenges need to be addressed, including:

- The need to standardise terminology and occupational titles
- The need to standardise training requirements across industry
- The need to create a sustainable skills pipeline
- The need for standardised training material
- The high cost of training
- The quality of training

PROJECTIONS AND SOLUTIONS

SHORTAGE

The SIPs co-ordinators identified a shortage of approximately 1 050 supervisors. CETA has pledged R300 000 to support training and development in response to the scarcity identified. The implementation of the cidb Standard for Developing Skills through Infrastructure Contracts provides an opportunity for graduate to gain structured workplace-integrated learning and developing a much needed skills pipeline. All foremen in the future should firstly qualify as artisans before continuing with the foremen qualification.

NEW QUALIFICATION

The CETA/SAQA registered qualifications will expire by 2015 and need to migrate to the QCTO model. The Master Builders Association (KNZ) has taken the initiative and played the role of the Development Quality Partner (DQP). The qualification is currently pending approval from the Quality Council for Trades and Occupations (QCTO). Once the qualification is registered by QCTO, there will be a need to develop standardised learning material and logbooks so further funding will be required.

DRAINAGE, SEWERAGE AND STORMWATER WORKER

OCCUPATIONAL DESCRIPTION

Performs routine tasks in maintaining drainage, sewerage and storm water systems

CAREER PROGRESSION:

- Drainage structures and services worker
- Concrete worker
- Environmental worker
- Drainage and Services Artisan
- Foremen

LEARNING PATHWAY

For information on the learning pathway see the National Careers Advice Portal, http://ncap.careerhelp.org.za/occupation and select the occupation.

TRAINING AND DEVELOPMENT

Enrolment can take place at any time as it is based on a three month skills programme which is offered by CETA accredited training providers. Informal training may take place on-site or training is based on skills programmes using SAQA registered unit standards. Career progression comes with a combination of on-site training, experience and aptitude.

Training programme

- Apply health and safety to a work area
- Use and maintain basic hand and power tools
- Demonstrate and apply knowledge of pipes, associated fittings and valves, and meters used in water and wastewater reticulation systems
- Lay pipes and wastewater reticulation systems
- Install and maintain a below ground drainage system
- Install, test and maintain above ground drainage systems
- Understand and describe basic plumbing principles
- Work in confined spaces on construction sites

- Excavate and trench and install shoring
- Construct precast kerbs and concrete channels on a roadwork construction site
- Lift and move a load on a construction site

Training Providers

- CETA Accredited training providers
- Public and Private TVET Colleges

OVERVIEW AND CHALLENGES

Very few of the existing Unit Standards meet all of the requirements as currently identified in the proposed areas of learning. The cost of training to employers is also viewed as a challenge. Shortages of competent people will add to the delays in service delivery in a very critical area of water and sanitation.

- No standardised training programmes
- No standardised training material
- High cost of training

PROJECTIONS AND SOLUTIONS

SHORTAGE

The SIPs co-ordinators identified a shortage of approximately 800 Drainage and storm water workers. SETAs have pledged R660 000 to support training and development in response to the scarcity identified. The implementation of the cidb Standard for Developing Skills through Infrastructure Contracts provides an opportunity to contribute to the development of a competent workforce. The training of on-

site mentors will be of critical importance and should be given attention. An entry point into the industry and allows for progression to the Construction Artisan qualification.

NEW QUALIFICATION

There is a need to develop an industry standardised training programme. The CETA/SAQA registered qualifications will expire by 2015 and need to migrate to the QCTO model. SAFCEC has been appointed as the Development Quality Partner (DQP) and is currently in the process of developing the QCTO aligned Drainage and Services qualification. Once the qualification is registered, there will be a need to develop standardised learning material and logbooks for models of employable skills (MES) for areas of specialisation. Funding is required for the development of the Construction Artisan Qualification: Drainage and Services.

HANDYPERSON

OCCUPATIONAL DESCRIPTION

A handyperson is responsible for:

- Care and maintenance of the building, grounds and gardens
- Maintenance of machinery, and/or general tools, and ladder with due regard to Health and Safety requirements
- Repairing broken windows, screens, doors, fences, tables, shelves, cupboards and other items
- Replacing minor defective items such as light bulbs
- Repairing and painting interior and exterior surfaces such as walls, ceilings and fences
- Adjusting doors and windows
- Replacing tap washers
- Putting up handrails and grab rails
- Loading and unloading small loads up to 50kgs
- Unblocking of sinks and drains
- Routine checks on door closures, emergency lighting, fire fighting equipment, and the fire alarm
- Conducting weekly maintenance checks

CAREER PROGRESSION

- Handyperson
- Specialised trades person
- Maintenance manager

LEARNING PATHWAY

For information on the learning pathway see the National Careers Advice Portal, http://ncap.careerhelp.org.za/occupation and select the occupation.

TRAINING AND DEVELOPMENT

Enrolment can take place at any time as it is based on a three to nine months skill programme, inclusive of on-site work integrated learning which is offered by CETA accredited training providers. Training is informal, normally takes place on-site and

career progression comes with a combination of on-site training, experience and aptitude.

Skills Programmes are based on unit standards:

- Apply Health and Safety to a work area
- Install and maintain basic plumbing components
- Install carpentry finishing components
- Use and maintain basic hand and power tools on a construction site
- Prepare, prime and paint new and previously coated surfaces
- Erect, use and dismantle access equipment
- Install glazing
- Apply and maintain safety in an electrical environment

Training providers

- CETA accredited training providers

OVERVIEW AND CHALLENGES

Handypersons are in great demand due to their ability to carry out minor maintenance and repairs. They play an integral role in the management of facilities, both in the private or public sector, across a vast range of industries.

- Training is very informal
- Need to standardise training programmes
- Need for standardised training material

PROJECTIONS AND SOLUTIONS

The SIPs co-ordinators identified a shortage of approximately 850 handypersons. CETA has pledged R110 000 and R2 200 to support training and development in response to the scarcity identified. There is a need to develop a standardised training programme. The implementation of the cidb Standard for Developing Skills through Infrastructure Contracts provides an opportunity to contribute to the development of a competent workforce.

ROAD MARKER

OCCUPATIONAL DESCRIPTION

The Road Marker and Sign erector should be dealt with as separate occupations even though there are a number of training modules that overlap. A road marker should be able to set out, prepare surfaces for road marking and apply road markings and lines using specialised marking plant, material and equipment. Projects may include roads, bridges, footpaths, car parks, sports fields and airfields. Road marking can be categorised into national and regional roads (machine intensive) and municipal roads which can be more labour intensive

CAREER PROGRESSION

- Hand worker (preparation of surface)
- Pre-marker (setting out)
- Road marking machine operator/foreman (marking)
- Traffic controller (Please define the occupation and type of training or certification require)
- Supervisor

LEARNING PATHWAY

For information on the learning pathway see the National Careers Advice Portal, http://ncap.careerhelp.org.za/occupation and select the occupation.

TRAINING AND DEVELOPMENT

Training is very informal, normally takes place on-site and career progression comes with a combination of on-site training, experience and aptitude. Training can be based on three to six month skills programmes using SAQA registered unit standards. The skills programme duration is inclusive of on-site practical experience.

TRAINING PROGRAMME

Hand Worker (3 months)

- Apply health and safety to work area
- Use and maintain basic hand and power tools
- Install road studs
- Install road markers
- Paint road symbols by spray gun

Pre-marker (6 months)

- Calculate construction quantities to develop a work plan,
- Read and interpret construction drawings and specifications
- Set out control point for centre line and edge line marking
- Set out control points for marking barrier lines and islands
- Set out control points for marking symbols
- Use and maintain small plant and equipment on a construction site

Road marker machine operator/foremen (6 months)

- Apply quality principles on a construction site
- Develop and use keyboard skills to enter text
- Operate mechanical painting machine for remarking
- Implement roadside safety procedures
- Maintain records on a construction site
- Handle, transport, store and utilize hazardous materials on a civil construction site

Training providers

- CETA accredited training providers

OVERVIEW AND CHALLENGES

There are approximately eight large specialised road marking contractors nationally. These contractors mainly work on the national and regional roads. Contractors require specialised plant which costs approximately R3m. Municipalities also require the services of road marking contractors but on a much smaller scale. In some cases municipalities manage the road marking and maintenance in-house. The challenges relating to the development of road markers include the following:

- Training is very informal and is normally conducted in-house
- There are a limited number of qualified training providers
- There is a need to standardise training programmes
- There is a need for standardised training material
- Material, plant and equipment is expensive

PROJECTIONS AND SOLUTIONS

SHORTAGE

The SIPs co-ordinators have identified a shortage of approximately 200 road markers and sign erectors. CETA has pledged R220 000 to support training and development in response by the scarcity identified. The implementation of the cidb Standard for Developing Skills through Infrastructure Contracts provides an opportunity to contribute to the development of a competent workforce.

NEW QUALIFICATION

There is a need to standardise the skills training programmes and the various occupational titles at each level. The National Certificate Construction Roadworks will expire by 2015 and needs to migrate to the QCTO model. SAFCEC has been appointed as the Development Quality Partner (DQP) and is currently in the process of developing the new QCTO aligned qualification. Once the qualification is registered, there will be a need to develop standardised learning material and logbooks for models of employable skills (MES) for the Road Marker occupation.

SCAFFOLD ERECTOR

OCCUPATIONAL DESCRIPTION

Scaffold erectors erect scaffolding for buildings and ship structures. They install ladders, handrails, walkways, platforms and gangways, and erect, move, dismantle frame scaffolding, mobile tower scaffolding, tube clamp scaffolding and system scaffolding.

CAREER PROGRESSION:

- Scaffold erector
- Scaffold inspector

LEARNING PATHWAY

For information on the learning pathway see the National Careers Advice Portal, http://ncap.careerhelp.org.za/occupation and select the occupation.

TRAINING AND DEVELOPMENT

Enrolment can take place at any time as it is based on a three month skills programme which is offered by CETA accredited training providers. Informal training may take place on-site or training is based on three to six month skills programmes using SAQA registered unit standards and career progression comes with a combination of on-site training, experience and aptitude.

TRAINING PROGRAMMES

Scaffold erector

- Apply health and safety to the work area
- Establish and prepare a work area
- Working at heights
- Use, erect and dismantle access scaffolding

Scaffold inspector

- Inspect access scaffolding after erection, alteration/repositioning and before dismantling

- Explain and perform fall arrest techniques when working on heights

TRAINING PROVIDERS

- CETA accredited training providers

OVERVIEW AND CHALLENGES

- No standardised training programmes
- No standardised training material
- No industry standardisation of the various grades
- Poor communication of career opportunities and progression

Furthermore, the CETA/SAQA registered qualifications will expire by 2015 and need to migrate to the QCTO model.

PROJECTIONS AND SOLUTIONS

SHORTAGE

The SIPs co-ordinators identified a shortage of approximately 500 scaffold erectors.

NEW QUALIFICATION

SETAs have pledged R937 108 to support training and development in response to the scarcity identified. There is a need to develop an industry standardised training programme. The CETA/SAQA registered qualifications will expire by 2015 and need to migrate to the QCTO model. The implementation of the cidb Standard for Developing Skills through Infrastructure Contracts provides an opportunity to contribute to the development of a competent workforce.

SHUTTER HAND

OCCUPATIONAL DESCRIPTION

Constructs, erects, installs, renovates and repairs structures and fixtures of wood, plywood, wallboard and other materials

CAREER PROGRESSION:

- Shutter hand grade 3
- Shutter hand grade 2
- Shutter hand grade 1
- Structural worker
- Structural team leader
- Foremen

LEARNING PATHWAY

For information on the learning pathway see the National Careers Advice Portal, http://ncap.careerhelp.org.za/occupation and select the occupation.

TRAINING AND DEVELOPMENT

Enrolment can take place at any time as it is based on a three month skills programme which is offered by CETA accredited training providers. Training is based on three to six month skills programmes based on SAQA registered unit standards and career progression comes with a combination of on-site training, experience and aptitude:

Training programme

- Shutter Hand Grade 3
  - Apply health and safety to work area,
  - Erect strip steel formwork for straight walls, columns and bases
  - Use and maintain power tools on a construction site
  - Use and maintain hand tools on a construction site
  - Erect and dismantle scaffolding
  - Identify and use protective clothing and equipment in general construction
- Shutter Hand Grade 2

  - Fabricate, erect and strip steel and timber formwork for T-walls, decks and beams and single flight stairs,
  - Apply productivity principles on a construction site
  - Establish and prepare work area
  - Read and interpret construction drawings and specifications
  - Procure materials, tool and equipment
- Shutter Hand Grade 1
  - Fabricate, erect and strip steel and timber formwork for curved, sloped and E-wall and curved bases with kicker, incorporate water bar
  - Apply quality principles on a construction sites
  - Set out construction work areas
  - Read and interpret construction drawings and specifications
  - Lead and supervise construction teams
  - Calculate construction quantities and develop a work plan

Training providers:

- Public/Private TVET Colleges
- CETA accredited training providers

OVERVIEW AND CHALLENGES

The shutter hand plays a crucial role in the construction industry. They are required in large teams as in the case of most elementary occupations. Shortages of competent shutter hands will result in a compounded increase in costs and delays in infrastructure contracts as they form part of the integrated structural workers' team.

No standardised training programmes

- No standardised training material
- No industry standardisation of the various grades
- Poor communication of career opportunities and progression

PROJECTIONS AND SOLUTIONS

Currently there is an estimated shortage of 2 500 shutter hands. There is a need to develop an industry standardised training programme. The CETA/SAQA registered qualifications will expire by 2015 and need to migrate to the QCTO model. The Master Builders Association (KZN) has taken the initiative and played the role of the Development Quality Partner (DQP). The qualification is currently pending approval from the Quality Council for Trades and Occupations (QCTO) approval. Once the qualification is registered by the QCTO, there will be a need to develop modules of employable skills based on the shutter hand occupation and standardise learning material and logbooks so further funding will be required.

SURVEY ASSISTANT

OCCUPATIONAL DESCRIPTION

Performs routine tasks to assist Land Surveyors and Survey Technicians by transporting, assembling, maintaining surveying equipment and relevant survey information.

CAREER PROGRESSION

- Survey Technician and Technologist
- Land Surveyor
- Cartographer

LEARNING PATHWAY

TRAINING AND DEVELOPMENT

Enrolment for learnerships as a Surveyors' Assistant can take place every two years or annually for a full qualification which is offered by CETA accredited training providers. The training covers routine and/or predetermined tasks to assist geomatics technicians and/or professionals to capture, process and disseminate geospatial information. Survey-assistants must have an understanding of:

- The fundamentals relating to survey practices
- Instruments, units of measurement, conversions and communication in the workplace
- Numerical methods required in surveying
- Basic operation of a computer
- Geographic information systems (GIS)
- Survey drawing and computer-aided design
- Survey legislation
- Mapping and geography
- Cadastral survey

TRAINING PROGRAMME

- National Certificate: Surveying
- National Certificate (Vocational): Building and Civil Engineering NV(C) 4
- Building and Structural Surveying (NATED)

Training Providers

- CETA Accredited training providers
- Public and Private TVET colleges

OVERVIEW AND CHALLENGES

Very few of the existing Unit Standards meet all of the requirements and there is no standardised training programme or training materials. The cost of training to employers is also viewed as a challenge.

PROJECTIONS AND SOLUTIONS

SHORTAGE

The SIP's co-ordinators identified a shortage of approximately 150 assistant surveyors. CETA has pledged R60 000 to support training and development in response to the scarcity.

The Department of Rural Development and Land Reform (DRDLR) has formalised a strategy to capacitate other government departments, municipalities and state enterprises with trained survey officials.

NEW QUALIFICATION

A QCTO qualification is under development and DRDLR is in the process of applying as an AQP (Assessment Quality Partner) and DQP (Development Quality Partner).

TRAFFIC SIGN ERECTOR

A Traffic Sign Erector, assembles, and maintains roadside signs and billboards at designated locations. Depending on the size and position of the signage one maybe be required to assemble hoisting equipment or rigging, such as cables, pulleys, or hooks, to move heavy equipment or materials. A sign erector uses handtools and power tools, digs hole with post hole digger or shovel. Connects columns, beams, and girders with bolts, according to plans and instructions from supervisors. Replace worn and damage signs. Erect metal sign support structures over highways.

CAREER PROGRESSION:

- Traffic Sign Erector
- Rigger
- Supervisor

LEARNING PATHWAY

For information on the learning pathway see the National Careers Advice Portal, http://ncap.careerhelp.org.za/occupation and select the occupation.

TRAINING AND DEVELOPMENT

Training is informal, normally takes place on-site and career progression comes with a combination of on-site training, experience and aptitude. In the case of crane operators and working at heights formal training is required for compliance purposes. Training can be based on 6 month skills programmes using SAQA registered unit standards. The skills programme duration is inclusive of on-site practical experience.

TRAINING PROGRAMME

Sign Erector

- Apply health and safety to work area
- Establish and prepare a work area

- Implement roadside safety procedures
- Maintain records on a construction site
- Read and interpret construction drawings and specifications
- Erect directional signs (range > 10m²)
- Erect directional signs overhead (range <10m²)

Training providers

- CETA accredited training providers

OVERVIEW AND CHALLENGES

There is a scarcity of skilled Traffic Sign Erectors and a need to standardise skills training programmes and the various occupational titles at each level. The challenges relating to the development of road markers include the facts that:

- Training is very informal and is normally conducted in-house
- There are a limited number of qualified training providers
- There is a need to standardise training programmes
- There is a need for standardised training material
- Cost of material, plant and equipment is expensive

PROJECTIONS AND SOLUTIONS

SHORTAGE

The SIPs co-ordinators identified a shortage of approximately 200 road markers and sign erectors. CETA has pledge R220 000 to

support training and development in response of the scarcity identified.

NEW QUALIFICATION

The National Certificate Construction Roadworks will expire by 2015 and needs to migrate to the QCTO model. SAFCEC has been appointed as the Development Quality Partner (DQP) and is currently in the process of developing the new QCTO aligned qualification. Once the qualification is registered there will be a need to develop standardise learning material and logbooks for models of employable skills (MES's) for the Sign Erector occupation.

CHAPTER 10

Managers

OVERVIEW

The Public Service is responsible for macro socio-economic policy making on infrastructure and the architect of an enabling environment for national development. Public Service management covers such aspects of management as productivity management, professional and technical, and management of human, financial and other resources. It involves range of activities ranging from planning, formulation and implementation of policies, programmes and projects for the delivery of goods and services to the nation through a number of government and quasi-government institutional arrangements. Consequently, it is imperative that the structures, policies and operations of the public service respond adequately to the overall direction the State is adopting to enhance its economic and national development.

Developing management capacity requires more than attendance at one or two short courses. Management prowess develops over years as experience, the level of responsibility and the degree of complexity of challenges increases. The notion that any manager can manage anything has resulted in the demise of many businesses and structures.

In terms of achieving the National Development Plan's objectives of building a capable state, management in the public sector must be strengthened. Not only are senior managers often inadequately skilled or experienced, but large numbers of management posts are vacant. In the environmental field alone, it is reported that vacancies in environmental management posts range anywhere between 35% and 50% across national and provincial structures. The development of management capacity in the SIPs skills plan relates to management within the public sector. It is clear that, without the ability to plan and manage the rollout of projects by the public sector, the end result of the SIPs will not be achieved.

PUBLIC SECTOR COMPETENCY FRAMEWORK

The overall model for managerial competencies was developed by the Department of Public Service and Administration (DPSA). DPSA identifies three types of competencies applicable across all Public sector jobs – behavioural competencies, core competencies, and technical competencies. They are described as follows:

- **Behavioural** – Competencies which reflect the desired attributes across all occupational levels and roles
- **Core** – Competencies that are shared across the identified occupation roles e.g. Management Accountant, Contract Manager or Supply Chain Management.
- **Technical** – Functional/technical competencies that provide for different levels of complexity described in accordance with occupational levels.

MIDDLE MANAGEMENT COMPETENCIES

As indicated in Figure 105, management roles in the public service start at salary level 7 and extend to level 16. The technical specialists envisaged in the SIPs are found mainly in the Middle Management Service Band.

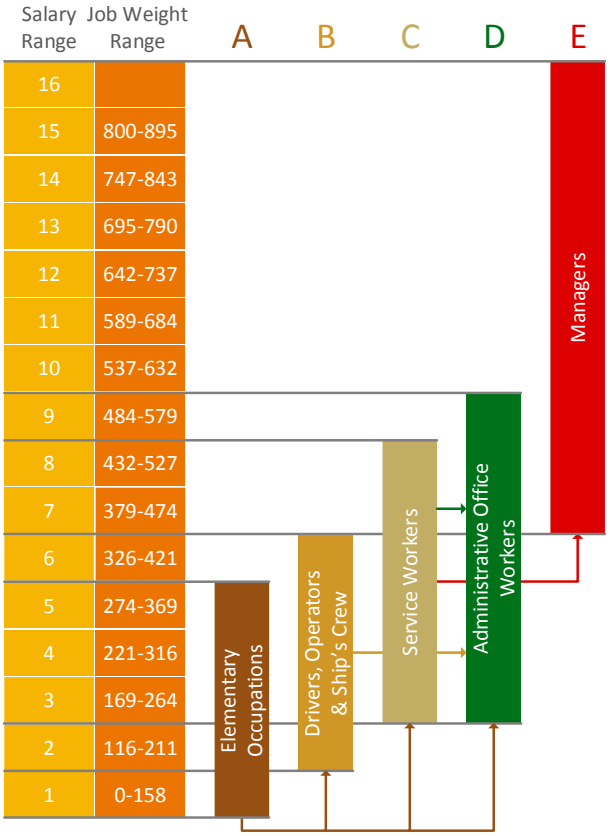


Figure 105: Public Service Career Path Possibilities

Source: DPSA Code of Remuneration (CORE), 1999

It is for this reason that the competencies discussed here are those applicable to this band. The Middle Management Service competency framework consists of four types of competencies – Feeder and Generic.

FEEDER COMPETENCIES

Feeder competencies are those middle management competencies which all employees entering the middle management ranks must possess or be able to acquire. If several of these are advanced stage competencies before entry into the middle management ranks, the performance on the middle management generic competencies will be greatly enhanced. New employees joining the middle management cadre should either be selected for these minimum competencies or they should acquire the necessary competencies (skills) at the appropriate proficiency level as part of their basic induction training.

Feeder competencies can be considered as those competencies that must be mastered before undertaking the generic competencies for middle managers on salary levels 11 and 12. Establishing feeder competencies ensures that all middle managers have the same basic entry skills which in turn supports the abilities of managers to work together with internal and external customers/citizens, according to a common framework.

GENERIC COMPETENCIES

Generic competencies are those competencies that are required by middle managers in most of their duties and activities throughout the Public Service. They do not

include the specific occupational or professional competencies, but only the generic middle management competencies.

SPECIALIST COMPETENCIES

Specialist competencies refer to the specific occupational competencies that characterise the specialist and/or technical component of each business unit or directorate. Specialist competencies are the competencies by which the Public Services give expression to their work and tend to relate only to specific professional or occupational functions, such as trade agreements, techno-economic, trade tariffs, legal drafting and business regulation.

UNIQUE COMPETENCIES

Unique competencies are those competencies which are specific to a single or few individuals or small groups of individuals undertaking very specialised or unique functions in the Public Service (e.g. protocol management, translation, speech writing). By the nature of the competency, the expertise that lies in a unique competency cannot be obtained generally and generally is to be learned on-the-job and deals primarily with proprietry or specialised knowledge. Thus, they apply to only a few individuals and in most cases do not form part of any competency framework.

Table 37: Enabling competencies

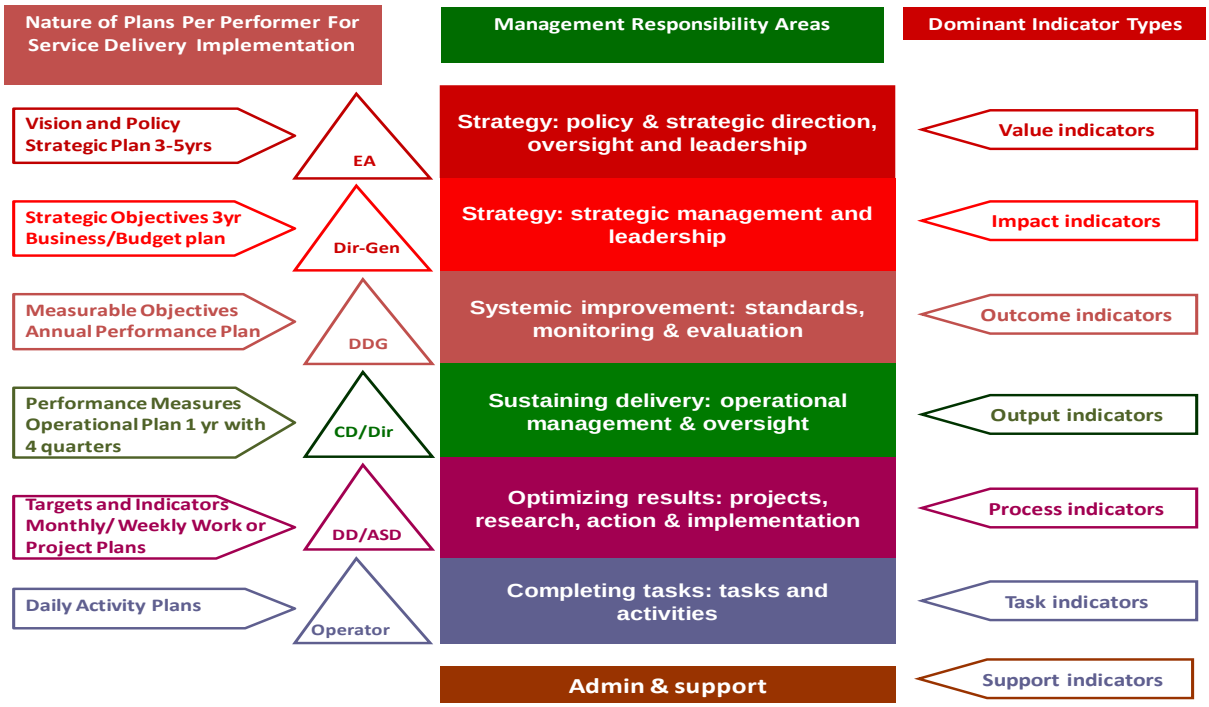
Cognitive/Professional Competencies	**People Competencies**
▪ Applied Strategic Thinking ▪ Creative Thinking (Feeder) ▪ Decision Making (Feeder) ▪ Problem Analysis (Feeder) ▪ Technical Proficiency (Feeder) ▪ Problem Solving and Decision Making	▪ Concern for Others (Feeder) ▪ Developing Others ▪ Diversity Citizenship (Feeder) ▪ Impact and Influence ▪ Organisational Communication ▪ Effectiveness (Feeder) ▪ Self-Management (Feeder) ▪ Team Membership (Feeder)
Results/Service	**Business/Organisational**
▪ Citizen Focus and Responsiveness ▪ Citizen Service Orientation (Feeder) ▪ Managing Interpersonal Conflict ▪ Resolving Problems ▪ Networking and Building Bonds ▪ Project Management	▪ Applying Technology ▪ Budgeting and Financial ▪ Management ▪ Continuous Improvement ▪ Diversity Management ▪ Communication and Information ▪ Management ▪ Planning and Organising ▪ Team Leadership

MANAGEMENT RESPONSIBILITIES IN THE PUBLIC SERVICE

As described in the Code of Remuneration (CORE), managers in the public service employment are found in the salary levels 9 – 16, the latter being the highest level (Director-General). For the purposes of the SIPs, the category of occupations identified as critical in fulfilling the role of government departments, falls within the Salary Levels nine to twelve, otherwise commonly referred to as Assistant Directors and Deputy Directors, as this is the band where technical and professional specialists are usually found – see Figure 106. The other nomenclatures for job titles adopted mainly by provinces and a few national departments are Deputy Manager which is equivalent to Assistant Director and Manager which is equivalent to Deputy Director. In terms of CORE, these are regarded as professionals and managers.

Differently put, the Table 38 indicates the Occupational Roles, but enhances the understanding of the application of occupational roles in the corporate ladder of the public service employment service.

Figure 106: Management responsibilities



Source: Etienne Geldenbloem, DPSA

Table 38: Occupations roles

Occupational Role	Examples of Relevant Positions	Post levels
Occupational Role 1 – Administrative	▪ Clerk ▪ Administrator	Post levels 1 – 6
Occupational Role 2 – Technical	▪ State Accountant ▪ Senior State Accountant	Post levels 7 – 8
Occupational Role 3 – Supervisor (Tactical)	▪ Supervisor (Tactical) ▪ Assistant Director (Assistant Manager)	Post levels 9 – 12
Occupational Role 4 – Managerial (Strategic)	▪ Director (Senior Manager) ▪ Chief Director ▪ Deputy Director General	Post levels 13 – 16

Source: National Treasury's Competency Framework for Financial Management (2010)

LEARNING AND CAREER PATHS IN THE PUBLIC SERVICE

The learning and career paths in the management occupations described in this chapter are for the most part informed by this perspective. Contextual expertise features strongly in the managerial competencies required; and certainly for the public sector there is an increasingly widespread understanding of this. There are three possible entry points into the Public Service:

- Entry from external labour market – common
- Promotion through the ranks or transfer from another department – also common
- Talent development (bursaries/scholarships, internships, learnerships) – not common

For example, DIRCO, Trade and Industry, Limpopo and KwaZulu-Natal Provincial Treasuries place interns in the sector for periods of workplace experience to develop this contextual expertise.

For purposes of the SIPs – the professions should be seen as a feeder system to management occupations, as generic managers are not required, but rather specific expertise needs to be developed as in the case of professionals as outlined in Chapter 5.

LEARNING INDICATORS

Figure 107 demonstrates how management competence develops as a result of combining three type of experience.

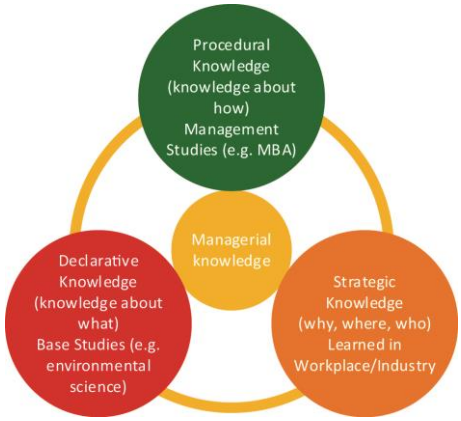


Figure 107: Nature of managerial competence

Source: Etienne Geldenbloem, DPSA,

- Usually, people will:
  - Begin with a primary degree in a particular subject. For example, an environmental manager will start with an environmental science degree
  - Work for five to seven years in the field, where they develop their contextual expertise
  - Follow management studies where they develop their procedural expertise
- Sometimes people will begin with a primary degree and go on immediately to management studies. Only then will they enter a workplace.

Occasionally people will begin in a workplace; and progress through work experience and short courses to management. Such managers often do not have the required the subject matter expertise – an understanding of what they are managing

PROFESSIONALISATION OF THE PUBLIC SERVICE OCCUPATIONS

The current public service recruitment policy regime does not require professional registration for appointment into the occupations falling under the management cluster. There is however a set of values and guiding principles defining the minimum professional conduct of public servants as contained in the Batho Pele principles.

The eight Batho Pele principles were developed as an acceptable policy and legislative framework regarding service delivery in the public service[2]. These principles are aligned with the Constitutional ideals of:

- Promoting and maintaining high standards of professional ethics
- Providing service impartially, fairly, equitably and without bias
- Utilising resources efficiently and effectively
- Responding to people's needs; the citizens are encouraged to participate in policy-making; and
- Rendering an accountable, transparent, and development-oriented public administration.

For the purposes of ensuring best practice and international benchmarking, the Management Cluster identified professional bodies that have contributed to the development of management skills in the public sector. These are listed in Table 39.

Although the managers discussed may enter from another profession, there is also the need to consider professional registration of each type of manager listed. In most of the above occupations, there is not a registering body or a formal process for developing competence in the occupation. Consideration needs to be given to developing categories of registration for many of these occupations.

Table 39: Bodies that have contributed to development of manager's reports

Occupation	Professional Body
Contract managers	CIPS
Environmental Manager	EAPASA and IAIA
Management Accountants	CIMA
Project Managers	PMSA,IPM, SACPCMP
Quality Managers	SAQI

To ensure a constant pipeline of managers, it will be necessary to develop career paths per occupation. Undergraduate qualifications and technical or professional training would be required before people assume management positions. Thus undergraduate qualifications, workplace development to the level of technical competence needs to be put in place, followed by a management development programme.

For the SIPs it will be necessary to determine the numbers required, identify current staff who can be developed and then determine the additional support required. This could be attendance at short courses, longer term certification or postgraduate courses or could simply be moving into a new position under the mentorship of an experienced manager in the occupation.

CROSS-CUTTING CHALLENGES

There are several cross-cutting challenges which need to be addressed.

- **Competing with the private sector** – Due to benefits which are generally considered less than attractive compared to those in the private sector, the public service struggles to retain technical and professional skills,

including those in the occupations identified for the SIPS project

- **Rapid promotion** – The public service remunerative scheme's deemed view of specialists and professional occupations results in staff being promoted too rapidly before they acquire adequate experience for senior posts. This is mainly in pursuit of benefits obtainable in senior management
- **Attracting graduates** – Graduates and young individuals with potential struggle to identify how they can embark on a career in the public service. This is mainly due to inadequate advocacy programmes to promote the public service as an employer of choice, and therefore, the first choice of study, as early as at the school level.

RECOMMENDATIONS

Chapter 13 of the National Development Plan presents opportunities for the public service to build the necessary capacity not only to meet its role in the implementation of SIPs as well as its mandate beyond the SIPs and also to achieve a professional public service. These options are:

- Implementation of a Graduate Recruitment Scheme by attracting young people with potential, retain them by developing their skills and sustaining their morale. Examples of schemes from which to benchmark international best practices are the United Kingdom's Civil Service Fast Stream and the Malaysian Talent Emporium
- Develop Technical and Specialist Professional Skills by strengthening the state role in developing technical skills
- Institutionalising career paths for technical skills to enable individuals with high levels of expertise to continue as practitioners without having to divert to management careers. This will enable the retention of professionals who can focus on project work and train less experienced staff
- Retain the interns after they have accumulated sufficient experience in the public sector so that the knowledge and skill invested in the in-service training of interns is utilised to the benefit of the public service.

MANAGEMENT OCCUPATIONS IDENTIFIED FOR SIPS

The section below discusses each of the occupations which has been identified as a critical area in which the public service needs to strengthen its capacity in order to adequately fulfil its role in the implementation of the SIPs. The capacity referred to here includes technical capabilities and quantity (adequate number of employees to meet the demand). There is a two-pronged approach to this capacity development as follows:

- Ensure that current incumbents in the identified posts are assisted to improve their competencies through various interventions available, be it mentorship, coaching or upgrading their current qualifications
- Increase numbers to address the shortage, although it may not be for immediate use, but for the foreseeable future.

These interventions include assisting those in the higher education system or TVET colleges who are almost ready to graduate but lack opportunities for work-integrated learning. The other potential skills pool is those in the higher education system or TVET colleges in need of financial assistance to complete their programmes. Linked to this approach is also career guidance for school learners and school leavers. The latter can be redirected into scarce and critical occupations.

Each of the occupations identified will address various mechanisms as viewed by the Occupational Teams which were established as communities of expert practice in the occupations.

COMMERCIAL CONTRACT MANAGERS

OCCUPATIONAL DESCRIPTION

Commercial contract manager – Plans, organises, directs, controls and coordinates the contractual arrangements related to the implementation of programmes and projects

LEARNING PATHWAY

The learning pathway is as follows:

- A degree in supply chain management specialising in capital contract management
- Internship in an organisation that engages in complex capital projects
- Workplace experience including rotation, mentoring and coaching to develop competence

OVERVIEW AND CHALLENGES

Contract Management encompasses the management of all contracts and agreements during the entire life cycle of any project, including the proper control of related documentation. Contract managers are responsible for:

- **Risk management** – assessing and understanding the risks that impact the stakeholders and the consequences, generating a strategic mitigation plan and managing delivery on the plan
- **Strategic sourcing** – identifying suitable suppliers and service providers (globally and locally) who are able to meet the desired levels of service, quality, technical expertise, technology and
- **Supply chain management** – improving quality, reducing Total Cost of ownership (TCO), reducing time to market and achieving delivery to required timescales, reducing vulnerability
- **Operations management** – including planning and control, capacity constraints, scheduling, benchmarking, performance management, process engineering, TQM, and global best

practices in driving efficiency through supply chains

- **Financial management** – accountability for controlling spend in accordance with budget
- **Negotiation and relationship management**
  - **External** – negotiating the best value with suppliers and service providers and ensuring sustainability and continuity of supply
  - **Internal** – building strong communication platforms with internal stakeholders to ensure alignment with key performance expectations
- **Legal aspects** – understand terms and conditions in contracts and agreements, their implications, risks of non–delivery, liability risks and penalties, obligations of all parties, implications of legislation and regulatory environment, nature of performance, warranties, termination and loss assessment.

National Treasury has identified Commercial Contract Management as one of the key technical competencies in their supply chain management framework.[60] An assessment of contract managers showed that South African contract managers in the public sector lagged behind both local and global standards in a number of areas. The spider diagram in Figure 108 indicates attributes measured. A score above 4 is a real strength, below 3.25 indicates a development need and below 2.25 indicates a significant development need. The global average is 3.38, the South African average is 3.29 and the public sector average is 3.02.

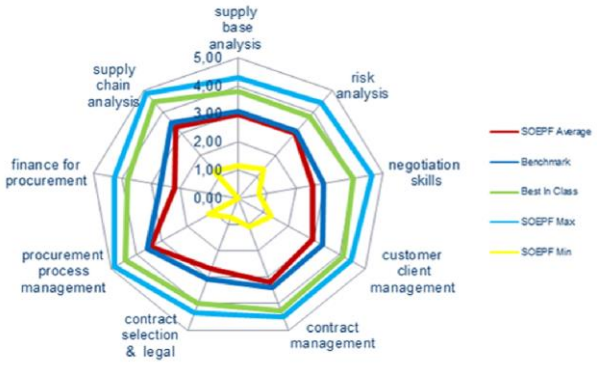


Figure 108: Rating of contract managers in South Africa

Source: CIPS

There are many barriers to the entry and development of contract managers. These include:

- **Entry level** – The necessary degree is not offered by most HEIs in South Africa. Where it is offered the curriculum does not include sufficient focus on the competencies outlined above. Contract Management is not a specific module in the curriculum.
- **Practical level** – The nature of complex Commercial Contract Management involves very large amounts of capital. The organisations in the sectors that engage in projects involving such sums of capital are seriously affected in periods of slow economic activity. Therefore they offer few opportunities for internships.
- **Work experience** – These are high-risk roles in any organisation. The skills pool is too small to warrant freeing up professionals in the workplace to mentor less-experienced colleagues. The competencies required take many years to learn and apply effectively and the associated costs and risks to an organisation are not justified in light of their strategic goals to reduce costs and improve competitiveness.
- **Assessment of competence** – There is no recognised national standard for the profession. Practitioners are not required to meet any specific level of competence or to adhere to any code of professional conduct.
- **Expertise achieved** – The current pool of talent is ageing and there is no stream of incoming talent to replace it. Expertise is achieved only after many years of working experience, including job rotation, suitable exposure to relevant projects and close collaboration with more experienced professionals.

SOLUTIONS

A national discussion needs to take place in terms of developing contract management into a profession in its own right, in which case theoretical and structured workplace training programmes need to be developed and a process developed for professional registration.

SHORT-TERM (6 – 24 MONTHS)

- **Licensing of the profession** – Make this mandatory for practitioners to improve the standards of professionalism. Do this by partnering with relevant professional bodies.
- **Scope of SCM degree curriculum –** Include Complex Contract Management as part of the degree programme at universities/business schools.
- **Availability of SCM qualifications** – Ensure that more HEIs offer degrees or similar qualifications in Supply Chain Management and that contract management is a core module.
- **Skills and competency development** – Support current practitioners who do not have a qualification or adequate skills (training, applied learning opportunities, assessments, mentoring provided by retired professionals.
- **Applied learning interventions** – Introduce programmes centred in practical, workplace learning opportunities with applied learning as a medium for delivering know-how.
- **Competence of Educators** – Assess competence of lecturers and education professionals in terms of supply chain and contracts management. Engage global and local subject matter experts to design and develop the ideal profile of education practitioners.

MEDIUM (2 – 5 YEARS)

- **Increase attractiveness** of the profession with initiatives such as the CIPS Global **Be a Buyer** campaign at secondary and higher education institutions
- **Provide bursaries** in Supply Chain Management
- **Offer specific courses** on Complex Contract Management to amplify current offerings in supply chain management.

LONG (5 YEARS AND ONWARDS)

- Include relevant subjects in secondary education
- Improve quality of subjects offered at primary and secondary schools – such as mathematics, accountancy.

PROJECTIONS

It is estimated that there are some 36 000 supply chain practitioners in South Africa of whom only 133 are professionally registered MCIPS in South Africa. Of the total, some 6 500 are considered to need skills enhancement in contract management in the public sector. The training and development which is needed to increase the number of commercial contract managers is shown in Table 40.

Table 40: OT Recommendations

Intervention	Timeframe
Short-term	
Skills development and training initiatives	6 to 12 months
MCIPS Designation and applied learning interventions	3 to 18 months
Qualification (Certificate, diploma, advanced diploma and professional diploma)	12 to 36 months
Medium term	
Qualification (relevant degree)	36 to 48 months
Practical experience	36 months
5 to 10 years of hands-on experience	
Long-term	
Continue to attract new entrants with bursaries and workplace development support	

ENVIRONMENTAL MANAGER

OCCUPATIONAL DESCRIPTION

Environmental manager – Plans, organises, directs, controls and coordinates the development and implementation of an environmental management system within an organisation by identifying, solving and alleviating environmental issues in compliance with environmental legislation and ensures corporate sustainable development.

LEARNING PATHWAYS

There is no clear pathway and requirements vary from one employer to another.

THEORY

- **A TVET Certificate** – Environmental Practice Level 4 which is suitable for environmental officers
- **National Certificate** – Environmental Management Level 5
- **Advanced Certificate** – Environmental Management Level 6
- Bachelor of Environmental Education, and Training and Development Practice Level 6
- Diploma in environmental practice
- Degree in environmental practice

PRACTICAL

Induction into the world of environmental practice. The DEA offers practical training for Environmental Assessment Practitioners.

WORKPLACE

Gain experience in the workplace.

OVERVIEW AND CHALLENGES

The environmental manager's role has been evolving over recent years in pursuit of environmental sustainability and social responsibility.

Environmental managers come from a wide range of backgrounds, but recently they have

increasingly been sourced from academic institutions which offer higher education qualifications in environmental management.

In the public sector, environmental managers are involved in the management and application of environmental laws, policies, regulations, procedures, systems, maintaining detailed records of technical audits and environmental impact assessments, building environmental awareness and providing relevant training to employees.

In other sectors, environmental managers lead environment-focused projects to ensure environmental compliance, operational efficiency and minimising environmental impacts. The challenge for the environmental practitioner is to understand the importance and complexity of human-environment interactions, to address conflicting interests and manage complex issues associated with climate change, water security, low carbon economy developments, new regimes of waste management, issues associated with loss of biodiversity and marine resources, sustainable development planning and the emergence of a green economy. They may seek inputs from ecologists, botanists and hydrologists.

To this extent, environmental managers are drawn from a wide range of professionals

covering many disciplines, who are able to plan, assess impacts, design solutions, develop and manage systems to ensure compliance.

A much broader definition of environmental management is thus adopted in this context to promote inclusivity and extend beyond the field of environmental impact management to integrated environmental management.

REGISTRATION

There is currently no official registration body to assess the competency level and certification for environmental practitioners as professionals. For now, the Interim Certification Board (ICB) of Environmental Assessment Practitioners of South Africa (EAPSA) provides voluntary certification for EAPs, the South African Council for Natural Scientific Professions (SACNASP) requires registration of professional natural scientists, and the Southern African Institute of Ecologists and Environmental Scientists (SAIE&ES) provides voluntary certification of ecologists and environmental scientists.

An assessment of several certification options found voluntary certification to be the most appropriate immediate strategy to introduce quality control in environmental assessment practice. However, the establishment of a statutory Council for Environmental Professionals which includes the full range of environmental disciplines is the way to go.

SOLUTIONS

SCHOOL

Career guidance

Environmental education and awareness in schools can contribute significantly to attracting young people to the profession.

THEORY

Curricula and materials

Implement the National Certificate in Environmental Management (NQF 5) as a workplace-based learning programme to fast-track existing practitioners with no degree in the natural sciences but who have chosen to move into environmental management from a human sciences base.

Harness the network of environmental lecturers and practitioners to share materials, and engage in enhancing content and materials used in all environmental curricula. Also consider integrating some workplace experience into qualifications to provide students with the tools to be successful when they enter the world of work.

Staffing

More environmental lecturers are needed, and practitioners need to be encouraged to deliver lectures in their areas of specialisation. Lecturer education programmes are needed to ensure consistent offerings across the field.

Student support

Attraction and retention of skills is key to ensuring stability in the workplace. Making bursaries available should attract potential candidates into the field.

WORKPLACE-BASED LEARNING

Without a recognised career path and professional registration, there are no formal workplace training programmes. A two year mentorship programme needs to be developed which should include an adequate range of activities for the candidate to gain broad experience. Regular assessment and review of progress should take place to ensure that outcomes are achieved.

Induction workshops and seminars need to be convened for new entrants into the field to expand their horizons, promote knowledge transfer and ensure support from the environmental network.

ASSESSMENT

A statutory council needs to be established to include the full range of environmental disciplines and professionals. Industry-wide input is required to determine the theoretical underpinnings required, accreditation and registration criteria.

RPL

There are currently officers with many years of experience but no formal training who could consider completing the National Certificate: Environmental Management to gain a formal qualification and eventually progress to a management position.

Furthermore, there are many science graduates who can move or have moved into the field but have not had a good grounding in environmental principles. Their experience should include attendance at courses to cover the following topics:

- Environmental management foundation
- Environmental laws and policies
- Environmental systems and tools
- ICT skills – including GIS and modelling technologies
- Environmental
- Environmental management reporting
- Environmental ethics and social justice
- Orientation to sector or discipline specific particulars

With this understanding they could eventually be considered for registration via RPL.

EXPERTISE

For those currently practicing, it is essential that they participate in continuing professional development to keep up with trends, legislation and the like. Short courses should be made available on an on-going basis.

EMPLOYMENT RELATED ISSUES

Building a capable state

There is currently no professional career pathing to development support for environmental professionals. Research needs to be undertaken to scope the range of environmental jobs to identify career paths. Once this is completed, sufficient posts need to be included in organograms.

- Secondment

Suitable professionals with appropriate qualifications and experience currently employed in the private sector should be employed to head up implementation teams, not only to manage them, but also to create environmental management teams and transfer skills and practical experience to less experienced staff.

- Salaries

Salaries and benefits need to be reviewed to address vacancies and the high turnover rates and also to ensure that experienced environmental managers can be attracted and retained in the public sector.

SETAS

There is no environmental SETA as environmental issues are cross-cutting. All SETAs need to quantify environmental skills required within their sector and support their development. Several SETAs have already committed funds for the development of environmental managers amounting to a total of R3.6m as at June 2014.

MANAGEMENT ACCOUNTANT

OCCUPATIONAL DESCRIPTION

A management accountant plans, reviews and administers accounting systems and procedures; analyses the financial information needs of organisations, projects; provides advice on financial planning and risk management and provides management with reports to assist in decision making. The management accountant provides insight into cost performance and supports the implementation of benchmarking and improvement initiatives.

LEARNING PATHWAYS

For information on the learning pathway see the National Careers Advice Portal, http://ncap.careerhelp.org.za/occupation and select the occupation.

OCCUPATIONAL ROLE

As recommended in the generic organisational structure of the Office of the Chief Financial Officer, the management accounting function is the responsibility of the Chief Financial Officer. The management accountant is responsible for providing financial input to the planning processes, compilation of the departmental budget and the monitoring and reporting of the actual spend against the budget. The functions of the management accountant are:

PLANNING

Provide financial inputs into the strategic plan, annual performance plan, business plans and project plans.

BUDGETING

MTEF budgeting process, estimates of expenditure (national and provincial) monthly

cash flow and adjusted monthly cash flow, adjustment estimates and rollovers.

MONITORING AND REPORTING

Monitoring of expenditure against the budget, analysis and interpretation of financial information to facilitate effective decision making and annual reporting.

OVERVIEW AND CHALLENGES

National Treasury has developed a comprehensive Capacity Development Strategy (CDS) for Public Financial Management. The strategy provides a national perspective to address financial management capacity constraints in the public sector.

Through the capacity development strategy, a project was launched in 2012 to promote and develop Financial Accounting capacity within government. This project highlighted that a similar, if not a bigger, need exists for the development of Management Accounting capacity in government along the same lines.

Management Accounting policies, norms, standards, guidelines, competency frameworks, occupational qualifications, education and training programmes and change interventions must be developed to support professionalisation of management accounting in the public sector.

National Treasury project currently addresses the following five key focus areas:

- Management Accounting legislation, policies, frameworks review
- Implementation of Management Accounting capacity development related activities (detailed in the CDS)
- Support in the improvement of the government Management Accounting system
- Development of Management Accounting as a discipline in government
- Stakeholder relationship management.

CHALLENGES

There is currently a lack of understanding in the public sector as to what the true functions of a management accountant are and the value they can bring to an organisation.

Some of the weaknesses noted in the current functions of management accounting in the public sector include the following:

- There are inconsistencies in the alignment of the strategic plan to the budget which may negatively impact on the service delivery of a department and the non-achievement of the strategic goals and objectives of government
- The budget is compiled by the Office of the Chief Financial Officer, often independently of programme managers who are accountable for service delivery and spending of budget allocations
- Insufficient planning on how to spend the budget which could impact on the effectiveness and efficiency of service
- Reporting on actual budget spend is not assessed against actual service delivery
- Government departments do not usually have profitability and return as investment objectives.
- There is a lack of economic incentives to manage costs
- Government is consistently challenged to improve performance in a constrained environment

Management accountants play an important role in aligning the department's available resources (budget) to achieve government's service delivery goals. Unfortunately, there are few management accountants in the Chief Financial Officer's Structure, and where there are, employers tend to advertise incorrectly, attracting people who are poorly-qualified for the job.

SOLUTIONS

SHORT-TERM

Awareness

The first short term initiative is to make both existing and potential employees aware of management accounting as a career in the public sector. Awareness campaigns can be conducted through information sessions, posters, career guidance sessions at secondary schools and HEIs.

Theory

- CIMA Qualification

In the short term the employer has the option of enrolling learners on the existing qualifications offered by the Chartered Institute of Management Accounts (CIMA).

The three qualifications offered are as follows:

- CIMA Certificate in Business Accounting Level 5, Registration Number: 01Q010016001205, NLRD: 24418
- CIMA Advanced Diploma in Management Accounting Level 6, Registration Number: 01Q010017002406, NLRD: 24406
- Chartered Management Accountant Level 7, Registration Number: 01Q010012009307 NLRD:20400

For the level of managers, individuals will need to enrol for the Level 7 qualification.

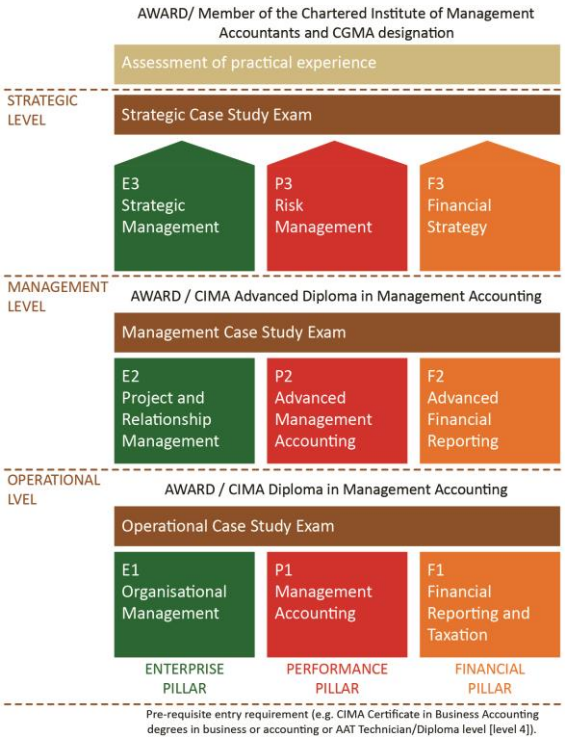


Figure 109: Qualifications offered by CIMA

Source: CIMA

Figure 109 explains the different qualifications offered by CIMA. Those who already have appropriate undergraduate qualifications may be exempt from completing some or all of the theoretical modules, but would still need the practical experience under supervision, and would need to pass the professional examination. On registration, they would become Chartered Global Management Accountants with the designatory letters ACMA and CGMA.

As part of the CIMA qualification, the learner is required to complete a minimum of three years' relevant practical experience, some or all of which may have been gained before registering as a CIMA student. The Practical Experience Requirements are the same for everyone, regardless of employment sector. The Practical Experience Requirements have been designed to be applicable across the broad range of business sectors, geographic and cultural environments. This should enable most management accounting students, whatever their training situation, to obtain experience which meets the requirements. The practical experience addresses basic, core and supplementary, to show the wide range of functions carried out by management accountants.

- Training service providers

Appropriately accredited training service providers must be sourced and managed through the professional training body.

- Workplace-based learning

Functions in the office of the Chief Financial Officer need to be broadened to include all the functions of a management accountant. Once these individuals are competent in all outcomes, they will become the mentors for new entrants.

Assessment

Once a designation is received, the member is expected to comply with the CIMA Code of Ethics, participating in CPD and renew their membership annually. If any of these regulated requirements is not met, the member will loses the designation, but retain the qualification.

Employment issues

- Design a management accounting framework, job and occupational profiles

The specific functions of a management accountant must be expanded to include all the elements of management accounting which are relevant to the public sector.

To ensure that the correct jobs are advertised, a management accounting framework needs to be implemented in the public sector. Policy changes are required to ensure that management accountants have the correct job titles, and their positions in organograms

and salary scales need to be reviewed. Where necessary, the offices of the Chief Financial Officer need to be restructured and a process needs to be put in place to ensure that trainees are recruited and management accountants are appointed. A change management process and buy-in of management accounting is required by relevant stakeholders.

- OFO

The current OFO code 12110 definition is for a Finance Manager. The definition will need to be revised or a new code may be required to cover management accountants.

MEDIUM-TERM

There may be individuals who do not want to go through the entire CIMA qualification, but still need to be capacitated to effectively perform as a management accountant. Development of the following short courses is proposed:

- Short course – unit standard based
- Short course – sector specific
- Short course – project management especially on infrastructure (SIPs)
- Elective course at universities

The course material for the above courses will need to be developed together with the relevant assessments.

- Training service providers

Appropriately accredited training service providers must be sourced and managed through the professional training body.

LONG TERM

Talent Pipeline

As part of the long term strategy for retaining management accountants in the public sector it is important to develop and implement a talent pipeline strategy to support the career path of the management accountants. This will provide individuals with the motivation and incentive to pursue their management accounting career in the public sector and will promote succession planning.

PROJECTIONS

National and Provincial Government in South Africa consists of some 163 Departments and 214 Public Entities while Local Government consists of 278 Municipalities and 60 Public Entities, thus bringing the total to some 441 Departments and Municipalities and 274 Public Entities. Each of these institutions has employees fulfilling Management Accounting duties e.g. budget planning and monitoring and a conservative estimate of an average of four such employees per institution (varying between one in very small institutions to a number in large and more complex institutions) results in a conservative requirement of 2 860 Management Accountants in government.

Adding to the above, the need identified for Management Accountants in the Infrastructure project and programme implementing departments and municipalities is expected to increase by, conservatively, a further 200 to a final immediate requirement of over 3 000 Management Accountants.

Furthermore, with an attrition rate of 33,3% an annual need for at least 1 000 qualified new entrants to government is required.

PROJECT OR PROGRAMME MANAGER

OCCUPATIONAL DESCRIPTION

Project or programme manager – Plans, organises, directs, controls and coordinates special programmes or projects.

LEARNING PATHWAYS

For information on the learning pathway see the National Careers Advice Portal http://ncap.careerhelp.org.za/occupation and select the occupation.

OVERVIEW AND CHALLENGES

The role of Construction Project Managers and Construction Managers was outlined in the Professions chapter. The public sector requirement for project or programme managers relates to the conceptualisation and quality assurance of projects being rolled out as shown in Figure 110.

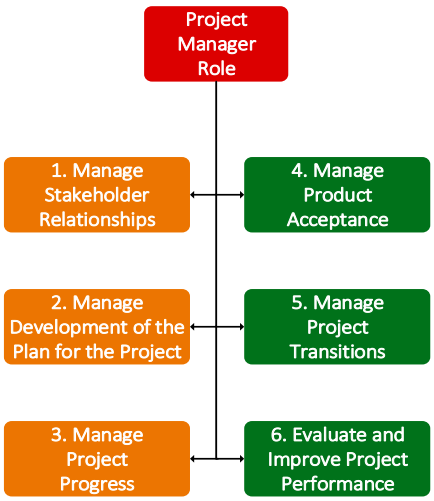


Figure 110: Quality assurance of projects

Competency requirements for project and programme managers include technical knowledge on the delivery of projects, programmes or portfolios, an understanding on the integration of work across disciplines, the production of deliverables and an understanding of the phases through which projects should progress.

Behavioural competencies are also important in that programme and project managers must be able to manage activities, relationships and interactions with project or programme personnel as well as stakeholders in the broader environment. They must also be mindful of political, economic, sociological, cultural and historical contexts.

Programme or project managers should be competent leaders and understand the role of project management within their organisations.

The development path is shown in Figure 110. The development of competent project and programme managers in the public sector is thus a long process.

SOLUTIONS

Senior programme and project managers in government need to have gained practical experience in their technical field of expertise before moving into management. Once their foundation competence has been established, top-up project and programme management training should be considered followed by gaining further experience in the management role under the direction of experienced programme and project managers leading to registration with a recognised project management body.

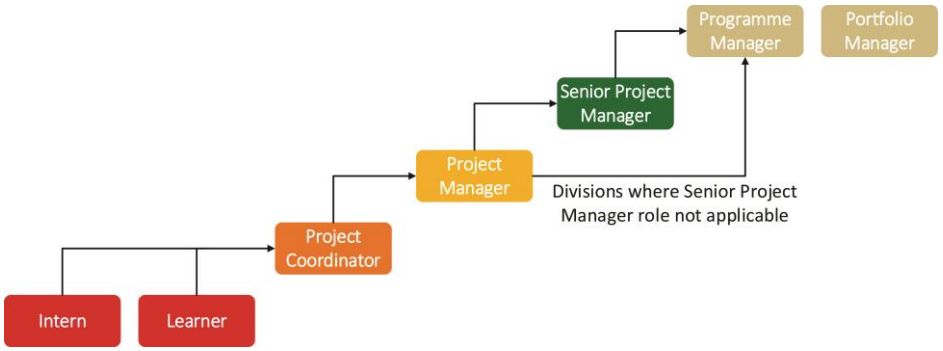


Figure 111: Project management career path

THEORY

The requirement for a technical foundation means that programme or project managers associated with the SIPs should first and foremost have technical training and experience in delivering projects.

Once they move into public sector project or programme management roles they may consider completing a dedicated course in project or programme management as outlined in Table 39. Most courses are based on ISO 21500 **Guidance on Project Management**.

WORKPLACE-BASED LEARNING

Having moved into public sector programme or project management, it will be necessary for them to be trained in the systems and procedures in place in the appropriate department and to attend courses which match the modus operandi of the organisation. Skills will further be honed by working alongside experienced project managers to acquire knowledge of the processes and procedures.

Where junior staff are taken on immediately after qualifying in a technical environment, it would be necessary to second them to companies that are delivering projects to develop the required technical competence.

ASSESSMENT

There are a number of organisations with which project and programme managers can register professionally both internationally and locally.

It is recommended that registration with local bodies such as SACPCMP or PMSA should be a requirement for senior project and programme managers.

The type of registration decided upon will be dependent on the type of work. The organisations and registrations are shown in Figure 41.

Table 41: Type of registration by organisation

Project Coordinator	**SACPCMP**	**Candidate: CPM**
	PMSA	Candidate
Project Manager	SACPCMP	Pr.CPM
	PMSA	PM
Senior Project Manager	SACPCMP	Pr.CPM
	PMSA	Sr.PM
Programme Manager	SACPCMP	Pr.CPM
	PMSA	Pr.PM
Portfolio Manager	SACPCMP	Pr.CPM
	PMSA	Pr.PM

RPL/Professionalisation

There are currently practitioners who have some experience but require top-up training and mentorship. It will be necessary to assess their capabilities and determine specific

interventions per practitioner. Professional bodies should be harnessed to assess candidates and advise on additional support and development required.

Table 42: Range of Project Management Courses

University	Course	Duration	Structure
University of South Africa	Practical Project Management Programme (NQF 6)	12 months	Part-time
University of Pretoria	Project Management (PPM)	20 days contact	N/A
University of Johannesburg	Project Management Certificate(PMC)	5 days	Part-time
University of the Witwatersrand	Certificate in Programme & Project Management	7 months	Block-study
Tshwane University of Technology	BTech: Project Management	12 months	Full-time
Durban University of Technology	Specialist Project Management (NQF6)	12 weeks	Contact & part-time
University of KwaZulu-Natal	Graduate Certificate in Project Management	3 Days	Contact session
University of Stellenbosch	Postgraduate Diploma in Project Management (NQF 8)	Two years	6 study blocks of 1 week
Cape Peninsula University of Technology	Certificate in Project Management (NQF 5)	16 Weeks	Contact session or part-time

EMPLOYMENT ISSUES

Building a capable state

Competent project managers are essential to ensure that projects are completed on time, to specification and within budget. It is essential that there are sufficient posts for programme and project managers in organograms. Limited succession planning and development of technically competent project managers has taken place, but generally technical administration is all that is taking place. Large numbers of experienced project managers are soon set to retire from the public sector. Posts, career pathing and training across the pipeline needs to be initiated as soon as possible.

QUALITY MANAGER

OCCUPATIONAL DESCRIPTION

Quality Manager – Plans, organises, directs and coordinates activities to ensure stated quality requirements and objectives are met.

Note: This is not the same as currently recorded under the curriculum code.

Functions may vary depending on the particular sector. Some managers may be product, project or service focused others may be systems and process focused or there may be a combination of functions. The function may also cover monitoring and evaluation of performance.

Quality Managers may be found across all sectors of industry, services, parastatals and government departments. Examples are:

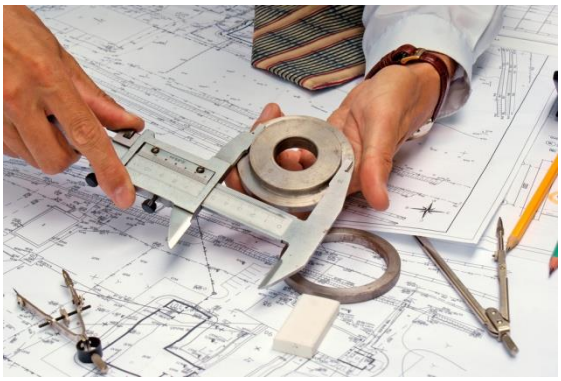
- Quality Assurance Managers
- Quality Systems Managers
- Quality Control Managers
- Product Quality Managers, Supplier Quality Managers
- Quality Engineering Managers
- Monitoring and Evaluation Managers
- Organisational Development Practitioners
- Metrologists

LEARNING PATHWAY

Quality managers may start their careers as inspectors or technicians gaining practical experience in quality control and quality assurance before working their way up into management.

Alternatively candidates may acquire formal qualifications in quality techniques from HEIs and then gain practical experience in applying the theory.

It is common to see quality managers moving from industry to the service sector. It is not so common to see this in reverse due to specific technical requirements.



ENTRY QUALIFICATION

Consideration would be given to NQF level 4 with Mathematics and the Foundational Learning Competence Certificate. RPL may be taken into consideration. Preferred qualifications would be a diploma or B Tech Quality. There is a current gap between the QCTO and higher education qualifications.

PRACTICAL INDUCTION

Early experience would be in the analysis and monitoring of quality performance measurements, quality aspects relating to research and development, support and actions related to communication on quality performance and actions related to quality management system development.

WORKPLACE-BASED LEARNING

Ideal candidates would be technicians, supervisors or managers in their specific industries or service sectors with a certain amount of knowledge of planning and construction of a systems-based approach to quality. Knowledge of basic statistical methods and project management principles would be an advantage. Individuals with existing work experience, technical expertise, communication skills and leadership capabilities required by a management

position could then be further trained to become competent quality managers in a variety of sectors.

OVERVIEW AND CHALLENGES

It has been established that there is a general shortage of qualified and experienced quality managers in South Africa. However, a shortage of quality managers is not simply solved by getting people to complete a relevant qualification. The background skills and knowledge required by a quality manager differs from sector to sector. Although courses are offered for quality candidates from NQF level 2 to 5, there is currently no bridge that will take a candidate from the trades and occupations level to higher education. Also the requirement for quality qualifications at higher education level is still under review.

It has also been observed that there is no real home for Quality Training in any particular SETA and each SETA sees Quality only in the context of their particular sector rather than as a generic qualification.

There is no official professional registration authority for quality although a number of quality bodies exist such as SAQI, SASQ, SAATCA. Also because quality is diverse across many sectors, the designation of a quality professional would need careful consideration. Quality Auditors, Quality Consultants and an array of Quality Managers all need a professional home.

SOLUTIONS

Quality courses are currently delivered by a number of HEIs, various SETA accredited service providers and a large number of other service providers. These courses need to be coordinated and recognition needs to be given to service providers that have chosen not to be accredited by various SETAs, mainly due to the high level of bureaucracy that is involved. The SSETA seems to be the obvious place to house a generic Quality qualification as the quality function is a service offered to many diverse organisations and sectors. For this to happen, the other SETAs would need to cooperate in sharing their particular needs across sectors. The following actions are required:

THEORY

New Qualifications

There is currently no generally recognised generic qualification for quality. The previous BTech in Quality has been phased out at Universities of Technology and a replacement degree has not yet been formalised. This is an issue which requires urgent resolution.

A postgraduate diploma in Quality is currently being considered. Some international universities offer a Quality qualification as an extension to an Engineering degree, the most popular of which is offered by the American Society for Quality.

Curriculum

- Directing of quality activities
- Planning and allocation of resources
- Monitoring, evaluating, reviewing and reporting on performance against quality objectives
- Planning and implementing continuous improvement
- Conducting root cause analysis, solving quality problems
- Verifying of quality inspections and audits at process or service level
- Initiating the development of work instructions
- Reviewing process documentation
- Maintaining and analysing Statistical Process Control and identifying trends
- Formulating reviews of quality measurement systems
- Establishing critical quality indicators

Lecturers

There are many current lecturers in HEIs who have knowledge of theory but there is a shortage of lecturers with practical experience and knowledge of modern trends in quality management.

Materials

Numerous short courses and workbooks are available and a QCTO qualification is currently being developed at the SSETA under the QCTO code 121908000.

Equipment

Workbooks, laptops and statistical software are needed to enhance quality programmes.

Budget

Substantial investment will be required to set up an entire system as follows:

- **Qualification** – Development of the Quality Management toolkit – R1m.
- **Institutions** – Assess train and accredit institutions to deliver training – R1m
- **Funding** – Set up the professional body – R1m
- **Professional exam** – developing and administering the professional exam – R2m

Timeframes

Time frames are shown in Table 43.

EMPLOYMENT RELATED ISSUES

Building a capable state

The understanding of the function of Quality Management also needs to be addressed in National and Provincial Government. An assessment of the HR Connect report of April 2012 for occupations in Government showed that, of the 46 National Government Departments listed, only eight had a position for a Quality Assurance Manager. Similarly, of the 110 Provincial Departments monitored, only 16 Quality Assurance Manager Positions were identified. The current aging workforce and an imbalance in race and gender must also be addressed.

Table 43: Timeframe for developing a quality management framework

Action	Timeframe
Complete qualifications and set up professional body	12 months
Time it takes to upskill the existing staff (theory/work exposure)	12 months from establishment of formal qualification
Period for the new entrant to become competent	Up to five years depending on previous exposure to management planning and development
Complete qualifications and set up professional body	12 months
Time it takes to upscale the existing staff (theory/work exposure)	12 months from establishment of formal qualification
Period for the new entrant to become competent	Up to 5 years depending on previous exposure to management planning and development

Source:

IDMS

National Treasury, cidb, Public Works, DBSA and others have recognised the need for comprehensive overall planning, execution and management of infrastructure from cradle to grave and have initiated the Infrastructure Delivery Management System to embed government's budgeting and expenditure cycles into the planning, delivery and operation and maintenance of infrastructure. The system encompasses three delivery processes as follows:

- **Portfolio management** – Identifying objectives, planning and intelligently grouping projects or initiatives into infrastructure programmes and monitoring and controlling the roll-out of these programmes
- **Project management** – Identified in the planning processes
- **Operations and Maintenance** – Assets are operated, maintained and ultimately disposed of the overall process is shown in Figure 112.

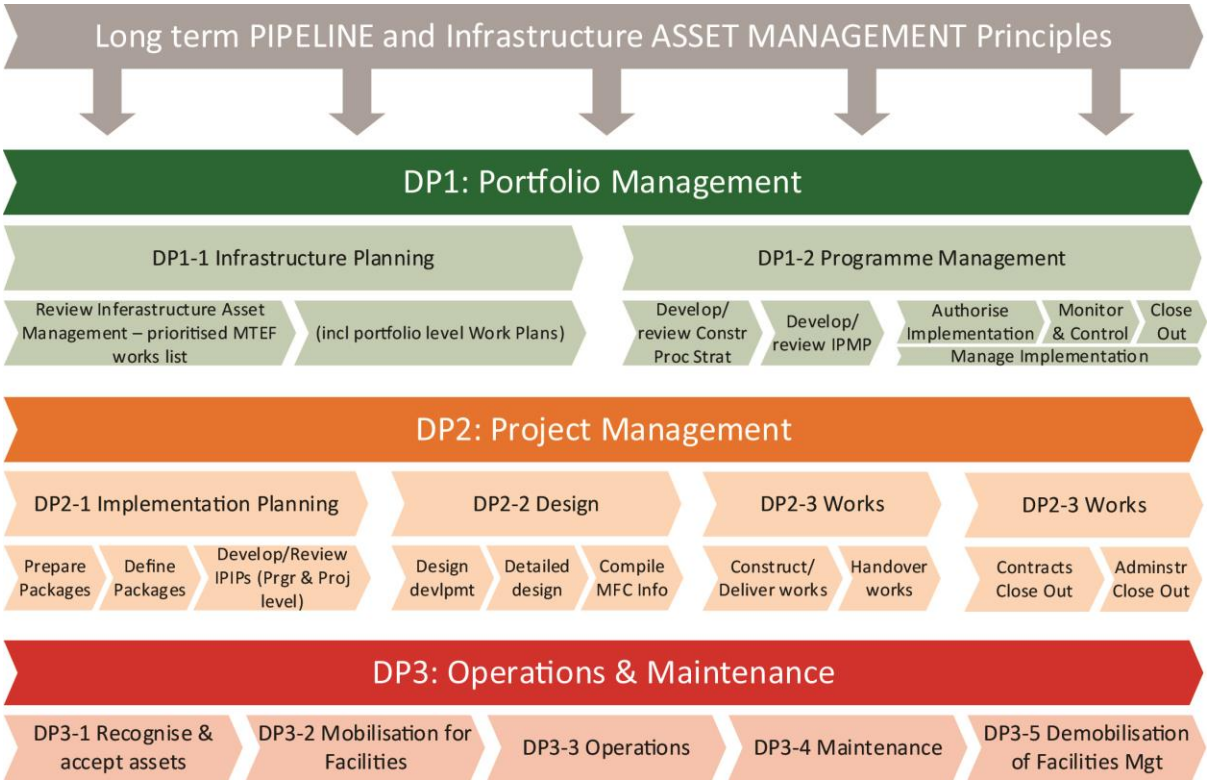


Figure 112: The IDMS

Source: NT and cidb

The rationale for the IDMS relates to the need to move from short- to medium-term planning and from medium-term to long-term planning to ensure sustained long-term growth. The IDMS further seeks to bundle projects to be less resource intensive given the shortage of technical skills and technical management.

The Management Companion supplied as part of the IDMS is intended to build management capacity. The companion is aimed at executives, top and senior management and provides them with sufficient understanding to hold middle managers accountable. The companion also outlines the roles and responsibilities of middle managers.

It can be seen that the managers listed as being in short supply in government are indeed those required to get projects off the ground and monitor progress as shown in Figure 113. The IDMS further seeks to ensure consistency in the project management approach by introducing uniform standards at all levels of government, impacting information management, monitoring and reporting. It would seem logical therefore that the training of all the managers should include comprehensive training on the IDMS. Sections 38 and 51 of the Public Finance Management Act require accounting officers and accounting authorities, respectively, to ensure that their institutions have and maintain a number of systems relating to risk and financial management, internal control, internal audit, procurement, provisioning and the evaluation of major capital projects. The PFMA regulations also prescribe that institutions implement a supply chain management system.

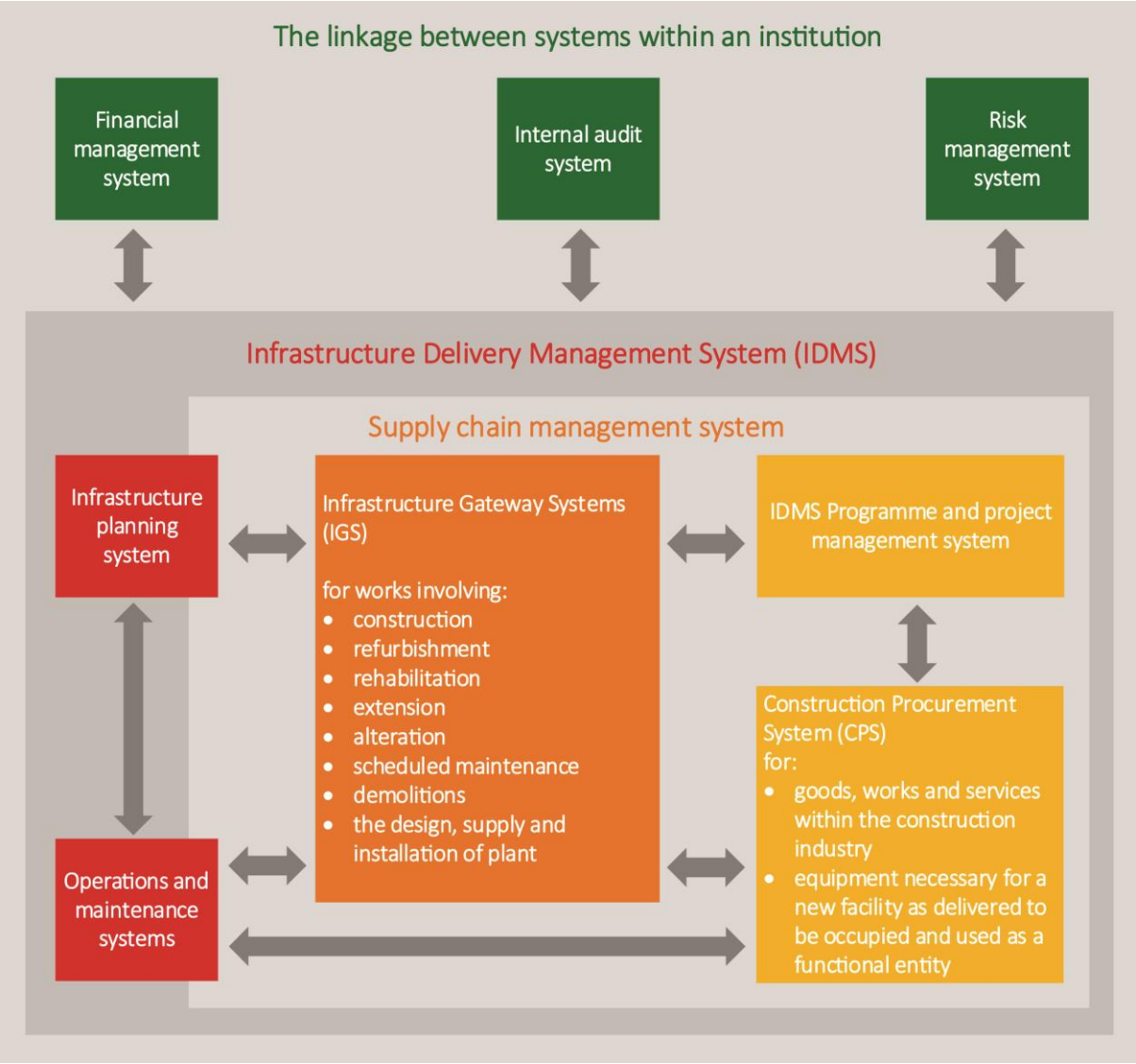
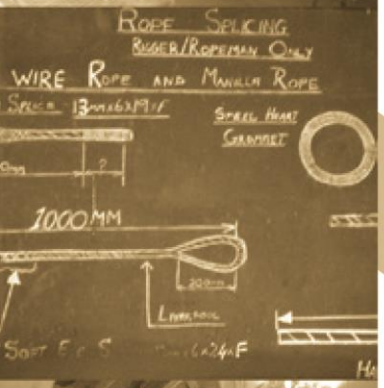


Figure 113: IDMS linkages

Sources: NT and cidb

School



Theory

Practical

Workplace

Assessment

Expertise

SECTION IV: PLANNING AND RESOURCING

CHAPTER 11

Skills through SIPs

BACKGROUND AND RATIONALE

The skills crisis in the construction industry is well documented and investigations by the Construction Industry Development Board (cidb), the South African Federation of Civil Engineering Contractors (SAFCEC), the Construction Education and Training Authority (CETA) and others have concluded that a comprehensive challenge exists to restore or replace the skills pipeline that produced a wide range of skills required by the construction and engineering industries.

The challenges with skills development in the country were clearly outlined in the cidb skills report[61] of 2007. The report recommended strategies to restore the skills pipeline and to contribute to the development of high level skills in the industry. These challenges and their mitigation strategies are summarised below:

- The dwindling number of mathematics and science graduates at grade 12 as well as competition amongst careers that require maths and science as entry level requirements. The proposed action to mitigate this was to:
  - Work with the Department of Basic Education to increase the number of mathematics and science graduates.
- The realisation that the construction industry has a negative public image and therefore career guidance teachers and parents are wary of encouraging learners to pursue careers in construction. The proposed action was to:
  - Improve the attractiveness of the industry by exposing learners to the wide range of career opportunities in construction, as well as showcasing successful construction role models.
- The report further acknowledged that construction industry training often lacks in relevance and quality resulting in graduates of some institutions, such as TVET colleges, failing to obtain gainful employment. It was proposed that industry must:
  - Assist TVET colleges to improve the quality and relevance of current training programmes increase the employment and career prospects of TVET graduates.
- Due to their practical nature, construction training programmes are expensive and learners need workplace experience to become fully competent. The practical training component has to be undertaken on project sites resulting in lower productivity and increased cost due to training wastage. To balance this, the report suggested that:
  - Industry must look at ways of strengthening the available funding mechanisms for experiential training of both TVET and University of Technology learners through structured internships and work-integrated learning.
- Practical training opportunities and access to workplaces was also identified as a major constraint to learners who wish to develop their skills to artisanal competence levels as well as those wishing to register for candidacy for the professions.
  - The report recommended the diversification of funding opportunities to contribute to increased skills development.

The cidb in partnership with industry stakeholders undertook a process of studying and developing interventions that may facilitate and invigorate the construction skills supply pipeline as well as improving the quality of training provision.

THE TRAINING STANDARD

The cidb Standard for Developing Skills through Infrastructure Contracts (the Skills Standard) (GG No. 36760, 23 August 2013) is one such measure that aims to promote human resource development in the construction industry by providing for workplace training of interns and up skilling of company employees in programmes that result in nationally accredited training outcomes.

84 No. 36760 GOVERNMENT GAZETTE, 23 AUGUST 2013

BOARD NOTICES
RAADSKENNISGEWINGS

BOARD NOTICE 180 OF 2013

Construction Industry Development Board

Standard for Developing Skills through Infrastructure Contracts

8 August 2013

The Standard has been prepared to leverage contributions towards an increase in the pool of qualified skilled people and, where required, professionally registered people, through training on professional services, services, design and build or engineering and construction works contracts associated with such expenditure.

The Standard establishes a minimum contract skills development goal which is to be achieved in the performance of a contract in relation to the provision of different types of workplace opportunities linked to work associated with a contract which culminates in or leads to:

- a part- or full occupational qualification registered on the National Qualifications Framework
- a trade qualification leading to a listed trade (GG No. 35625, 31 August 2012)
- a national diploma registered on the National Qualifications Framework; and
- a registration in a professional category by one of the professional bodies listed in Table 1 of this Standard.

This Standard provides for the dedication of 0,5% of the total value of general building and 0,25% of engineering contracts on public sector projects to structured workplace training opportunities for interns and candidates.

The Standard only covers learners who have completed the theoretical component of their training and require practical workplace experience as part of a qualification registered on the National Qualifications Framework. The training covered by this Standard includes work-integrated learning, workplace learning for part qualification, internships for TVET college graduates, learnerships and apprenticeships, P1 and P2 for University of Technology, students as well as candidacy for professional registration.

THE STANDARD DEVELOPMENT PROCESS

Following the cidb processes and in order to guarantee optimum stakeholder support, the Standard was developed in partnership with construction stakeholders. The stakeholders who engaged during the development process included client departments, contractor associations, statutory professional councils, training providers and affected government departments.

A framework document on the Developing Skills through Construction Works Contracts concept was prepared by the cidb and circulated to all construction stakeholders for comment. This was followed with exhaustive presentations and discussions with individual stakeholder groups which culminated in a focus group meeting of all interested parties. The focus group discussions highlighted

concerns and elements of the training landscape that had to be incorporated into the Standard, and a further revision was made to the framework document.

Finally, the Standard was published in a Government Gazette for public comment in February 2012. Subsequent to the public comment period, all endeavours were made to address the issues raised during the public comment period and, where required, changes made to the Standard.

Significantly, during this process the Presidential Infrastructure Coordinating Commission (PICC) had initiated the Strategic Infrastructure Projects (SIPs) and established a Special Projects Unit focused on the SIPs in the Department of Higher Education and Training (DHET). The SIPs Special Projects Unit together with the cidb, Council for the Built Environment (CBE), the statutory councils of the built environment and professional volunteer associations worked on a process to include the training of professionals in the provision of the standard. This was followed by extensive consultations with the built environment professionals and the subsequent extension of the standard to cover professional candidacy as a training method and the subsequent renaming of the Standard to 'The cidb Standard for Developing Skills through Infrastructure Contracts'.

The standard was finally gazetted as a national standard for training on infrastructure contracts in August 2013.

PROVISIONS AND INTENDED IMPACT OF THE STANDARD

To respond to the need for practical training of construction artisans and built environment professionals, the skills standard was designed to provide only for practical workplace experience and not the payment of fees or bursaries. This was in response to an observation of the high number of learners who successfully completed their institution-based education but were eventually lost to the industry due to failure to access workplace experience. It is therefore anticipated that the skills standard will have a significant impact on this sector by ensuring that interns are given workplace experience on all public sector projects.

The expected impact of the skills standard based on the infrastructure spending projections for the 2014/15 financial year is the creation of about 3 000 learning opportunities. This will cover all skills levels from entry level elementary skills requiring short term training to long term candidacy opportunities depending on the nature, value and duration of the infrastructure project. An electrical project with the following criteria:

Contract amount:	R2bn
Contract duration:	12 months
CSDG %:	0.25%
CSDG value:	R5m

can provide practical training opportunities for six electrical engineering candidates, eight graduates with a TVET college certificate and 44 short term skills programmes as shown in Table 44.

Table 44: Example: Training opportunities on a three year electricity project of R2bn

	Placement options	Notional cost per quarter	Notional cost per year
1	Electrical Engineering candidate	R47,750.00	R 191,000.00
	3 year candidacy		R 573,000.00
	6 Candidates		R 3,438,000.00
2	Unemployed TVET graduate	R 17,000.00	R 68,000.00
	2 year – placement		R 136,000.00
	8 artisans		R 1,088,000.00
3	Short term Skills Programmes	R 11,000.00	
	44 Short term programmes		R 484,000.00
	Total training allocation		**R 5,010,000.00**

WAY FORWARD

The cidb is providing client support on the implementation of the standard and has at all these sessions with clients indicated the importance of matching the training requirements to the capacity of the contractor.

Several client departments are already including the Standard as part of their tender data, and the cidb and DHET have encouraged the SIPs to adopt the Skills Standard. The cidb recognises the Skills Standard as an objective instrument for the implementation of training on infrastructure projects and wishes to encourage all client departments to adopt it on all their projects.

In terms of the cidb Act, the cidb is considering mandating the use of the Skills Standard on all public sector projects that have duration of 12 months or more and a contract amount exceeding:

- R2m in the case of a professional service or service contract or an order issued in terms of such a contract; or
- R40m (or cidb Grade 7) in the case of an engineering and construction works, or design and build contract or an order issued in terms of such a contract.

A full copy of the Standard can be found on the CD attached to this report and on the cidb website: www.cidb.org.za

The standard will apply to all SIPs projects above the qualifying level.

CHAPTER 12

Gearing the supply side to respond to Occupational Team recommendations

INTRODUCTION

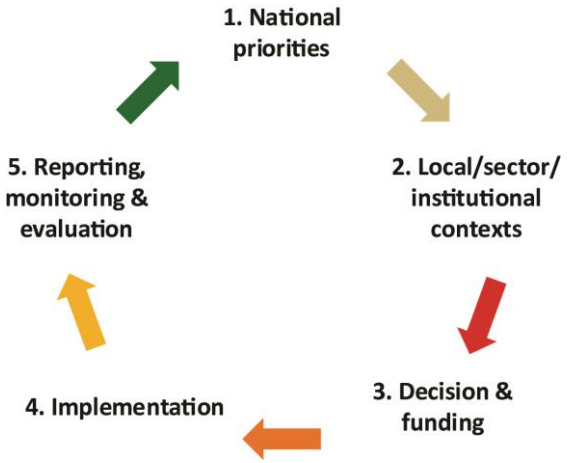
Having determined what needs to be done, the next question is: who is going to do what about it? (And what has already been done?)

The answers lie largely with the Department of Higher Education and Training (DHET) and its public institutions – the fifty TVET colleges, the twenty-three universities, the twenty-one Sector Education and Training Authorities (SETAs) and the National Skills Fund (NSF) and it is with these institutions that this chapter will begin. However there are other actors that are responding, or need to respond, to scarce skill signals from the SIPs. A few of this latter group are discussed under the heading other.

GENERAL PLANNING CYCLES FOR DHET INSTITUTIONS

Planning and resourcing takes a slightly different form in the three primary service delivery arms of DHET but all follow the same basic logic. Clearly there is a need to embed OT advice into all five steps:

- **Step One** – National priorities are set and are captured into policy and core planning documents
- **Step Two** – Institutions are invited to interpret these national priorities in their own contexts,



be these contexts institutional or sectoral. This involves institutions interacting with their own constituencies to determine their own priorities.

- **Step Three** – Institutions then submit their plans to DHET to secure public funds or grants. This is followed by a series of engagements where the DHET interrogates the plans produced by the institutions and comments on them. After the engagement, either the Minister or the Director–General makes a decision and funds are then committed.
- **Step Four** – Financial allocations and implementation then follows on the basis of the decisions.
- **Step Five** – Institutions report on a regular basis, judgements are made and the cycle repeats. The Occupations identified through the processes outlined in this report constitute national priorities. They were therefore circulated to the universities, colleges and SETAs during their planning cycles in 2013/14. The process followed, and the agreements reached for each of DHET's institutions, is now described at greater length.

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UNIVERSITIES

UNIVERSITY PLANNING (5 YEAR CYCLE)

As most academic programmes at universities are at least three years long, it does not make sense to plan on an annual cycle only. A five year enrolment planning cycle began in 2012 for the period 2014/15 to 2019/20.

The first step was a request to universities to prepare their own anticipated enrolment plans and targets taking due account of the national priorities which were given to them.

Once drafted, these plans were submitted to and analysed by the DHET after which meetings were held with individual universities to engage on the plans.

The DHET prepared a framework for engagement with the institutions. It was informed by the national imperatives as stipulated in the country's various planning documents such as the National Development Plan, the Minister of Higher Education and Training's own performance agreement with the President, and the Medium term Strategic Framework – which had some very specific targets for engineering, amongst others. The SIP priority skills list was included in this framework[62].

One-on-one meetings were then held with the institutions. At these meetings, the Department presented an overview of the national enrolment planning context for the period up to 2030, together with an analysis of the national planning profile as collated through the institutional submissions.

In the light of these engagements, universities revised their plans and submitted the revised enrolment plans to the Department in August 2013. The Minister of Higher Education and Training will finalise these plans when he publishes his **Ministerial Statement on Student Enrolment Planning 2014/15 – 2019/20 for Universities.**

This Ministerial Statement will set targets for enrolment and success for each university under four broad headings (Science, Engineering and Technology; Business and Management; Education and Humanities). However, there are further national targets which speak at a more granulated level to national programme priorities, which take the SIP occupations into account. These national targets need to be met across the university system.

Only when the 2014 Ministerial Statement is published will it be possible to assess the degree to which the SIP priorities have been addressed.

There will be an opportunity to revise these targets midway through the five-year cycle.

UNIVERSITY RESOURCING

The Ministerial Statement sets out the funding that will be allocated to individual institutions based on their approved plans. This funding is clustered under different headings which are discussed below:

BLOCK GRANTS

Block grants make up more than 70% of the total state allocations to universities. They are made up of four elements:

1. Funding linked to projected student enrolment numbers
2. Funding linked to the number of students who graduate
3. Funding for research outputs and
4. An institutional factor based on the number of disadvantaged students and the size of the institution.
   - The funding for enrolments is the largest amount and it is calculated by multiplying the approved number of full-time

equivalent students per programme type by a special weighting number which is worked out using an estimate of the cost of delivering the programme. Programmes are clustered into four funding groups using the Classification of Education Subject Matter (CESM) categories. These weightings are shown in Table 45.

Table 45: Weighting of classification of the CESM

Funding Group	CESM categories included in funding group
1	07 education, 12 law, 18 psychology, 19 pubic administration and services
2	04 business, economics & management studies, 05 communication and journalism, 06 computer & information sciences, 11 languages, linguistics & literature, 17 philosophy, religion and theology, 20 social sciences
3	02 architecture & the built environment, 08 engineering, 10 family ecology & consumer sciences, 15 mathematics & statistics
4	01 agriculture & agricultural operations, 03 visual and performing arts 09 health professions & related clinical sciences, 13 life sciences, 14 physical sciences

Source: Ministerial Statement 2012

The weighting of each funding level and the number of students who enrol determines the size of the Block Grant that is transferred to institutions annually.

There is a degree of flexibility at institution level to direct resources into specific courses within each funding group. This is an area of flexibility which this report can help inform (showing as it does which specific programmes are in demand).

EARMARKED FUNDS

In addition to the Block Grant mechanism, there are also Earmarked Funds which are dedicated to particular national priority areas of work, which in the 2013/14 and 2014/15 period were the following:

1. Teaching Development Grant
2. Foundation Provision Grant
3. Research Development Grant
4. Clinical Training Grant
5. Veterinary Sciences Grant
6. Infrastructure and Efficiency Grant
7. National Student Financial Aid Scheme
8. Multi-campus Grant

The purpose of these earmarked grants was spelt out in the annual Ministerial Statement on the Funding of Universities, and of particular interest to the SIPs are the following Earmarked Grants:

- The **Teaching Development Grant** – Provides financial support to all universities for the implementation of teaching and learning development activities that will lead to improvement in student success. Institutions can decide which faculties receive this grant – which means they could direct its use it to attend to some of the OT recommendations in this report.
- The **Foundation Provision Grant** – Aims to improve the academic performance of students who are at risk of dropping out due to their poor educational backgrounds. Such students are placed on Ministerially approved extended curriculum programmes which are in most cases one year longer than the regular qualification. Additional earmarked funds are provided to universities, as the extended nature of the curriculum of these students requires more effort from universities to maintain.

A university may use its total state allocation for foundation provision across various Ministerially approved extended curriculum programmes. About 1% of foundation funds allocated to a university should be used to train staff who are responsible for the provision of formally approved extended curriculum programmes to foundation students.

- The **Research Development Funds** – Provide financial support to all universities to develop research capacity among academic staff at universities so that they can contribute to postgraduate teaching and to research output (masters graduates, doctoral graduates and research publication units - books for the specialist, conference proceedings, articles in accredited journals). In some cases, universities would first be required to focus on increasing their percentage of instruction/research staff with masters and doctoral degrees to achieve these goals.
- The **Infrastructure and Efficiency Funds** – Are used for new facilities and their equipment. The 2011 Ministerial Statement indicated that a different approach has been taken with the allocation of infrastructure funds for the period 2012/13 onwards. Some of the key factors taken into account during the allocation process was funds allocated to universities in the previous funding cycles, the progress of projects and trends on spending as well as interest earned and savings realised which required the Minister's approval prior to using the interest earned.

Some of the guiding principles, priorities and criteria that have informed preliminary allocations include:

- Alignment with Performance Monitoring and Evaluation (PME) targets and enrolment planning requirements
- Cooperative projects and efficiencies for the system needs
- Uplifting Historically Disadvantaged Institutions (HDIs)/rural campuses
- Need for student housing
- Sustainability of university contributions in some as opposed to reserves in others
- Current progress on projects and historical spending trends
- Better cash flow projections for projects to prevent under spending in a specific year
- Cross fertilisation of ideas and practices
- Provision for persons with disabilities
- Alignment with other funding through the National Research Foundation (NRF)/Department of Science and Technology (DST) providing minimum infrastructure in terms of well-founded laboratories.

Whilst the actual allocation of funds to universities is set out in the Ministerial Statement, individual universities have discretion through the use of the block grant and when determining which faculty will benefit from the earmarked grants.

Those faculties delivering programmes linked to priority SIP occupations are encouraged to apply for the earmarked grants at institution level, through institution-specific procedures.

Currently it is up to Occupational Teams and their networks to engage with relevant university administrations to access the funds allocated.

Table 46 taken from the Ministerial Statement on University Funding: 2014/15 And 2015/16, published in November 2013, shows the amounts that have been earmarked for infrastructure and efficiency funding over three years, including 2014/15.

These amounts exclude the new funds from National Treasury earmarked for capital expenditure on the two new universities in the Mpumalanga and Northern Cape provinces. Of the R6bn, R184.2m has been set aside for them Information and Communication Technology (ICT) needs of

universities and will be allocated in a separate process. An amount of R210m has also been set aside for the establishment of the Sefako Makgatho Health Sciences University based at the Medunsa campus which has been unbundled from the University of Limpopo.

Table 46: Funding categories and allocation

Category of University	Funding categories	Total allocation (R'000)
Historically disadvantaged universities (HDIs)/ campuses	Student housing – upgrading and new	1 412 638
	Infrastructure backlog – upgrading and new	1 114 195
Universities/campuses other than HDIs	Student housing – upgrading and new	239 136
	Teacher Training – meeting scarce skills needs	662 460
	Health sciences – meeting scarce skills needs	442 519
	Engineering – meeting scarce skills needs	513 779
All universities	Life and Physical Sciences – meeting scarce skills needs	555 721
	Cooperative Projects – partnerships with HDIs	134 500
	Development of African Languages, Humanities and the Social Sciences	311 654
	Disability units – upgrading and new	123 835
	Research infrastructure – well founded laboratories	74 053
	Project Management	50 000
	DHET monitoring and oversight support	5 000
	ICT	130 509
	Medunsa	210 000
Total		**6 000 000**

An overview of the university infrastructure initiatives under SIP 14 is outlined below.

SIP 14: UNIVERSITIES

The infrastructure projects for the universities covers student housing for all universities, backlogs in infrastructure at historically disadvantaged universities, engineering, health sciences SIP 14 also includes the establishment of the three new universities referred to below.

The growth of the higher education system needs to be supported by quality infrastructure. As it has done since 2006/07, the Department will continue to invest in the system though the allocation of infrastructure and efficiency grants. Over the MTEF period of 2012/13 to 2014/15, R6bn was allocated towards infrastructure projects across the existing 23 universities with R2.3bn committed for the current financial year.

Investment in student housing has been one of the areas prioritised, particularly for historically disadvantaged universities. A total of R1.6bn from the R6bn was allocated for student housing development. This will provide at least 9 000 new beds across the system, mostly at historically disadvantaged institutions and campuses.

Over the last five years the Minister has established three new universities. The University of Mpumalanga (UMP) and Sol Plaatje University (SPU) were established in August 2013 and opened their doors to their first cohort of students earlier this year. Each university has a ten to fifteen year development plan to ensure that they grow and develop to become sustainable and

successful institutions taking their rightful place within the system as flagship universities. Both universities started their lives in existing refurbished buildings. Substantial new infrastructure for each institution will be built in phases in line with their development plans. Over the next three-year period, R3.158bn will be allocated to infrastructure development of the two universities. Barring any unforeseen challenges, contractors for the new infrastructure programme will be on site in September 2014.

The third new university, the Sefako Makgatho Health Sciences University (SMU) was established in May 2014. The SMU will have its first intake of approximately 5 000 students in the 2015 academic year. As a comprehensive health and allied sciences university, it is the first of its kind in South Africa and will offer a broad range of programmes from higher certificates to PhDs, embracing medicine, and broader health and allied sciences professional programmes as well as related programmes in medical law, health sciences education, humanities and bio-engineering.

TVET COLLEGES

Major changes are under way in the college system. Signalling this is their name change from Further Education and Training (FET) colleges to Technical and Vocational Education and Training (TVET) colleges.

Another significant change is the transfer of their oversight from the Provincial Education Departments (PEDs) to the national Department of Higher Education and Training (DHET) from 1 April 2015. This transfer means that funds will no longer be made through the Provincial Equitable Share Formula – which sometimes resulted in provinces making different allocations to the various programmes. Instead, colleges will now be equitably funded with funding based on their programme enrolments. The fiscal allocation to a college will now be calculated in a similar way to that of the universities, in other words by multiplying the cost of an individual programme by the number of approved learner enrolments.

To expedite this process the Minister has set up a Ministerial Committee to advise him on how best to fund the TVET and Community Colleges in future. It is envisaged that factors such as the urban or rural location of the college and the poverty levels of the communities they serve will also be factored into the new framework. The review will also consider streamlining access to alternative funding sources (such as from the National Skills Fund (NSF) and the Sector Education and Training Authorities (SETAs) – particularly for workplace-based learning opportunities. This will support the growing need for these colleges to be responsive to the labour market and for their learners to gain access to workplace learning opportunities – an emphasis which has led to the opening of SETA offices in many colleges.

However, whilst these changes are being finalised, legislated and implemented, the planning and resourcing of colleges will continue to be governed by the process outlined in Government Gazette No. 32010, 16 March 2009, entitled National Norms and Standards for Funding Further Education and Training Colleges (NSF-FET Colleges) – albeit now from the national rather than the provincial level.

COLLEGE PLANNING

The annual planning cycle is summarised in the Table 47.

Table 47: College 3-year Planning Cycle

Time of year	Action
End March	DHET must release national enrolment targets and priorities
April	Colleges commence their annual planning process for next three calendar years
End July	DHET must approve annual funding base-rates applicable for next college year
End August	Colleges must submit the next three years plan to DHET
End September	Final annual reports with audited financial statements for previous financial year
End October	DHET signs off on next three year plans
End November	Schedule of payments to colleges to be confirmed and communicated to colleges.

SIP Priorities

At the end of 2013 colleges were informed of SIP priority trades and were requested to take these into account in their planning for 2014 and beyond. This was late in the cycle and so the impact was minimal for 2014.

It is hoped that there will be an improved response to these signals when college plans are signed off for 2015 and beyond in October 2014.

COLLEGE RESOURCING

Currently there are seven different income streams for colleges:

1. Formula funding of programmes
2. Earmarked capital funding
3. Earmarked recurrent funding
4. College fees
5. Student financial aid
6. Fee-free-service income
7. Other private funding

A degree of responsiveness to priority trades is possible under a number of these headings as illustrated below, although there are also some serious constraints as shown:

FORMULA FUNDING OF PROGRAMMES

Formula funding of programmes is intended to cover the recurrent costs of delivering college programmes, but also of certain capital costs associated with those programmes, specifically costs relating to the replacement of the facilities and equipment used. This funding is determined on the basis of the cost of delivering each programme –so different programmes attract different allocations.

The funding norms cover only the currently registered programmes i.e. the Report 191 (NATED) and National Certificate (Vocational) (NC(V)) programmes. The funding norms do not cover the Occupational Qualifications of the QCTO. This means that currently the new trade qualifications are not covered at all by this process which is a matter of serious concern.

A student who is doing all subjects in a registered programme is regarded as Full Time Equivalent (FTE) and a student enrolled for fewer subjects must be combined with others to constitute an FTE. The funding norms require that a Programme Costing is conducted to determine the actual costs of delivering these programmes which are adjusted annually by Consumer Price Inflation (CPI). Formula funding is therefore determined by multiplying the programme costs by the FTEs.

The selection of which programmes to offer is partly determined by the college and partly determined by the national targets set. However the national Norms and Standards for Funding Further Education and Training Colleges (NSF-FET Colleges) (GG 32010, 16 March 2009) does state that 'the development of public funding strategies for technical and vocational TVET must involve a critical level of participation by various government stakeholders, and non-government stakeholders' (paragraph 92).

SIPs

From a SIP perspective, there is currently considerable flexibility at college level for an individual institution to determine its own Programme and Qualification Mix (PQM). Colleges are therefore in a position to respond to SIP signals.

However the formula does not cover the QCTO programmes to which all trades are moving. This is an important policy matter that needs to be addressed urgently.

It is recommended that in the short term the theory and practical components of all registered QCTO qualifications be added to the register of approved TVET college programmes.

EARMARKED CAPITAL FUNDING

This public funding stream covers two types of capital expenditure:

- Capital expenditure to expand the infrastructure of existing campuses or to construct new campuses
- Capital expenditure required to address capital infrastructure backlogs inherited from spending in the past. It is always conditional in the sense that it is earmarked for specific capital investments where these investments are integrated into the strategic plans of colleges.

SIPs

Clearly strategic plans of colleges could take into account SIP demands, and so this is an avenue for potential alignment.

It is recommended that this requirement be integrated into the national template for Strategic Plans circulated by DHET to colleges.

EARMARKED RECURRENT FUNDING

This funding stream is earmarked for projects of a developmental nature, in particular staff development, development and implementation of computerised systems, and college-level research.

SIPs

This is therefore an extremely important funding stream for responsiveness to priority SIP trades. Unfortunately there are serious budget constraints under this heading, but a consideration of the SIP signals should be taken into account by DHET when/if funding becomes available.

COLLEGE FEES

Colleges are permitted to charge students the 20% student fee portion which augments the 80% state subsidy to cover the total Programme Cost that funds the three economic categories (i.e. Personnel; Non-Personnel Non-Capital (NPNC) or operational costs; as well as Capital infrastructure).

Student financial aid

The 20% student fee may be carried by the student or his/her parents OR the student may qualify for a National Student Financial Aid Scheme (NSFAS) bursary (described below). NSFAS bursaries are paid to those students who qualify for admission academically but who are unable to afford the fees.

SIPs

NSFAS does not currently cover the cost of learnerships, internships or QCTO qualifications – these are funded through SETA grants or other private sources of funding where this is available.

This again presents a challenge with regard to the new trade qualifications of the QCTO – meaning that NSFAS does not cover any of the costs of this learning. This is a matter that requires urgent policy attention.

FEE FOR SERVICE AND OTHER PRIVATE FUNDING

This stream of funding is derived by colleges from training services offered on a market basis to private and public clients. Even training services offered under the auspices of universities by colleges is considered to be part of their fee-for-service income.

Income from the National Skills Fund and the SETAs are important sources under this heading. The fiscal allocation for 2014/15 and 2015/16 under each of these headings is shown in Table 48.

Table 48: Fiscal allocation for 2014/5 AND 2015/6

	2014/15 R'000	**2015/16 R'000**
Formula funding of programmes	5 785 918	6 123 747
Earmarked recurrent funding	41 255	55 827
Total	**5 827 173**	**6 179 574**

Source: DHET

SIP 14: TVET COLLEGES

The Technical and Vocational Education and Training (TVET) Infrastructure Development Programme was initiated to establish 12 new TVET college campuses and to refurbish two existing campuses.

The sites were originally identified as a result of an analysis of the Provincial Multiple Indices of the Deprivation Report of the Human Sciences Research Council (HSRC) and the consideration of the 50 most negatively affected municipal wards in each province. These were then prioritised on the basis of those sites which are rural and have not had access to adequate TVET opportunities in the past.

After a process of consultation, taking into account the need to support the expansion of access to teaching and learning opportunities and providing for the optimal spread of sites for local employment, the number of sites was increased from 14 to 16. These are within four Provinces, namely:

Table 49: Need in support to access teaching

Province	**Total Number**
Mpumalanga	1
Limpopo	2
Eastern Cape	4
KwaZulu-Natal	9

The development of these sites was initiated via a R2.5bn TVET College Infrastructure Grant from the National Skills Fund (NSF).

The sites are located in Balfour, Thabazimbi, Giyane, Graaff Reneit, Aliwal North, Lusikisiki,,

Sterkspruit, Mzimkhulu, Msinga, Greytown, Nkandla Town, Nkumgamathe (Extension of Nkandla Town), Bhambanana, Nongoma (2 refurbishments) and Vryheid.

The design of the campus was based on the new Model TVET Campus and includes student accommodation, workshops, computer laboratories, a student resource centre and security fencing. The Master Plan for a typical campus is shown in Figure 114.

The current construction plan will allow for seating of over 10 000 students and provide over 2500 beds.

The land was obtained from a combination of local municipalities and state land.

To date the contract for Thabazimbi, Bhambanana and Nkandla Town have been awarded. The remaining 13 sites are going out on tender in August 2014.

OTHER SOURCES OF FUNDING

NATIONAL STUDENT FINANCIAL AID SCHEME (NSFAS)

The NSFAS is the South African government student loan and bursary scheme. NSFAS provides loans and bursaries to students at all 25 public universities and 50 public TVET colleges throughout the country. Its mission is: To transform NSFAS into an efficient and effective provider of financial aid to students from poor and working class families in a sustainable manner that promotes access to, and success in, higher and further education and training in pursuit of South Africa's national and human resource development goals.

The mission statement is made up of three distinct elements which describe why NSFAS exists, what it does, and the impact on their constituency:

- NSFAS exists to provide financial aid to eligible students at public TVET colleges and public universities.
- NSFAS identifies eligible students, provides loans and bursaries and collects student loan repayments to replenish the funds available for future generations of students.
- NSFAS supports access to, and success in, higher education and training for students from poor and working class families who would otherwise not be able to afford to study.
- NSFAS funding has grown from R441m in 1999 to R8.5bn in 2013.

Information pertaining to the NSFAS is to be found on their website:
http://www.nsfas.org.za/

Figure 114: Layout of Mbhambanana College

THE SKILLS DEVELOPMENT LEVY/GRANT

In 1999 the Skills Development Levies Act was passed. It requires all employers (whose gross wage bill exceeds R500 000 per year) to pay a one per cent payroll levy to the South African Revenue Service (SARS). Table 50 shows how the 1% levy is allocated.

Table 50: Skills levy allocation

%	Allocated for
SARS – 2%	Collection Agent
National Skills Fund – 18%	National priorities as determined by the Executive Authority
SETA – 10.5%	10% for SETA Administration + 0.5% for QCTO
Mandatory Grant – 20%	For companies that submit Workplace Skills Grant and Annual Performance Plan
Discretionary Grant – 49.5%	Sector priorities – 20% of 49.5% = SSP 80% of 49.5% for priority occupations on PIVOTAL list

Source: DHET

The spending of the SETAs' 80% is governed by the SETA Grant Regulations that were published on 3 December 2012 (GG. No 35940) and which were implemented from 1 April 2013.

Of primary interest to the SIPs is the spending of the Discretionary Grant and in particular, that of the PIVOTAL grant, where PIVOTAL stands for Professional, Vocational, Technical and Academic Learning Programmes.

SECTOR EDUCATION AND TRAINING AUTHORITIES (SETAS)

SETA PLANNING

Since the inception of the levy in 2001, the National Skills Development Strategy (NSDS) has been adopted by the responsible Minister on the advice of the National Skills Authority to steer the spending of the skills development levy. An NSDS is the overarching strategic guide for skills development and provides direction to sector skills planning and implementation in the SETAs. It also guides the use of the skills development levy in the National Skills Fund and sets out linkages with, and responsibilities for, other education and training stakeholders.

Individual SETAs are expected to develop five year Sector Skills Plans (SSPs) which describe how their sectors will contribute towards the achievement of the current NSDS goals whilst simultaneously addressing priorities in their own sectors. These SSPs are used to guide the preparation of SETA's Annual Performance Plans (APPs), with targets and budgets, which they then report against. SSPs may be adjusted on an annual basis.

The goals of the current NSDS, NSDS III, 2011 – 2016, are set out below:

Goals of NSDS III

1. Establishing a credible institutional mechanism for skills planning
2. Increasing access to occupationally-directed programmes
3. Promoting the growth of a public TVET college system that is responsive to sector, local, regional and national skills needs and priorities
4. Addressing the low level of youth and adult language and numeracy skills to enable additional training
5. Encouraging better use of workplace-based skills development

6. Encouraging and supporting cooperatives, small enterprises, worker-initiated, NGO and community training initiatives
7. Increasing public sector capacity for improved service delivery and supporting the building of a developmental state
8. Building career and vocational guidance

As indicated above, SETAs must prepare five-year Sector Skills Plans (SSPs), with sectoral targets that speak to these goals. However they are also expected to prepare annual plans with targets under set headings..

A key part of the SSP prepared by each SETA is a list of priority occupations per sector. This list, called the SETA's Pivotal List. The SETA's Pivotal Plan outlines the PIVOTAL programmes to be supported by the SETA. A copy of the most recent list is included in the attached CD.

The SETA Grant regulation makes provision for the strengthening of partnerships with education institutions. Individual SETAs have developed their own grant policies in line with these regulations. These policies by SETAs outline two modes of aligning skills funding to address scarce and critical skills as outlined in the PIVOTAL list, but not necessarily limited to the list.

The two modes of the funding for Discretionary Grant funding are:

- Funds dedicated to particular partnerships with identified institutions which are based on partnership agreements signed with these institutions. Once these agreements are signed no further application process needs to be followed; and
- Funds which need to be applied for and which are subject to partnership agreement with employers.

Where partnership agreements are in place, funds can be allocated from SETA to partner without a further application process. As an example, the Wholesale and Retail SETA Grant Policy states *'11.7. Higher Education and Training Institutions: DHET has, through the NSDS, mandated SETAs to work closely with Public education and Training Institutions in a bid to create one coherent post school education system. In pursuing this imperative, the W&RSETA, will enter into Memorandums of Understanding (MOUs) with Public FETCs and HETIs that focus on wholesale & Retail Business as a field of study. These partnerships will be used to develop a link between the institutions and the sector for the benefit of employed and unemployed learners. This therefore means that funds will be set aside to make the partnership with Public Institutions possible.'*

This is a new development and offers Occupational Teams and their networks excellent opportunities going forward.

SETA PLANNING CYCLE

The process for preparing and implementing these plans is outlined in Table 51.

Table 51: SETA Planning Cycle

By end April	Employers, with the concurrence of their workforce, submit Workplace Skills Plans (WSPs), together with Pivotal Plans, for the year ahead and Annual Training Reports (ATRs) for the year past
By 1 August	On the basis of these inputs, SETAs revise their SSPs, prepare Sectoral Pivotal Plans and submit them to the DHET for initial engagement
By end August	SETAs send their first draft Annual Performance Plans (APPs), including budgets, and their proposed Service Level Agreements to the DHET
September – October	Engagement between DHET and SETAs on their APPs, budgets and SLAs takes place
15 November	SETA APPs, budgets and SLAs finalised and submitted for approval
Before end March following year	Minister considers and, if he agrees, he approves the SETAs APP and budgets. The Director-General signs an SLA with each SETA
Cycle continues	

2014 SIP INPUT INTO THIS PROCESS

In January 2013 a consolidated list of all of the Occupational Team Reports was circulated to all the SETAs. It was called the Support required for the development of SIP Priority Skills'. As set out in Chapter 4, this report detailed, per occupation, the support needed to increase the number of people with each SIP-identified priority skill.

One-on-one meetings were held with SETAs to review these requirements.

SETAs were then afforded the opportunity to update their proposed APPs and budgets taking this consolidated Occupational Team report into account.

By the end of the financial year, 31 March 2014, SETAs submitted their commitments to this report. These commitments were in effect a refinement of their own SSPs. This was possible because the Support required for the development of SIP Priority Skills was more detailed than their own plans, and it was possible for SETAs to interpret broader objectives (e.g. such as a commitment for a specified number of learnerships or apprenticeships) into commitments for specific occupations (e.g. general apprenticeship targets were translated into commitments for the sixteen priority trades of the SIPs).

The following figures and tables show the overall commitments that were made. The detail is contained in the CD appended to this report.

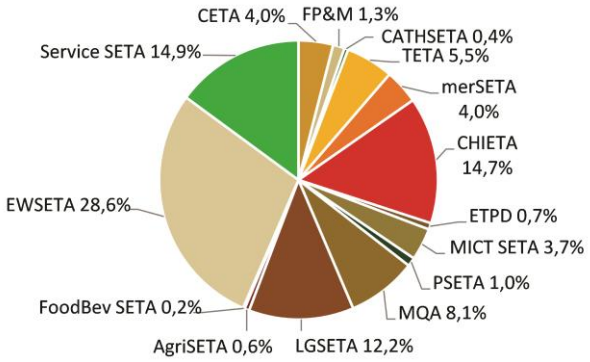


Figure 115: Total number of learners benefitting from SETA funding

The total number of learners to benefit from these commitments stood at 4 399 for bursaries and 9 060 for structured workplace learning.

Figure 116 shows the various levels of commitment from the different SETAs to the call from the SIPs.

The task now is to ensure that these funds are allocated as committed.

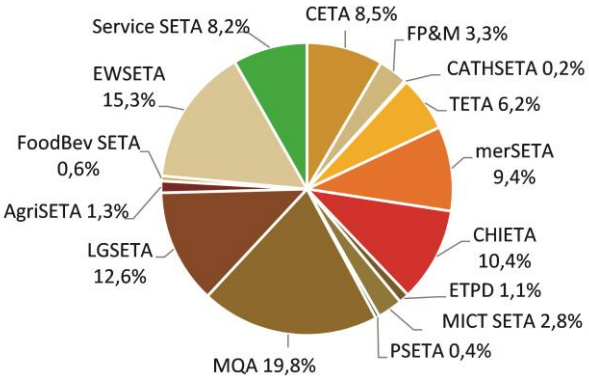


Figure 116: % of Rand value committed per SETA

The total rand value of the commitments stood at R 796 688 551 at the end of July 2014.

A detailed report of the current SETA commitments to SIP priority occupations can be found in the CD attached to this report.

Also appended is a list of contact people in each SETA who can assist any employer or provider with accessing a grant under this commitment schedule.

Table 52: SETA commitments to July 2014

Occupation	Number Required	Number Committed	R required	R committed
Management	180	716	R 16 400 000	R 36 961 090
Professions and associates	4 230	2 364	R 645 478 679	R 180 827 000
Services	225	555	R 4 000 000	R 15 234 800
Trades	2 552	7938	R 339 198 300	R 514 956 513
Operators	4 340	1 125	R 109 255 740	R 37 562 040
Elementary	9 650	701	R 176 600 000	R 11 147 108
TOTALS	**21 177**	**13 399**	**R 1 290 932 719**	**R 796 688 551**

TETA FUNDING FOR PLANT AND MACHINE OPERATORS

Transport SETA has committed R1 919 000 towards new simulators for the Crane and Hoist Operators after it was established that such operators are scarce in our country and more training is needed.

NATIONAL SKILLS FUND

The National Skills Fund (NSF) receives 20% of the levy funds collected from employers. It therefore receives 20% of 1% of the nation's private sector wage bill. The public sector does not contribute to the NSF. The Director-General of DHET is the Accounting Authority of the NSF.

Section 28 of the Skills Development Act (Act 97 of 1998) states that: '*the money in the Fund may be used only for the projects identified in the national skills development strategy as national priorities or for such other projects related to the achievement of the purposes of this Act as the Director-General determines (28(1))'*

Since its establishment in 2000 the NSF has funded a very wide range of projects, initially guided by the goals of the NSDS but more recently premised on key strategies such as the New Growth Path, Industrial Policy Action Plan, Rural Development and those mandated by the DHET. The majority of the funded projects cut across the priorities identified in this report. For example, the NSF has funded bursaries in excess R3.7bn through its relationship with both NSFAS and the NRF.

Table 53 shows the summary of the projects that have been funded by the NSF.

Going forward a proposal is being put to the NSF to fund those areas of the Support required for the development of SIP priority skills which the SETAs have not made a commitment to support. The process is still under way.

Table 53: National Skills Fund Projects 2012/13 – 2013/14

Projects	**2013/14** R'000	**2012/13** R'000	**Types of skills funded**
1. Government Priorities	1 308 720	1 091 354	
1.1 New Growth Path	428 456	223 775	Cadets– pilots + maritime; Artisans; mechanical engineers
1.2 Industrial Policy Action Plan	64 800	43 385	Tool and die makers; call centre agents; graduate placement
1.3 Rural Development	101 008	113 017	Elementary worker-EPWP ;IT technicians; Cooperatives
1.4 Education and Health	5 920	12 593	Community Health workers;
1.5 Justice and Crime Prevention	106 151	131 032	Security; offender training; Police reservists
1.6 Co-operatives and Small Enterprises	107 354	129 294	Cooperatives; SMME;CBOs; Entrepreneurs
1.7 Public Sector Capacity	495 031	438 258	Expand access to NATED and NC(V); limited infrastructure and staff capacity
2. DG Priorities	1 523 696	1 447 469	
2.1 Worker Education	9 433	4 584	Workers; farm workers
2.2 Skills System Capacity Building	11 888	-2 511	
2.3 Training Lay-off	17 091	39 483	Workers facing retrenchments
2.4 Academia, Research and Development	-	390	
2.5 Bursaries	1 272 200	1 238 398	Undergraduate and postgraduates in various fields-via NSFAS and NRF
2.6 DHET Projects for Academia, Research and Development	213 084	167 125	Skills Planning models
3. Skills Infrastructure	303 165	53 951	
3.1 Community Education Centres	275 061	32 838	
3.2 Public Delivery Infrastructure	28 104	21 113	
Total	**3 135 581**	**2 592 774**	

Source: NSF

Some of the projects that have been funded by the National Skills Fund were not initially identified as SIP projects, however they will contribute directly to the work of the SIPs, as the project below illustrates. This centre is set to make a considerable contribution to SIP 8.

THE SOUTH AFRICAN RENEWABLE ENERGY TECHNOLOGY CENTRE

The South African Renewable Energy Technology Centre (SARETC) was funded by the National Skills Fund, under the auspices of the Department of Higher Education and Training. An amount of R105,578m was approved in December 2012, for the initial start-up capital and equipment costs related to the construction of a state of the art, renewable energy training and technology facility on land which was donated by the Cape Peninsula University of Technology (CPUT) on its Bellville campus.

The project is managed by CPUT which is being assisted through an Advisory Board comprising industry representatives, partner academic institutions (Northlink College and Stellenbosch University), development agencies (Green Cape, GIZ) and government institutions (SANEDI, DHET/NSF, SETAs), and will be a National Institute once fully operational. The establishment of the centre is justified by the anticipated construction of renewable energy power plants over the next twenty years and the challenges and opportunities it provides for skills development, job creation and economic growth. The location of the centre in the Western Cape is justified by the proactive efforts of the local universities in renewable energy research, as well as the province being the manufacturing home of almost all solar manufacturers in South Africa. Combined with this, the establishment of a renewable-energy manufacturing hub in the town of Atlantis, confirms that the Western Cape is the ideal place to establish SARETC.

One of the main goals and strategies behind SARETC is to ensure that the skills required to build, operate and maintain world class renewable energy utility scale power plants are available in South Africa and are adequately serviced by educational institutions in the country. SARTEC is set to drive skills development and training requirements that will allow the renewable energy industry to grow. The centre will utilise and leverage resources from the exiting four universities and the existing and expected manufacturing industry in the Western Cape.

On completion the project will provide a facility for engineering students, artisans and general elementary workers to be skilled in working with renewable technologies. It is anticipated that the programme will be self-funded and sustainable after three years of commencing with the relevant training. Some of the skills sets that will be generated through the programme will be: PV farm maintenance technicians, wind farm turbine service technicians, biogas operators and maintenance technicians, wind turbine apprentices, high voltage operator electricians, solar maintenance and cleaning elementary workers.

The project is supported by Eskom, The South African National Energy Development Institute, MerSETA, The Department of Energy, University of Stellenbosch, Nelson Mandela Metropolitan University, Northlink TVET College and the DHET.

OTHER PUBLIC AGENCIES ADDRESSING SIP SCARCE SKILLS

In addition to the above primary sources of funding for education and training (from universities, from colleges and from the skills levy via SETAs or the NSF), there are a range of other sources of support. Below three of these are highlighted although it should be remembered that others also exist which are not covered in this report. The four to be covered here are:

1. The National Research Foundation
2. Infrastructure Skills Development Grant
3. Municipal Infrastructure Support Agency
4. Unemployment Insurance Fund

THE NATIONAL RESEARCH FOUNDATION (NRF)

The NRF's website states that it 'receives its mandate from the National Research Foundation Act (Act No 23 of 1998). According to Section 3 of the Act, the objective of the NRF is to promote and support research through funding, human resource development and the provision of the necessary facilities in order to facilitate the creation of knowledge, innovation and development in all fields of research, including indigenous knowledge, and thereby to contribute to the improvement of the quality of life of all the people of the Republic.' It reports to the Minister of Science and Technology.

The NRF manages a wide range of programmes one of which is the Human and Infrastructure Capacity Development (HICD) within the Office of the Deputy Chief Executive Officer: Research and Innovation Support and Advancement (RISA).

The NRF manages bursaries and scholarships for Master and Doctoral research. Many of these support the SIPs as can be illustrated by the following advertisement viewed on their website on 2 August 2014:

South African Square Kilometre Array Project (SKA SA) Undergraduate and Honours Bursary Programme 2015. The South African Square Kilometre Array Project (SKA SA) is pleased to announce the opening of the call for undergraduate bursaries for 2015.

Applications for bursaries and other funded opportunities are frequently posted on their website: http://www.nrf.ac.za/. The website also advertises a range of internationally funded partnership programmes, a number of which are also resonant with the SIP objectives.

INFRASTRUCTURE SKILLS DEVELOPMENT GRANT (NATIONAL TREASURY)

This grant is managed by the National Treasury and applications have to be submitted through a local municipality. Its strategic goal is to develop capacity within the municipalities by creating a long term and sustainable pool of young professionals with built environment related technical skills (engineering, town planning, architecture, quantity surveying, Geographic Information System).

It aims to recruit unemployed graduates into municipalities to be trained as per the requirements of the relevant statutory council/professional body within the built environment and to strengthen the capacity of local government to deliver quality infrastructure effectively and efficiently, by increasing and strengthening the pool of skills available.

Its focus is on improving technical and management capacity in infrastructure delivery and technical services in municipalities. It does this by supporting the

professionalisation of the above mentioned skills by training graduates according to the recognised professional registration processes.

The level of ISDG success will be determined by the numbers of registered professionals at the end of each training cycle as well as the total of the registered professionals absorbed or employed by government. To date the ISDG has a total number of 326 graduates in training as per the tabled occupation list and the first group of graduates are expected to exit the programme by the year 2015/16.

The number of graduates currently being supported by the ISDG are shown in Table 54:

Table 54: Number of graduates currently supported by ISDG

OFO	Occupation	Projection years	No of learners	OFO	Occupation	Projection years	No of learners
214501	Chemical engineer	2014/15	10	214904	Quantity Surveyor	2014/15	11
214201	Civil engineer	2014/15	2	216401	Town planner	2014/15	9
214202	Civil engineering technologist	2014/15	15	311203	Town planning technician	2014/15	1
311201	Civil engineering technician	2014/15	55	641201	Bricklayer	2014/15	1
215101	Electrical engineer	2014/15	2		Micro-biology Engineer	2014/15	5
215102	Electrical engineering technologist	2014/15	4		Construction Project Management	2014/15	15
311301	Electrical engineering technician	2014/15	27		Environmental Scientist	2014/15	9
214301	Environmental engineer	2014/15	27		Analytical Chemistry	20114/15	10
311202	GIS practitioner	2014/15	16		Water Care	2014/15	40
214401	Mechanical engineer	2014/15	1	671101	Electrician	2014/15	35
311501	Mechanical engineering technician	2014/15	14	642607	Pipe fitter	2014/15	16
				642601	Plumber	2014/15	1

MUNICIPAL INFRASTRUCTURE SUPPORT AGENCY (MISA)

Municipal Infrastructure Support Agent (MISA)
REPUBLIC OF SOUTH AFRICA

The Municipal Infrastructure Support Agent (MISA) is a component of the Department of Cooperative Governance (DCoG) established in terms of Presidential proclamation 29 of 2012. MISA has been established to build technical capacity of municipalities to undertake efficient planning, delivery, operations and management of municipal infrastructure to develop the capacity of municipalities to sustainably deliver and manage infrastructure.

It has established a Technical Training programme to provide technical training (short skills programmes) and continuous professional development (CPD)/initial professional development (IPD) support to experienced and/or inexperienced municipal officials in the built environment professions and related trades who are already professionally registered/not yet

professionally registered to ensure technical support to the body of professional practice within the local government sector for municipal institutional technical capacity.

The MISA Technical Training Programme entails the training of municipal officials in technically-related short courses in:

- Civil Engineering
- Electrical Engineering
- Water
- Sanitation
- Waste Management
- Town and Regional Planning
- Roads and Construction.

Overall it has committed R39 975 000 to areas identified as scarce for the SIPs, made up as follows:

Table 55: Committed bursaries for 2014/15

Occupation/ discipline	No.	Unit cost	Total
Civil engineer	127	R60 000	R7 620 000
Civil Eng. technician	150	R8 000	R1 200 000
Electrical engineer	24	R60 000	R1 440 000
Electrical technician	50	R30 000	R1 500 000
Town planner	15	R60 000	R900 000

Table 56: Workplace-based learning for 2014/2015

Occupation/ discipline	No.	Unit Cost	Total
Civil engineer	135	R25 000	R3 375 000
Civil engineering technician	20	R180 000	R3 600 000
Electronic engineer	20	R180 000	R3 600 000
Town planning technician	20	R180 000	R3 600 000
Bricklayer	50	R45 000	R2 250 000
Electrician	172	R45 000	R7 740 000
Millwright	20	R45 000	R900 000
Boilermaker	20	R45 000	R900 000
Plumber	30	R45 000	R1 350 000

Table 57: UIF Contribution to the SETAs

UNEMPLOYMENT INSURANCE FUND (DEPARTMENT OF LABOUR)

The Unemployment Insurance Act (No. 63 of 2001) mandates the Unemployment Insurance Board (in Ch. 6, Section 48) to advise the Minister on (1)(a)(iii)):

(iii) policies for minimising unemployment

(iv) the creation of schemes to alleviate the effects of unemployment

As a consequence of the advice given, the Labour Activation Programmes Project was started which funds training for the unemployed. This project permits the UIF to allocate funds for training on conditions that:

- All Artisanal project the Unemployment Insurance Fund will base the maximum amount of funding on the approved National Artisan Moderation Body's grant level of R139 350
- The Unemployment Insurance Fund shall always cover a percentage of the total project costs (i.e. not full costs)
- The Unemployment Insurance Fund does not cover costs for Project Management. All proposals should be based on the normal day to day projects implemented by the applicant's organisation which will then equate to the applicant organisation already having a Project Manager in place to work together with the Unemployment Insurance Fund Project Manager for the implementation of the proposed project

In practice it has entered into partnerships with SETAs for the funding of this training, with the UIF contributing 50% and the SETA the remaining 50%. Its contribution for the current financial year is shown in Table 57.

Occupation	Implementing Partner	Projection years	Financial commitment	No of learners
Different Apprenticeship Programmes	CHIETA	2014/15	104 512 500.00	1 500
	TETA	2014/15	44 382 975.00	637
Professional Drivers	TETA	2014/15	2 966 750.00	140
End User Computing	MICT SETA	2014/15	47 700 000.00	900
Scuba Divers	TETA	2014/15	6 657 500.00	100
Pilots	TETA	2014/15	8 940 900.00	20
Seafarers (Maritime)	TETA	2014/15	5 000 000.00	250
Basic Construction	Dept. of Public Works	2014/15	30 676 000.00	850
Community House Building	Dept. of Human Settlements	2014/15	54 238 000.00	1 800
Solar Geyser Installers	EWSETA	2014/15	5 100 000.00	300

CORPORATE SOCIAL INVESTMENT

There are literally unlimited opportunities for enterprises to contribute to the SIP Skills Plan. For example, PRASA has established a Centre for Transport Studies based at the University of Cape Town and SANRAL funds Chairs for research in Stellenbosch and UCT. Where a single company is unable to fund such a Chair on their own Trust Funds could be created to which a number of firms could contribute.

Another kind of example, is included in the inset but there are many others.

MEDUPI LEADERSHIP INITIATIVE (MLI) – ESKOM

Medupi Power Station is a new dry-cooled coal-fired power station being built by Eskom and its construction suppliers near Lephalale (SIP 1). The name Medupi, is a Sepedi word for rain that soaks parched lands. Medupi Power Station has a 50 year design lifespan (2014 to 2064) and will ensure that our grandchildren have an adequate supply of energy for growth and prosperity.

Eskom has strategically facilitated a multi-stakeholder partnership for construction workforce demobilisation when the power station reaches completion. At its peak there were more than 17 644 construction workers on site. The Medupi Leadership Initiative (MLI) stakeholder forum includes suppliers, regional and national Government, organised labour and the local community. This has empowered contracted staff with added skills to access future potential opportunities in the job market. The main initiatives of the MLI are:

1. To equip the local Lephalale TVET College to be able to provide substantially more skills development opportunities in relevant work related areas.
2. Redeploy a number of demobilised constructed staff to the Drylands project. The project focuses on sustainable land management and developing a biodiversity-rich rural green economy.
3. Aggregate and coordinate Corporate Social Initiative (CSI) initiatives of MLI participants.
4. Collaboration with the local municipality to match demobilised worker supply to demand in projects such as construction and operation of bulk infrastructure, housing, schools and waste management.

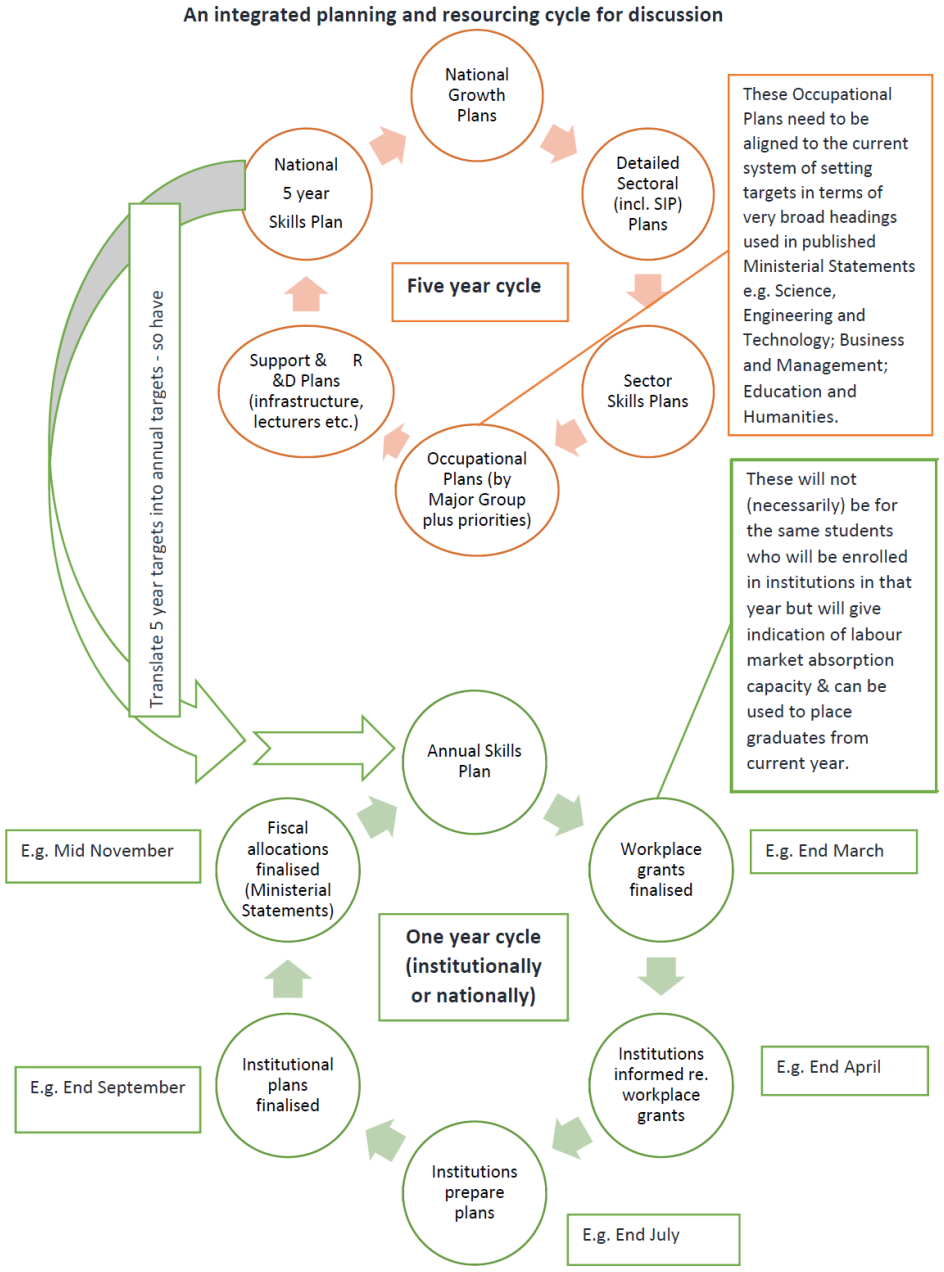
SOME THOUGHTS FOR THE FUTURE

If learners are to seamlessly traverse a learning pathway from theory to workplace to assessment and employment then there needs to be a clear funding flow for the learners between sequential phases of learning. Currently colleges and universities generally provide the theory and practical foundation and SETAs generally incentivise employers to provide workplace-based learning by offering them a grant where funds permit. Alignment between the planning cycles of universities, colleges and SETAs is desirable – with the possibility of there being a conditionality link between them (e.g. if workplaces are secured for occupations that require them, then enrolments can be publicly funded). Currently there is little alignment – indeed their planning and resourcing cycles are generally in parallel to one another as shown in Table 58:

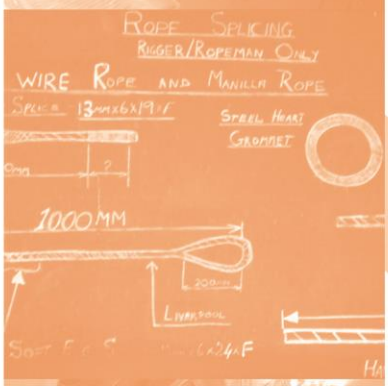
Table 58: Parallel planning cycles

Period	Current SETA planning cycle	Period	Current College planning cycle
		End March	DHET must release national enrolment targets and priorities
End April	Employers, with the concurrence of their workforce, submit Workplace Skills Plans (WSPs), together with Pivotal Plans, for the year ahead and Annual Training Reports (ATRs) for the year past.	April	Colleges commence their annual planning process for next three calendar years
End July	On the basis of these inputs, SETAs revise their SSPs, prepare Sectoral Pivotal Plans and submit them to the DHET for initial engagement.	End July	DHET must approve annual funding base-rates applicable for next college year
End August	SETAs send their first draft Annual Performance Plans (APPs), including budgets, and their proposed Service Level Agreements to DHET.	End August	Colleges must have completed the next three years plan
End September	Final annual reports with audited financial statements for previous financial year	End September	Final annual reports with audited financial statements for previous financial year
September – October	Engagement between DHET and SETAs on their APPs, budgets and SLAs	End October	Three year plan of colleges completed
15 November	SETA APPs, budgets and SLAs finalised and submitted for approval.	End November	Schedule of payments to colleges to be confirmed and communicated to colleges.
Before end March following year	Minister considers and if he agrees, he approves the SETA APP and budgets. The Director-General approves their SLAs.		

If colleges and universities knew in advance where learners might be placed (i.e. a list of employer grant approvals was available from all SETAs), this could help inform their enrolment planning. It is therefore recommended that the SETA planning cycle be brought forward somewhat to allow for this information to reach colleges and universities before they finalise their plans. Some thoughts on how this might work are illustrated below and are submitted to the DHET for consideration.



School



Theory

Practical

Workplace

Assessment

Expertise

SECTION V: INFORMING LEARNERS

Contents	Section V
Chapter 13	**Employment and career development services** *Career services* *Subject choices* *Access to learning programmes* *Access to funding*

CHAPTER 13

Employment and Career Development Services

INTRODUCTION

When all is said and done, the primary purpose of all this work is to attract more people to follow learning pathways that lead to the attainment of occupational competence, and then expertise, in one or other of the identified occupations in demand for the SIPs. So it is vitally important that information about the occupations in demand is circulated as widely as possible.

The first question is who to target?

The answer to this question is not as straightforward as might initially be thought. After all if a person is to begin at the very beginning of the learning pathway (as a student straight out of school), it will take them a longer time to complete their learning than it will take a graduate who has already completed their theory and has only the workplace learning component to complete. So when asking who to target, it is necessary to ask, when are they needed? The answer to this question determines the target audience. It will effectively be like reading the learning pipeline against a timeline, as shown in Figure 117.

The message from most private sector employers is that if the SIP projects kick off right away, they will find the skills they need (locally or abroad) to do the work, albeit in some cases at a premium price. However most agree that we must keep producing the next generation of skilled people if projects in future are not to be stalled for a lack of skills – hence the focus on education and training in this report.

Each category requires a different information strategy and purpose, all of which need to be implemented if the flow of skills from entry to expertise is to be maintained over time, as shown in Table 59.

Given that a large number of learners are not yet ready to apply for expert positions on multi-million rand SIP projects, it follows that they need to find employers who will provide them with the work experience and exposure they need to help prepare them for these positions in future

This means that ALL employers (**not just those engaged on SIP projects**) need to be targeted. Only in this way will the flow of expertise.

EMPLOYMENT SERVICES

If the need is now, employers will in general be seeking those who are already expert or at least competent. Only a small proportion (up to ten per cent) will tend to be learners. In this case the SIP Skills Plan recommends that employers and learners both use the Department of Labour's Employment Service South Africa (ESSA) system to find each other.

In brief ESSA matches work seekers to registered job vacancies. To do this it encourages work seekers to register their availability for employment (together with a profile of their skills and experience) and it encourages employers to register job vacancies, with clear criteria for the kind of person they would like to recruit.

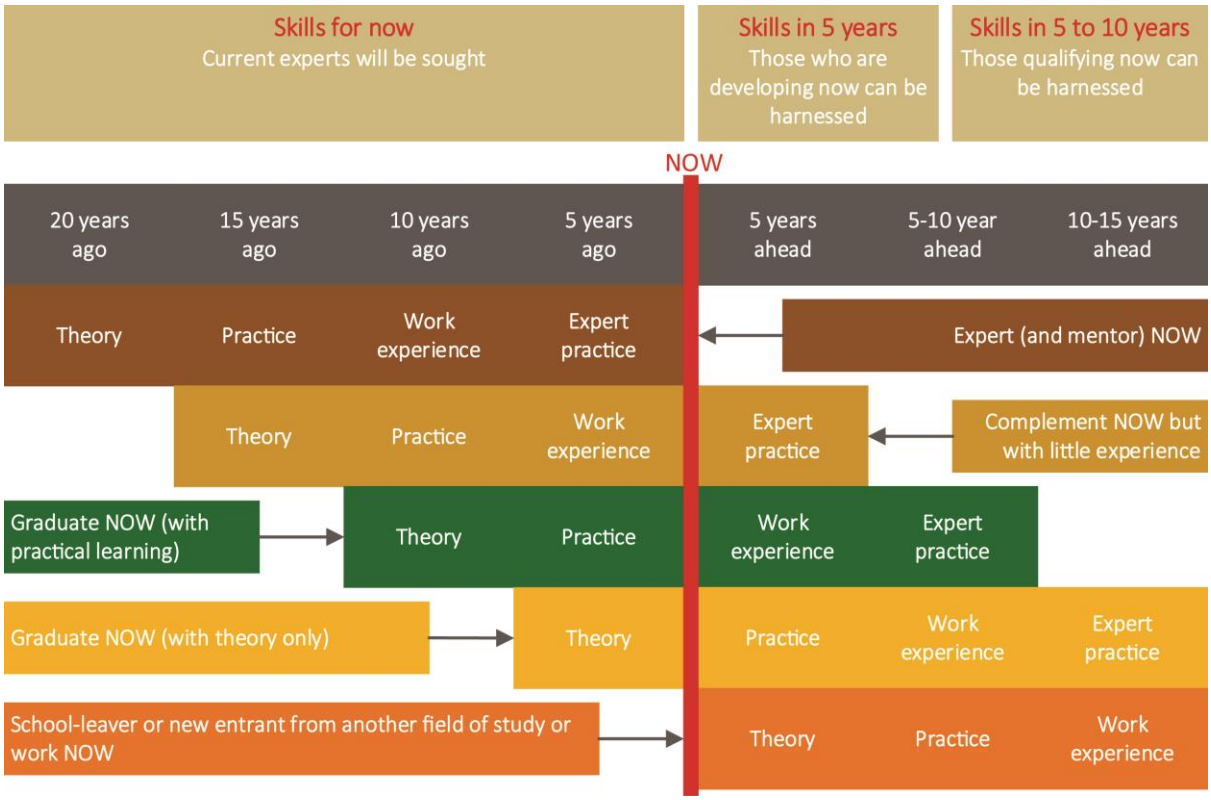


Figure 117: Learning pipeline versus timeline

Table 59: Information required to attract appropriate resources

Target group	Agencies best placed to reach the target audience	Information purpose
Expert (and mentor) NOW	Professional bodies, National Artisan Body, trade associations with networks , public sector (DPSA and DCOG)	Attract experts to mentor next generation (and to perform complex tasks carrying high risk)
Competent NOW but with little experience	Assessment agencies (professional bodies, Assessment Quality Partners of QCTO)	Attract newly competent practitioners into entry level positions
Graduate NOW (with practical learning)	Universities and colleges (e.g. through DHET)	Attract young graduates into candidacy or apprenticeship programmes
Graduate NOW (with theory only)	Universities and colleges (e.g. through DHET)	Attract young graduates into candidacy or apprenticeship programmes
School-learners and leavers	Schools	Inform school learners and leavers of options and entry requirements to encourage interest
Current workforce	SETAs and their network of employers	Identify career pathways for progression
Unemployed with related experience (for RPL)	ESSA (see below), National Youth Development Agency	Recognition of Prior Learning for accelerated pathways to occupational competence

The ESSA system generates a short list of possible matches and this list is sent to the employer to make a final selection.

The ESSA system was introduced in 2007 at the Department of Labour's 127 Labour Centres across the country. And from 5 July 2012 it has been available to work seekers and employers online [See Online Services at www.labour.gov.za and then go to Employment Services for South Africa (ESSA).

There are currently 2.9 million people registered on the ESSA database and more and more employers are making use of the ESSA System such as Eskom, Transnet, Shoprite/Checkers/Pick 'n Pay and government departments.

A copy of the names of national and provincial Department of Labour officials available to help those wishing to use the system is attached on the CD at the back of this report.

A list of all 127 labour centres is also attached.

CAREER DEVELOPMENT

Many Occupational Teams have highlighted a lack of awareness of their occupations as a contributing factor as to why there is a scarcity of relevant practitioners.

Career development services can play an important role in informing individuals about occupations in demand and in improving the match between labour demand and supply and, ultimately, in increasing employment outcomes.

The term Career Development covers services such as career advice, career guidance, career counselling, career planning, and the like aimed primarily at learners at school who are making decisions about possible careers to follow, although they also serve others who want to advance or want to change their current situations.

Wide distribution of information about these occupations to those making career choices is therefore a vital part of the solution.

The Minister of Higher Education and Training was tasked in 2010 to coordinate career development activities in the country. His department, the Department of Higher Education and Training (DHET), in partnership with other departments, agencies and institutions, is therefore creating coordinated career development services in the country.

MAJOR CAREER DEVELOPMENT SERVICES

KHETHA CAREER DEVELOPMENT SERVICES

The DHET, through a contract with the South African Qualifications Authority (SAQA), has launched a multi-platform career development service consisting of:

National Career Advice Portal (NCAP)

The National Career Advice Portal is accessible from the DHET website and provides easy-to-use information on learning pathways for occupations, (http://ncap.careerhelp.org.za).

LESSONS LEARNT ON ESSA: THE SALDANHA BAY REGISTRATION PILOT, NOVEMBER – DECEMBER 2013

A committee was established between Saldanha Bay IDZ Committee and the Department of Labour (DOL) as a means to create a partnership to ensure that individuals are up-skilled in order to equip them with the necessary skills to enable them to participate in the opportunities presented by the Zone Development. The Community Skills and Training Committee consists of two ward committee members from each ward, who meet monthly with SBIDZC Associate: Skills Development.

The Partners initiated a jointly-driven mass registration campaign (to ESSA) across the Saldanha Bay Municipality (SBM) over November and December in 2013.

Summary of results: An estimated 6,000 forms were issued over the 14 days. This relates to nearly 9% (Census, 2011) of all economically active persons in SBM (population aged between 15-65 years old is 69 411). Preliminary results from DOL indicate 16,007 persons were captured and registered from SBM on ESSA. This relates to nearly 23% of all economically active persons in SBM. Education analysis of the preliminary results indicates 50% have some secondary education, 23% with Grade 12 education, 5% with completed primary, 5% with incomplete primary education, 2% with none. Some 16% of respondents did not indicate their highest level of education. Further analysis of the data set revealed that some 4% of the 23% with Grade 12 education have listed further NQF level qualifications post matric.

Total Costs to SBIDZ LICO = R 224 066, Marketing professionals and collateral = R 109 003.38, Campaign Assistants = R 109 200.00, Emergency venue costs = R 2 500.00, Incidental costs = R 3 362.28

An interest questionnaire assists users refining their choices for an occupation before they proceed in selecting a learning pathway, and consequently a qualification and institution at which to study. Future modules will provide more information on the occupation itself, e.g. videos, link users to funding options for their studies and work-placement opportunities. This service also provides users with access to other relevant career and application information.

Note: An internet address for each of the occupations in demand is provided as part of the occupation description in this report.

National Career Advice Helpline

A dedicated team of career development specialists assist people via telephone, email,

fax, letters and social media to provide information on careers and occupations, plan for future learning and make informed career decisions. The helpline is accessible through **calling 0860 111 673 and sending an SMS or 'Please Call Me' to 072 204 5056**.

Central Applications Services

At the moment through the dedicated helpline team of career development specialists, people are assisted to better understand their achievements and to plan for future learning and career options (http://cach.dhet.gov.za). This service is to be fully developed into a Central Applications Services that will provide a single point of access to learning programmes linked to funding opportunities for qualifying learners across the PSET system.

Radio Programmes

Weekly programmes are broadcast in 10 different languages to advise the public on topics such as choosing and funding of studies, career choices such as apprenticeships and experiential opportunities such as learnerships and internships. A schedule of programmes is available on the CareerHelp website (http://www.careerhelp.org.za).

Website and Mobi-site

The website provides a comprehensive, quality-assured collection of information on career development in South Africa (http://www.careerhelp.org.za). The site is mobile-friendly for viewing on small screens. Users of Facebook can make contact through this service (http://facebook.com/careerhelp).

Print resources

Print resources are available that highlight the importance of subject choice, encourage early application for the post-secondary school institutions, and provide guidance on learning opportunities. These resources are distributed directly to schools, at career expos and in training workshops. Some publications may be downloaded in portable document format (PDF) from the CareerHelp website (http://www.careerhelp.org.za). Most significant is the Apply Now! Booklets that are distributed to all grade 12 learners each year and provide comprehensive information on most of the career development topics relevant to school-leavers.

Training and Support Services

A dedicated team of career development practitioners provides career development training to student support service staff at TVET colleges throughout the country. The team also provides career advice at career expos and reaches people in poor and deep rural areas.

Walk-in Service

A standardised model for career development services walk-in centres has been developed which is being expanded to TVET colleges, labour centres and other centres that provide career development services. The standardised model is helping to ensure a trustworthy baseline of quality assured service to the public.

Decade of the Artisan

The DHET is managing the Decade of the Artisan to promote artisanship as a career of choice to South Africa's youth, particularly to ensure that South Africa develops the necessary artisans to successfully implement the country's Strategic Infrastructure Projects. This is an integral part of the career development services that the DHET is offering.

SETA CAREER DEVELOPMENT SERVICES

SETAs offer sector specific career development services including reports on sector scarce skills, career guides/booklets, career information distributed through career exhibitions, learnerships and career videos. SETAs are the crucial link between the education and training providers and the workplace. Contact details for all the SETAs are provided on the CD at the end of this report.

NATIONAL YOUTH DEVELOPMENT AGENCY

The National Youth Development Agency (NYDA) has 14 branches which offer career development services to young people in-school, out-of-school and unemployed. They have a career guidance manual which caters for the outlined youth categories. The career guidance manual provides John Holland's assessment questionnaire which helps young people prioritise relevant careers based on their interests. At the beginning of each year, the NYDA conducts a *Start Here Campaign*. The campaign is about creating awareness on careers and the necessity of correct subject choices for Grade 9 learners. Information dissemination is further conducted through attendance of career exhibitions. Furthermore, the NYDA has a Job Seekers Database which registers unemployed youth and work opportunities.

ENGENIUS INITIATIVE OF ECSA

The Engineering Council of South Africa (ECSA), established by the Engineering Profession Act, (Act no 46 of 2000) together with its recognised voluntary associations committed themselves during 2010 to establish and manage a campaign called Engenius.

The Engenius Campaign is a nationally coordinated stakeholder campaign to grow and transform the engineering profession by attracting sufficient numbers of suitably qualified learners representing the demographics of South Africa. This would be achieved by:

- Promoting national collaboration, coordination and support amongst partner organisations involved in advancing the engineering profession.
- Empowering partner organisations to communicate the Engenius message.
- Promoting the engineering profession nationally to primary and high school learners through its message.

GOVERNMENT DEPARTMENTS

The following departments also have career development activities that take place throughout the year. This list is not exhaustive and some other departments may have career development activities that are not mentioned here.

Department of Labour

The Department of Labour (DoL) has 127 labour centres across the country with 95 career counsellors. Career advice is one of the services provided in the labour centres. Information on careers is also distributed through outreach programmes. The DoL developed the Employment Services Systems (ESSA) database that registers the unemployed as well as available work and learnership opportunities. There are two ICT enabled trucks that are used to ensure accessibility of ESSA to people in rural areas who may not easily have access to the internet.

Department of Basic Education

The Life Orientation Curriculum includes themes on Career Development from the early grades. Life Orientation teachers are equipped with resources and training to provide career development services in schools. The Department of Basic Education (DBE) furthermore coordinates Girl Education Movement and Boy Education Movement (GEM/BEM) clubs in schools focusing on providing lifeskills and career information to learners. The department also organises special career development programmes such as a career dress-up day and camps as part of career awareness for learners. The DBE further issues a subject choice guide for Grade 9 learners.

Department of Science and Technology

The Department of Science and Technology (DST) coordinates a national science week as part of creating awareness and promoting careers in science and technology. The DST hosts camps, science festivals and programmes targeting Dinaledi Schools.

Department of Environmental Affairs

The Department of Environmental Affairs (DEA) hosts biodiversity career development workshops in rural schools. The purpose of these workshops is to expose learners in rural areas to biodiversity linked to rural environment. They have a career booklet which is distributed to learners. Through the sustainability week initiative, the DEA exposes learners to global challenges. There are other activities for promoting environmental sector careers for learners and unemployed youth.

Department of Defence

The Department of Defence (DoD) has developed a video showcasing all careers available within the department. Brochures on careers are available for learners and educators. The DoD attends career exhibitions to display information on careers in their sector.

SUBJECT CHOICES

Many of the occupations in demand require new entrants to have achieved certain levels of competence in mathematics, science and technology. It follows that learners have to know this when they make their subject choices at the end of grade 9. The DBE issued a subject choice guide to schools for Grade 9 learners. This guide aims to provide information to grade 9 learners to select the correct combination of subjects in order to pursue their interest and career of choice. This information is also accessible in the DHET's Apply Now! Booklet.

For example, entry into engineering degree programmes requires at least a C in mathematics and science, criteria which also apply to many other scientific and technical occupations such as science, medicine, law, accountancy and teaching degrees in mathematics and physical science. Passing paper 3 and AP Maths greatly increases success rates. Many trades also require a minimum level of mathematics, science and drawing as entrance requirements, the level depending on the trade.

The Department of Basic Education's reports indicate a 17% decline in the number of candidates who wrote mathematics between 2009 and 2013 (from about 290 400 to 241 400). At the same time, the number of candidates writing mathematics literacy rose sharply to 58% of the 2013 cohort.

Likewise, the number of candidates who wrote physical science has also fallen by 17% over the same period (from about 220 900 to

184 300). Critically, as the number selecting mathematics is declining, the overall number of learners who achieve an NSC pass with more than 40% in mathematics has been falling over the same period to 17% of the class of 2013.

This means that national pool of learners able to choose an occupation which requires mathematics is very limited, impacting on the numbers required in terms of infrastructure delivery. Addressing this is a national priority.

ACCESS TO LEARNING PROGRAMMES

Each education and training institution currently manages access to its own learning programmes. This brings about a number of challenges relating to equal opportunity for access. Applicants need to pay an application fee for each institution they apply to. Applicants with little access to information and/or financial resources are not able to apply as extensively as the privileged few.

The 2013 White Paper for Post-School Education and Training states: 'After it is fully established, the Central Application Service (CAS) will be extended to TVET colleges. It will promote greater equity of access for all students, particularly the poor, for whom multiple application fees can be prohibitive. Over time, the CAS will replace all other application systems, preventing student walk-ins and building a national culture of applying early for PSET opportunities.'

The development of the CAS system is currently under way with the first phase of piloting to be conducted with universities. Once fully functional, the CAS will service the entire PSET system.

While there will be one application system for the whole of the PSET system, admission decisions will remain the prerogative of the institution itself. This too has been confirmed through the White Paper where it states that 'The CAS will not change the ability of institutions to make their own admission decisions'.

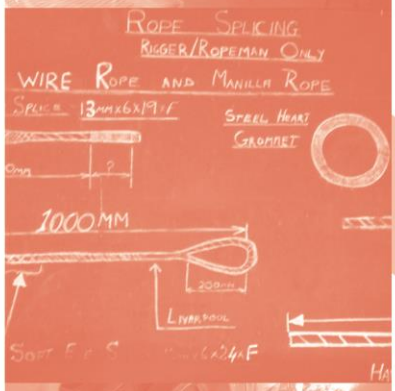
ACCESS TO FUNDING

The South African government has made the National Student Financial Aid Scheme (NSFAS) available for TVET Colleges, Universities and Universities of Technology. The aid is available in the form of bursaries and loans. Students are able to process applications through the post-school Education and Training Institutions. Some government departments like the DBE's Funza Lushaka scheme and the DST offer bursaries. While not all SETAs offer bursaries, some, such as the LGSETA, FoodBev SETA and Bank SETA are amongst those that offer bursaries. Learners can also apply for the Solomon Mahlangu Scholarship offered by the NYDA.

RECOMMENDATIONS

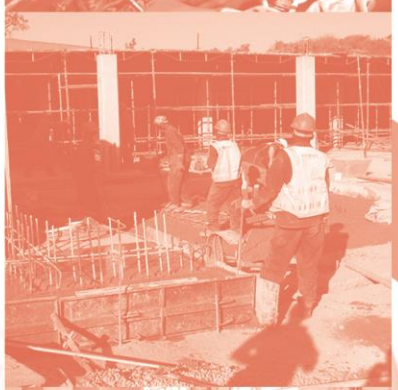
- Develop generic career development information resources for career development centres, learners and teachers
- Ensure that brochures on all occupations are prepared and distributed through workshops and career exhibitions
- Coordinate career development initiatives for the infrastructure programmes
- Harness Occupational Teams to quality assure content of the NCAP website
- Harness Occupational Teams to present on Khetha radio programmes
- Expand the Ingenious initiative of ECSA to all built environment professions
- Develop Ingenious-type programmes for the trades.

School



Theory

Practical



Workplace

Assessment

Expertise

SECTION VI: GOING FORWARD

CHAPTER 14

Going Forward

OVERVIEW

The vision of **A Better Life for All** is the purpose for which we are all working. And what could better represent this journey than infrastructure? Infrastructure connects the historically divided worlds of apartheid. Roads and railway lines that join worlds that influx control tried so hard to separate; power stations, solar parks and wind farms that bring light and means to homes, factories and farms; water systems that enable us to carefully manage and share this precious life giver; broadband that connects us to the world; radio telescopes that help us explore the beyond; all this physically manifesting the bonds we must build if our desired destination is to be reached.

The government has said that **Together, we can do more**. Perhaps this should now be reformulated: **Together, we must do more**. Certainly we must also work smarter if poverty is to be eradicated, if inequality is to be radically reduced and if unemployment, especially for the young, is to be reversed.

The blockage we must overcome is the blockage of silo working – not only within government, but between government and its social partners and indeed between social partners themselves. A mind-set of them and us is the mind-set of a society blighted by inequality, racism, sexism, xenophobia and fear. Of course there are many examples of collaboration already – and the various Accords signed stand high on this list – but these new ways of working need to be built into the way we do our routine 'day jobs'.

The National Infrastructure Plan itself points the way. It was conceptualised as a national endeavour – with many government departments and agencies combining behind it as a vital component of the broader National Development Plan. The Presidential Infrastructure Coordinating Commission (PICC) also symbolises the collaboration on which the plan is built, as too do the eighteen Strategic Integrated Projects (SIPs) – combining, as they do, multiple sectors and multiple actors.

This collaborative way of working is just as relevant to the task of **skilling South Africans for and through SIPs** as for the SIPs themselves. Indeed the very architecture of the Occupational Teams (the authors of the individual contributors to this report) was informed by this imperative – integrating as they do those who need to employ the skills as well as those responsible for driving their development and ensuring their quality.

GOING FORWARD STRENGTHEN: THE MODEL

There are a number of ways in which the model used to generate the scarce skills list might itself be strengthened. At the front end there is a need to improve some of the definitions and the tools used to generate the skills gap signifiers. This will be an ongoing challenge and should be seen as central to the task of the Skills Planning Unit envisaged in the White Paper.

At the 'back end' there is the need to include new sets of data into the modelling exercise:

- The first of these is the most urgent and that is the need to include operations and maintenance into each prototype or to generate new prototypes for this phase of the life cycle of assets. This is currently a serious gap especially given that the bulk of the state's

funds are budgeted for maintaining existing infrastructure (and indeed should be);

- The second is the need to include the skill requirements of government more systematically into the work done. Currently the data contained in the prototypes is principally that of the planning, development and construction phases of the life cycle of assets, and does not focus on the skills that government departments need to generate the work or oversee the contracts generated and take over responsibility once the work is completed. The work relating to the rollout of the IDMS will be central to this. Pioneering work that is currently underway in the Water and Sanitation sector will also greatly inform this work.
- The third is to expand the prototypes for those sub-sectors which have not yet been developed and to use them to estimate the skill requirements for a greater percentage of planned, considered or proposed projects.
- The fourth is to develop skill prototypes for the localisation thrust of the National Infrastructure Plan. This envisages that local firms will be developed or expanded to deliver needed inputs into the SIPs projects – such as bitumen for roads, concrete for buildings, pumps and other enablers for large processing plants like water refineries etc. These projects will also require skills and these too need to be planned.
- Then to explore ways in which the down-stream possibilities that the new infrastructure opens up are exploited to the full by the local communities they serve.

This work will be incrementally done whilst at the same time, through review and evaluation, be progressively improved.

GOING FORWARD: STRENGTHEN THE OCCUPATIONAL TEAMS THEMSELVES

When considering the way forward, the first point to be made is that the Occupational Teams (and their networks) themselves need to be strengthened.

There is no doubt that some teams were stronger than others. Where there was an existing organisation – such as a professional body, a trade union or an employer association with a strong interest in the development of the identified skills – then the teams were strong, but where there were no such organisations, then the Intermediate Bodies or the DHET itself had to find individuals from whom advice could be sought. This is no doubt evident from the uneven quality of the individual reports themselves.

The strengthening of the Occupational Teams depends on both the direct membership of the Teams as well as the networks from which they are drawn. Each of these dimensions for each of the occupations can be interrogated and, where needed, improved. This is a task for the DHET, the Intermediate Bodies as well as the communities on which they draw.

This need not only be a top down activity. Individuals or constituencies are invited to approach the DHET or the Intermediate Bodies (contact details are provided on the CD attached) if they wish to contribute to the work of one or other of the Occupational Teams or form new ones. Groups that already perform the function of an Occupational Team, such as Advisory Bodies, are also invited to approach the relevant Intermediate Body if they wish to join this initiative. Naturally there are criteria that will inform the response, such as whether the occupation already has an Occupational Team or not, whether the group has national reach and so on – criteria that will be formalised by the DHET in due course if Occupational Teams become a living part of the Post- School Education and Training System – nevertheless these should not discourage people from applying as we are learning as we go.

NETWORKS

Occupational Teams are not small groups of people who work in isolation from the communities from which they are drawn, as outlined in greater detail in Chapter Four. An electronic portal has been developed to facilitate this community engagement and all are invited to use it to express their views on the plethora of topics associated with the development of their occupations. The website which provides access to this portal is https://sip-skills.onlinecf.net

It is hoped that employers and unions embrace this opportunity with both hands as it provides them with what they have for many years been asking, namely a platform that they can use to influence qualifications and curricula at institutions. It is hoped that they, individually and through their organisations, will actively participate in these Occupational Teams going forward.

GOING FORWARD: IMPROVING THE QUALITY OF THE ADVICE PROVIDED

This first generation set of reports points the way, but it can of course be improved. Over and above improving the participation of interested communities of expert practice into the generation of future reports, further research and developmental work is also required on such topics as:

- How capital spending rates impact on skill demand and how this should be understood
- How many people legitimately carry the full occupational title of each of the priority occupations now (this is not now known and estimations have had to be made)
- What definitions should be used by Statistics South Africa so that when people claim to be a plumber or an electrical engineer when answering the Quarterly Labour Force Surveys or the Census, they are indeed qualified to claim that title and it is right to count them
- How might these improved definitions be used to improve our national statistics?
- What is the replacement demand rate for different occupations
- How should we nationally define scarcity
- What range of specialisations is associated with each occupation? How and when are they best learnt
- How might progression from novice, to competent, to expert and mentor, best be facilitated? And how might the boundaries between related occupations best be traversed progressively?
- How do geographical factors (including international mobility) affect different occupations?
- How might the work done internationally best feed into the Occupational Teams' work?
- How might more penetrating research questions be answered and fed back into the Occupational Team planning process?

These are some of the questions which have challenged the authors of this report and which, going forward, need to be researched. New partnerships will need to be entered to explore these going forward.

Central to this process will be the need to interface with the findings and recommendations of the Department's own Labour Market Intelligence Project (LMIP), which is a partnership with the Human Sciences Research Council (HSRC) and the University of the Witwatersrand's Researching Education and Labour (REAL) unit. This project will submit its findings in 2015, at which point full engagement between the insights gained can be explored.

GOING FORWARD: INTERNATIONAL PARTNERSHIPS

There is a wealth of information available internationally. This information needs to be gathered more actively so that we can leapfrog over certain developmental phases in our own processes.

The work kindly done for this report by Alexander Gloss and Lori Foster Thompson from North Carolina State University in the USA entitled **Estimating the underlying characteristics of South Africa's critical/scarce occupations: A proof-of-concept study** (4 August, 2014) is an excellent illustration of this. Their report is briefly summarised below and the full text is included in the CD appended to this report. Occupational Teams are invited to reflect on the content of this report going forward:

'Estimating the underlying characteristics of South Africa's critical/scarce occupations: A proof-of-concept study' Alexander Gloss and Lori Foster Thompson, North Carolina State University, USA, 4 August 2014.

'This report presents a proof-of-concept attempt to estimate the underlying characteristics of occupations identified as scarce in, and/or critical to, South Africa. To estimate these characteristics, a correspondence is made between South Africa's Organising Framework for Occupations (OFO) 2013 and the United States Bureau of Labor Statistics' Standard Occupational Classification (SOC) system. Tentative matches between 85 of 92 OFO 2013 critical/scarce occupations with 59 SOC occupations were established through a crosswalk and rational review. The correspondence between the two occupational classifications/frameworks then allowed occupational information from the United States Department of Labor's Occupational Information Network (O*NET) to characterize the critical/scarce occupations. Information used from O*NET includes over 6,400 ratings of occupations' person-oriented (e.g., knowledge, skills, and abilities), work-oriented (e.g., general and detailed work activities), and contextual (e.g., work hazards and tools/technology) characteristics. Ratings for these occupational characteristics exist across occupations facilitating comparisons between occupations (e.g., two occupations can be compared by the degree to which job incumbents tend to rate the skill of critical thinking as important).

Descriptive results are provided in order to demonstrate the potential to characterize critical/scarce occupations in terms of their underlying characteristics. The potential policy implications of future studies which obtain more rigorous correspondence between the OFO and SOC occupations are introduced and next steps to undertake and validate such a study are discussed.'

CHIETA has undertaken their own investigation of the O*NET system and incorporated their findings into their own 'Occupation Profile Dictionary, 2013'. This shows how this information might be localised.

Further conversations with our international partners, who have struggled with this question for longer than we have, are already under way. Of particular importance are the two projects under way under the Social Dialogue facility of the European Commission – 'New Skills for New Jobs' and 'International Skills Planning'. These have just begun and will be reported in due course.

GOING FORWARD: SYSTEMIC IMPLEMENTATION OF THE ADVICE GIVEN

As outlined in Chapter 12, there are structured planning cycles undertaken for universities, colleges and SETAs on a five-year and annual basis. The advice given by OTs needs to be evaluated and costed and then fed into these processes so that decisions can be taken and implemented.

LESSONS FROM THE SETAS

A pilot run has already been undertaken with the SETA community. The first set of draft Occupational Team reports were presented to the SETAs in January 2014. The SETAs

considered the advice contained in these reports in the light of their own Sector Skills Plans and selected a sub-set of actions that served both purposes. They then made firm funding commitments against individual occupations (to support the theory or workplace components or to support those 'other' elements that will support expanded delivery in future). These commitments were then consolidated by occupation and conveyed back to the Occupational Teams. In total there is R796 688 551 currently in terms of funding available to take forward the advice given. This has unleashed energy and resources for the SIPs. A full copy of the commitments that have been made is included in the CD attached to this report.

The challenge now is to ensure that the committed funds are spent efficiently, effectively and quickly. To facilitate this process a list of the SETA contact names and details of the individuals in each SETA who can assist those interested in accessing the funds is provided on the CD attached to this report.

The SETAs however will not be sitting idle waiting for applications to arrive, they will be advertising these grants to the workplaces within their sectors and encouraging companies to apply for them. Employers are strongly encouraged to take up this offer. Where the funds are directed at institutions then these will be advertised to the relevant bodies.

Similar processes will also inform decisions taken by the National Skills Fund.

UNIVERSITIES AND COLLEGES

Similar processes have begun in relation to colleges and universities but, as their planning processes are different, their role too is somewhat different, although they too are critical planners in the system.

The detail of Chapter 12 will not be repeated here, but universities and colleges should consider the advice contained within this report when they plan for the years ahead. The DHET should consider this advice when they evaluate the plans received and should use the information contained in this report when advising the Minister on allocations to be made – although clearly choices will have to be made given the limitation of national resources.

Where institutions have discretion – such as to which faculty or department to allocate ear-marked funds – they too should consider the advice given in these pages. It is recommended that this consideration should be undertaken in a systematic way at all institutions. However, it is fully appreciated that each institution has its own areas of priority and that they will engage primarily with those areas of advice that are relevant to them.

WORKPLACES

PUBLIC SECTOR

The rollout of the Infrastructure Delivery Management System (IDMS) in government is a major project in its own right. The pioneering work done in the Departments of Water and Sanitation, in the Municipal Infrastructure Support Agency (the component responsible for support to municipalities of the Department of Cooperative Governance), by the Institute of Municipal Engineers of Southern Africa as well as the National Treasury and the Construction Industry Development Board (the original authors of the IDMS) at provincial level with the Departments of Basic Education, Health, Public Works and Finance shows the way. All

of the above groups have met to discuss a collaborative model going forward and this is an exciting new area for the next phase.

GOING FORWARD: COORDINATION

From the SETA experience, it is evident that some areas are more popular than others. It was found, for example, that some managerial occupations were 'over supported' i.e. that more money was allocated to them than was requested in the first report, while some professional, trade and other occupations were under-funded or not funded at all.

The same problem could easily arise from a laisse faire approach to institutional planning, leaving occupations in demand over-subscribed or unattended to.

This issue can only be addressed at a level above that of individual sectors or institutions. In practice, the level at which this coordination needs to be undertaken is different for universities, TVET colleges and the envisaged community colleges:

- University coordination is clearly a national matter and is managed through the Enrolment Planning and Programme Qualification Mix (PQM) process of the University Branch of the DHET;
- TVET college coordination is probably better managed at provincial level – but the oversight and steering of this process needs to be managed nationally by DHET following the shift of function from province to national government. In this regard it should be noted that the DHET, together with the SIP Skill Coordinators, has met with representatives from the Premiers' offices and a debate about the identification of provincial Centres of Specialisation for different occupations has begun and will similarly also have to linked to enrolment planning and a PQM process.
- Community College coordination is a new area that will have to evolve alongside these new institutions. However it is anticipated that coordination will have to take place closer to the ground, perhaps at district level but within national guidelines.

The Minister of Higher Education and Training, supported by his department, will have to take this process forward and arbitrate over competing claims for scarce public resources. They will also have to resolve competing advice from different constituencies within a single occupational community where this occurs. Their decisions will have to be informed by the broader National Development Plan and the resource availability.

The Coordination of the Occupational Teams is also an issue. The Intermediate Bodies have frequently asserted that this work is very time-consuming and requires full-time attention. Going forward it will be considered whether this should not become a full-time function with dedicated people and resources.

GOING FORWARD: MEASURING PROGRESS

Our monitoring and evaluation tools do not yet enable us to track learner achievement through occupational pathways. For example, while we know the number of learners completing a particular qualification, it is not known whether they proceed to attain a professional designation or trade qualification or occupational licence (or what happens to those that do not do so – do they nevertheless proceed to apply the skills learnt or do they leave the field entirely?)

As a first step towards being able to do this, institutions and entities (like the public providers, SETAs and professional bodies) will have to report administratively on the numbers that pass through their ranks – at a more granulated level than many currently do

i.e. at a level which permits mapping to specific occupational pathways. They will also have to grow the ability to trace their learners.

As a complementary measure, a powerful management information tool will need to be developed to assist in this process. The work that has been done by the artisan grouping is indicative of the kind of system that is envisaged.

GOING FORWARD: CALL TO ACTION

GOVERNMENT DEPARTMENTS

It is hoped that the methodology used in this report is useful for government. Indeed national, provincial and local governments are invited to consider ways in which it might be useful to them. One example might be the methodology of developing prototypes (skill profiles) for skills planning purposes. The validated prototypes that have already been developed are available and can be accessed from the website (https://sip-skills.onlinecf.net)[63]. The DHET is happy to share its experiences (please contact the Special Projects Unit in this regard: 012 312 5637 or bird.a@dhet.gov.za). The information is also provided to assist SIP Skill partners, wherever they may be, to identify niches where they might contribute and encourage them to take the initiative to do so.

Below some of these possibilities are illustrated, but there is no desire to restrict the inventiveness of citizens with resources or expertise to contribute in new ways.

Employers (public or private)

- Offer quality workplace learning opportunities for learners (with or without grants from SETAs)
- Identify specific areas highlighted in one or other of these Occupational Team reports to which a specific contribution could be made
- Invest Corporate Social Responsibility or Departmental funding (alone or together with others) into projects that support one or more of the needs identified
- Establish partnerships with colleges and universities for enrichment of particular programmes linked to needed occupations e.g. funding of Chairs at university or similar initiatives at college level, offering workplace learning for lecturers or donating equipment
- Participate in Occupational Teams which relate to critical skills needed for your business (contact Intermediate Bodies)
- Comment on reports generated by Occupational Teams to ensure relevance to your business arena (contact Intermediate Bodies)
- Work with your SETA to improve their capacity to deliver grants timeously to those offering quality training.

INDIVIDUAL COMPANIES OR EMPLOYER ASSOCIATIONS COULD RISE TO THIS CALL

Trade unions

- Nominate members with the relevant skills to participate in Occupational Teams
- Welcome learners into the workplace and help ensure that they receive quality learning opportunities
- Grasp learning opportunities where they are provided.

Individual colleges or universities

- Embrace this opportunity to contribute directly to the nation's dream and identify areas where specific contributions can be made and plan accordingly
- Establish partnerships with employers and expand learner and lecturer placements to enhance responsiveness
- Direct research students to address some of the areas identified in this report to assist in the national effort to improve the quality of these reports going forward
- Volunteer lecturers to participate in Occupational Teams or to become part of their

networks to comment on the reports generated

Professional bodies and voluntary associations

Contribute to and help implement the Occupational Team reports as suggested.

Others not individually mentioned

Wherever you are, seek ways of contributing to the national effort and make links with others so that our combined efforts can compound and the achievement of our goals accelerated.

GOING FORWARD: NEXT STEPS

As a first step, it is hoped that all will read this report and its recommendations. Should you wish to make corrections or suggest improvements to the advice given, then you are warmly invited to do so by submitting your input onto the portal (https://sip-skills.onlinecf.net).

However if you concur with the advice given then you are invited to explore ways in which to action it.

In order for us to be able to acknowledge those who respond to this call and for us to be able to monitor progress against the advice given, a special progress reporting template has been provided on the portal and you are invited to enter an account of your initiative against the relevant occupation and intervention item on the portal.

The DHET plans to prepare a consolidated report of initiatives taken before the end of this financial year (i.e. by March 2014). Your initiatives will be individually acknowledged if they have been reported on the Portal.

Further planning interventions will also be initiated to ensure that critical areas are timeously addressed. Details will be posted on the portal and distributed electronically when available.

Portal address

Please post your comments as well as reports of initiatives taken on

https://sip-skills.onlinecf.net

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- **SIP 4** – SANRAL (Ms Ntebogeng Kgomo; Mr Thabiso Malahleha, Ms Caretta Madlabane)
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- **Elementary and non-trade production workers Cluster** – Construction Industry Development Board-cidb (Ntebo Ngozwana, Mr Pranveer Harriparsadh and Mr Thabelo Ramau).

OCCUPATIONAL TEAMS

The four components of the Occupational Teams are listed below. Individuals are not listed as there were simply too many to name. To all, a very sincere thank you.

THEORY AND PRACTICAL

Higher Education Institutions

- Cape Peninsula University of Technology
- Central University of Technology
- Durban University of Technology

- Nelson Mandela Metropolitan University
- North-West University
- Rhodes University
- Tshwane University of Technology
- University of Cape Town
- University of Johannesburg
- University of KwaZulu-Natal
- University of Pretoria
- University of South Africa
- University of Stellenbosch
- University of Venda
- University of Witwatersrand

TVET Colleges

- Africa Training Centre
- Boland TVET College
- Central Johannesburg TVET College
- College of Cape Town
- Eastern Cape Midlands TVET College
- Ekurhuleni East TVET College
- Elangeni TVET College
- Gert Sibande TVET College
- Majuba TVET College
- Maluti TVET College
- Northlink College
- Orbit TVET College
- Sekhukhune TVET College
- Tshwane South TVET College
- Umfolozi TVET College
- Vhembe TVETCollege

Private Training Centres

- Africa Training Centre
- Amohelang Training Company
- Archonemulti Training Centre
- Centre for Logistics Excellence
- Goldee Trading Academy
- MCD Training Centre
- MOD Training Centre
- Nowethu Learning Institute
- Pro Can Skills Centre
- Rainbow Skills
- SEIFSA Training Centre
- Shine Mzanzi Skills Training and Development
- South African Paint Industry Training Institute
- Thule Training and Placement Consultant
- Tjeka Training Matters
- Tom Richards and Associates
- Training for Result
- Transvaal Training

WORKPLACE

Employers and Employer Associations

- AECOM
- Anglo American
- Anglo Platinum
- Arcelor Mittal
- Aurecon
- Aveng Grinaker-LTA
- Barlow
- Basil Read
- Carbon & Energy Africa
- Cargo Carriers
- Cargo Grey Stones
- Contractors Plant Hire Association
- Diesel Power
- Duma Empire
- ENNIS-FLINT
- Freightmax
- Goba
- Group Five
- Impala Platinum
- Imperial Logistics
- Intergraph
- Knight Piesold
- Lakeshore Trading
- Master Builders South Africa
- MCC
- Murray & Roberts
- National Business Initiative
- Nyeleti
- PIPP
- R&H Rail
- RHDHV Consulting
- RHP Consulting
- River Wood
- Road Pavement Forum
- SAFCEC
- SARTSMA

- Sasol
- SMEC South Africa
- South African Breweries
- Sterling Plant Hire Gauteng
- The Duma Empire
- The Road Freight Association
- Torque-IT
- Total Geo-spatial Information Solutions
- Trail Surveys
- Ubuhlebethu Business Enterprise
- Unitrans
- WBHO
- WSP Group Africa

Public Sector Employers, Components and Agencies

National Departments

- Agriculture
- Basic Education
- Communication
- Cooperative Government
- Correctional Services
- Economic Development
- Energy
- Environmental Affairs
- Health
- Home Affairs
- Human Settlements
- Labour
- Municipal Infrastructure Support Agent
- National Treasury
- Public Enterprises
- Public Service and Administration
- Public Works
- Rural Development and Land Reform
- Social Development
- South African Revenue Service
- Tourism
- Trade and Industry
- Transport
- Unemployment Insurance Fund
- Water and Sanitation

State- Owned Companies and State- Owned Enterprises

- Eskom
- Industrial Development Corporation
- National Home Builders Registration Council
- South African Air Force
- South African National Roads Agency
- State Information Technology Agency
- Transnet

Municipalities

- City of Tshwane
- eThekwini Metropolitan Unicity
- South African Local Government Agency

Provincial Departments

- Limpopo and Mpumalanga Agriculture

SETAS

- Agricultural SETA
- Culture, Arts, Tourism, Hospitality, Sports SETA
- Construction SETA
- Chemical Industries SETA
- Food and Beverage SETA
- Fibre Processing & Manufacturing SETA
- Local Government SETA
- Manufacturing Engineering and Related Services SETA (including support for research, logistics and consultation)
- Media, Information and Communication Technologies SETA
- Mining Qualifications Authority
- Public Service SETA
- Services SETA
- Wholesale and Retail SETA

ASSESSMENT

Statutory Bodies

- Engineering Council of South Africa (with special thanks for access to reports and extensive datasets)
- South African Council for Natural Scientific Professions
- South African Council for Planners
- South African Council for Professional and Technical Surveyors

- South African Council for the Architectural Profession
- South African Council for the Landscape Architectural Profession
- South African Council for the Project and Construction Management Professions
- South African Council for the Quantity Surveying Profession

Quality Councils and Associated Bodies

- National Artisan Moderation Body
- Quality Council for Trades and Occupations
- South African Qualifications Authority

Voluntary Associations

- Aeronautical Society of South Africa
- Association of Construction Project Managers
- Association of Construction Project Managers
- Black Business Council in the Built Environment
- Chartered Institute of Management Accountants
- Chartered Institute of Purchasing and Supply
- Consulting Engineers of South Africa
- Environmental Assessment Practitioners of South Africa
- Geo-Information Society of South Africa
- Institute for Timber Construction
- Institute of Information Technology Professionals South Africa
- Institute of Municipal Engineers of South Africa
- Institute of Plumbers of South Africa
- Institute of Timber Construction
- International Association for Impact Assessment
- South African Geomatics Institute
- South African Institute for Industrial Engineers
- South African Institute of Architectural Technologists
- South African Institute of Architectural Technologists
- South African Institute of Draughting
- South African Institute of Draughting
- South African Institute of Electrical Engineers
- South African Institute of Non- Destructive Testing
- South African Institute of Physics
- South African Institution of Civil Engineering
- South African Institution of Mechanical Engineering
- South African Quality Institute
- Southern African Bitumen Association
- Steel and Engineering Industries Federation of Southern Africa
- The Society for Automation, Instrumentation, Measurement and Control
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- World Wildlife Fund

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[62] The Occupations identified through the processes outlined in this report constitute national priorities. They were therefore circulated to the universities, colleges and SETAs during their planning cycles in 2013/14. The process followed, and the agreements reached for each of DHET's institutions, is now elaborated at greater length.

[63] Note: only those prototypes which have been quality checked are included on the website.

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economic development

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