the dti

Assessing the human capital outlook implications for skills development in the priority sector: Metal fabrication, capital equipment and transport equipment

Final report

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Executive summary

The objective of this study is to assess the demand and supply of skills within the metal fabrication, capital equipment and transport equipment sectors between 2011 and 2015. The study aims to inform **the dti** – as a key interface between economic strategy and skills planning in South Africa – in the development of a medium to long-term skills planning capacity.

The metals fabrication, capital equipment and transport equipment sector forms a significant part of the manufacturing industry. The sectors accounted for 44% of manufacturing sales (in Rands) and 29% of manufacturing employment in the final quarter of 2010.

Based on data availability and international and local literature, a **scenario based methodology** is employed to forecasts skills demand. The scenario model is a method to address the unknowable future by providing an overview of a set of possible outcomes.[1] In this document, 5 growth scenarios are applied along with 3 labour elasticity scenarios (how sector growth translates into employment growth). The result is the 15 potential outcomes shown below. The demand for new employment is added to replacement demand (due to retirement, mobility, mortality, and migration) to give the overall demand by occupation. The main source of data is StatsSA Quarterly Labour Force Survey, which has employment data on 62 occupations relevant to this study. These occupations are grouped into 6 major categories for ease of presentation for the majority of the document.

Table 1: Employment growth scenarios

Sector growth	Labour elasticity		
	Scenario a: Unit elasticity, 1:1	Scenario b: Baseline scenario, 0.8 elasticity	Scenario c: Underperformance, 0.5 elasticity
Scenario 1: 5% p.a.	5.0%	4.2%	2.5%
Scenario 2: 3% p.a.	3.0%	2.5%	1.5%
Scenario 3: 1% p.a.	1.0%	0.8%	0.5%
Scenario 4: 0% p.a.	0.0%	0.0%	0.0%
Scenario 5: -1% p.a.	-1.0%	-0.8%	-0.5%

Assuming strong sector growth of 3% for the duration of study period (2011 – 2015), coupled with a labour elasticity of 0.8 (the baseline scenario) the following forecasted results are found:

There is likely to be a **skills gap in the demand and supply of artisans**. Based on the model 31,522 new artisans will be required in the metals and related sectors alone. This forms a substantial part of the New Growth Path goal of 50,000 new artisans by 2015. Therefore a shortage of artisans is likely to occur in the economy as a whole, as well as in the metals and related sectors. Furthermore the supply is likely to be an overestimation (based on high growth rates), and the demand likely to be an underestimation (since there is evidence that a skills gap already exists) which implies that the problem may be bigger than implied by this paper. The

[1] Although the set is of course incomplete.

largest predicted **shortfall of skills is in welders and flamecutters**. Tool-makers, mechanical machine machinery assemblers, and sheet-metal workers are also expected to have large shortfalls in supply.

The forecasted supply and demand for technicians suggest some shortfalls. No shortage is predicted for electrical engineering technicians, but mechanical engineering technicians are predicted to take up 40% of the new, economy-wide supply, despite currently forming less than 5% of employment. A **skills shortage in mechanical engineering technicians** is therefore likely to occur between 2011 and 2015.

The model finds **no evidence of a shortfall in supply of mechanical or electrical engineers.** However, stakeholder consultations suggest that there is already a lack of engineers in the system, which means demand estimates are downward biased. Furthermore the assumed growth rate of the supply of engineers is high (to match the New Growth Plan goals). Discussions with academic institutions indicate that the growth rate is not sustainable, which – coupled with high demand – could lead to a skills shortage in these occupations. Similarly, **no evidence of a shortfall in the supply of technicians** is found.

A total of **12,789 new managers** would be required between 2011 and 2015. Since the recruitment of high level management is based more on experience than a degree, the pool of managers is not constrained by the supply coming from tertiary education institutions (for example MBA graduates). There does not appear to be a shortage in high level management, but there is anecdotal evidence of some constraints in filling middle management positions.

An additional **19,236 operators** are set to be employed between 2011 and 2015, along with **15,954 elementary workers.** The supply of unskilled labour in South Africa is highly elastic (there are a large number of unemployed individuals who are willing to work), thus demand can be met relatively easily. Even though some operator occupations require secondary education, the demand is still likely to be met. In 2010, 3,597 learners were enrolled for a National Certificate (Vocational) Level 4. A further 16,697 were enrolled for an N3 (also comparable to a National Senior Certificate), and 124,749 obtained their NSC with maths as a subject, along with a further 241,576 who passed with maths literacy.

Consultation with companies has confirmed findings from recent literature and empirical studies that the metals fabrication and related sectors, as well as wider manufacturing industry face a skills shortage. The **main skill shortages identified are artisans, technicians and engineers**. This has resulted in high wage growth in these occupations, as well as high mobility of employees. However, the **skills shortage is not the main constraint to business**; input prices, lack of demand, electricity, access to finance, and crime, theft and disorder are all viewed as more serious constraints. In a 2007 World Bank Enterprise Survey only 6% of small firms, 10% of medium sized firms, and 11% of large firms indicated that labour skill level is a major constraint (significantly below the Sub-Saharan Africa average as well as the upper middle income average).

Several constraints to meeting skills requirements are also identified:

- The **quality of students** is consistently raised by educational institutions and industry
  - Students are not able to complete their diploma/ certificates/ degrees in the minimum time, putting additional pressure on resources and capacity at educational institutions
- **Obtaining workplace experience** for graduates (and for internships and vacation work)
  - In response to the decreasing knowledge standards of graduates, companies are putting more emphasis on work experience, leaving graduates unemployed
- **Low emphasis on in-house training** by industry
  - South African firms offer less formal in-house training than comparable upper middle income countries[2]

[2] World Bank. 2007. World Bank Enterprise Survey: South Africa

- **Changes to the education system** in the past ten years may have exacerbated the decline in the quality of graduates exiting through the system
  - Shift from apprenticeship to learnerships for artisan training is generally regarded as unsuccessful by industry
  - Scrapping (and subsequent reintroduction) of the N courses have also caused some problems and confusion
- **Capacity at FET and HET institutions**
  - Difficult to find and retain appropriate lecturing staff
  - Institutions are under pressure to increase the intake of students, but facilities and number of staff has not increased in line with the increase of students over the past 5 years
  - Low student throughput rate places additional pressures on the system
- **Trade testing centres** and the **curriculum**
  - Varying levels of quality are enforced at trade test centres

International benchmarking of Turkey, Egypt and South Korea's technical and vocational education and training initiatives find that **South Africa already has in place many of the key factors which lead to successful growth strategies**. The focus should therefore be on the functioning and interaction of the institutions, and the actual implementation of the policies and strategies. The benchmarking exercise also highlights the **need for regular skills needs assessments**. One of the strengths of the South Korean system is based on its ability to respond to the changing needs of the economy.

A range of recommendations and support options are presented, largely focussing on the role of **the dti**. The main recommendation is for the Skills for Economy Unit to **gather, analyse and disseminate skills related information**. Regularly disseminating information to stakeholders would allow for better planning by companies and students, and can provide up-to-date data to inform debate at a strategy and policy level. This will require **updating, maintaining and improving the forecasting model** used in this document. Furthermore, it is recommended that this **model be extended to incorporate wider industry**. The current narrow focus on certain subsectors means that linkages to other manufacturing sectors and the rest of the economy are not considered fully. **The dti** also has a role to play in **promoting in-house training initiatives through BBBEE obligations,** which includes skills development. **Support to existing sub-sector skills programmes** such as the National Tooling Initiative and the National Foundry Technology Network is valuable, and it recommended that this should continue. These projects have been successful in mobilising industry and public sector around issues affecting these sectors. It is recommended that more such programmes are encouraged, particularly in areas which have a predicted skills shortage, such as welding. Finally, **the dti** should play an **active role in advocating and promoting** various skills related issues such industry involvement in curriculum; increased capacity at education institutes; incentives and programmes to improve graduate work experience; and information gather by other departments and stakeholders.

List of acronyms

AsgiSA	Accelerated and Shared Growth Initiative for South Africa
BBBEE	Broad-Based Black Economic Empowerment
B.Sc.	Bachelor of Science
BEng	Bachelor of Engineering
BTech	Bachelor of Technology
CSDP	Competitive Supplier Development Programme
CSIR	Council for Scientific and Industrial Research
DHET	Department of Higher Education and Training
the dti	Department of Trade and Industry
DST	Department of Science of Technology
ECSA	Engineering Council of South Africa
ETQA	Education & Training Quality Assurance
FET	Further Education and Training
GDP	Gross Domestic Product
GFETQF	General and Further Education and Training Qualifications Framework
HET	Higher Education and Training
HR	Human Resources
HRD-SA	Human Resource Development Strategy for South Africa
IDC	Industrial Development Corporation
HEQF	Higher Education Qualifications Framework
HSRC	Human Sciences Research Council
ICT	Information and communications technology
IMF	International Monetary Fund
INDLELA	National Development of Learnerships, Employment Skills and Labour Assessment
IPAP2	Revised Industrial Policy Action Plan
JIPSA	Joint Initiative on Priority Skills Acquisition
M.Sc.	Master of Science
merSETA	Manufacturing, engineering and related services Sector Education and Training Authority
N	National Certificate
NAACAM	National Association of Automotive Component and Allied Manufacturers
NC(V)	National Certificate (Vocational)
NDip	National Diploma
NFTN	National Foundry Technology Network
NQF	National Qualifications Framework

NSC	National Senior Certificate
NSDS	National Skills Development Strategy
NTI	National Tooling Initiative
OECD	Organisation of Economic Cooperation and Development
OFO	Organising Framework for Occupations
OQF	Occupational Qualifications Framework
PhD	Doctor of Philosophy
QCTO	Quality Council for Trades and Occupations
QLFS	Quarterly Labour Force Survey
R&D	Research and Development
RPL	Recognition to Prior Learning
TVET	Technical and vocational education and training
SARB	South African Reserve Bank
SASCO	South African Standard Classification of Occupations
SCHRD	Supreme Council on Human Resources Development
SEIFSA	Steel and Engineering Industries Federation of South Africa
SETA	Sector Education and Training Authority
VET	Vocational Education and Training
WSP	Workplace Skills Plan
WTO	World Trade Organisation
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QLFS	Quarterly Labour Force Survey
R&D	Research and Development
RPL	Recognition to Prior Learning
SAQA	South African Qualifications Authority
SASCO	South African Standard Classification of Occupations
SETA	Sector Education and Training Authority
the dti	Department of Trade and Industry

1 Introduction

1.1 Background and objectives

There is a need to identify bottlenecks to sustainable economic growth, particularly in the skills domain. Currently the SETA Sector Skills Plans, the Higher Education and FET enrolment planning, and the immigration quota list are not informed by a common and consistent modelling of current skills demand and supply. In response, **the dti** – as a key interface between economic strategy and skills planning in South Africa – is currently developing medium to long-term skills planning capacity to plan and adjust for future demand in terms of quantity, appropriateness and quality.

The objective of this project is to provide a substantiated assessment of the skills gap in the sector, supported by data, and analysis of implications of future growth projections for skills needs.

1.2 Project methodology and report structure

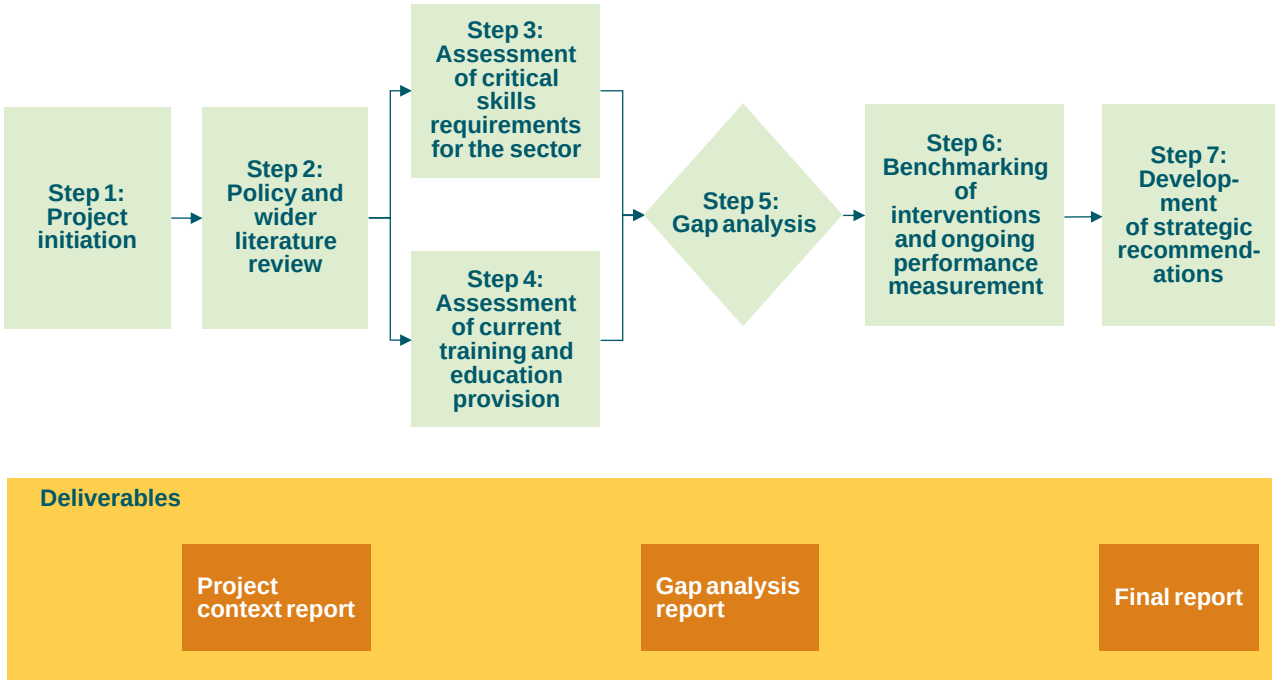
The project investigates methods and tools used for forecasting future skills needs, both internationally and nationally. This is done with the aim of verifying and validating the demand for skills within metal fabrication, capital equipment and transport equipment sectors. It contains information based on stakeholder consultation (industry, education institutions, and wider stakeholders) as well as secondary research and data. For the purposes of this project, data (e.g. sector growth, employment, and graduation from educational institutions) is of particular importance as it impacts not only on the quality and accuracy of the model, but also on the type of model used.

Based on the data available, as well as international literature, a scenario based methodology is applied to forecasts skills requirements between 2011 and 2015. This model is able to deal with some of the intrinsic lack of knowledge regarding the future by providing an overview of the sector based on a set of possible outcomes (although the number of scenarios form a very small part of the total possible scenarios).

This document represents the final of three deliverables. The main focus of this document is the analysis of the demand and supply of skills in the metals fabrication, capital equipment and transport equipment sectors. Using these results, a gap analysis is conducted. International benchmarking of successful interventions into the skills arena as well as methods for measuring ongoing performance are investigated. Based on the results from the benchmarking exercise and the gap analysis, strategic recommendations for the sector are presented.

The overall project approach is illustrated in the figure below:

Figure 1: Project plan



Chapter 2 provides a quick overview of the current economy, followed by a detailed overview of the metals fabrication, capital equipment and transport equipment sector. Chapter 3 focuses on industry skills requirements in the sector, whilst Chapter 4 assesses current training and education provision. Chapter 5 combines the results from Chapters 3 and 4 in a gap analysis. Chapter 6 consists of international benchmarking. Chapter 7 provides recommendations based on the findings of Chapter 3 to 6, including ways on dealing with data constraints.

1.3 Definition of the metals fabrication, capital equipment and transport equipment sectors and relevant occupations

The grouping of metal fabrication, capital equipment and transport equipment stems from the Revised Industrial Policy Action Plan (IPAP2). Matching the IPAP sectors to the StatsSA classifications lead to the following groupings being applicable: [3]

- Basic iron and steel, non-ferrous metal products, metal products and machinery
  - Basic iron and steel products
  - Basic precious and non-ferrous metal products
  - Fabricated metal products
  - Machinery and equipment
- Electrical machinery[4]
  - Manufacture of electric motors; generators, and transformers
  - Manufacture of electricity distribution and control apparatus
- Motor vehicles, parts and accessories, and other transport equipment
  - Motor vehicles
  - Bodies for motor vehicles, trailers and semi-trailers
  - Parts and accessories
- Other transport equipment

[3] StatsSA. 2011. Manufacturing: Production and sales
[4] Subheadings excluded include: Manufacture of insulated wire and cable ; manufacture of accumulators; primary cells and primary batteries ; and manufacture of electric lamps and lighting equipment

Excluded from this list is radio, television and communication apparatus and professional equipment as well as non-metal manufacturing industries such as chemical products and clothing and textiles.

Occupations are classified according to the Organising Framework for Occupations (OFO) used by the Department of Higher Education and Training (DHET) and merSETA. OFO classifies occupations into codes of increasing detail, starting with 8 OFO major codes, 43 sub-major codes, 98 minor codes, 377 unit codes and finally 1319 occupations. The table below shows how the OFO grouping relates to the National Qualifications Framework (NQF) and the National Skills Development Strategy (NSDS).

Table 2: General outline of OFO, NQF and NSDS

<table>
<tr><th>NSDS</th><th>NQF</th><th>Skill level</th><th colspan="4">OFO major groupings</th></tr>
<tr><td rowspan="5">Advanced</td><td>10</td><td rowspan="3">5</td><td colspan="2" rowspan="3">1 Managers</td><td colspan="2" rowspan="3">2 Professionals</td></tr>
<tr><td>9</td></tr>
<tr><td>8</td></tr>
<tr><td>7</td><td rowspan="2">4</td><td rowspan="5">5 Clerical workers</td><td rowspan="2">1 Managers</td><td rowspan="4">4 Community and service workers</td><td>3 Technicians and trade workers</td></tr>
<tr><td>6</td><td rowspan="3">7. Machinery driver and operator</td></tr>
<tr><td rowspan="2">Intermediate</td><td>5</td><td rowspan="2">3</td><td rowspan="2">6 Sale workers</td></tr>
<tr><td>4</td></tr>
<tr><td rowspan="3">Entry</td><td>3</td><td rowspan="2">2</td><td colspan="3" rowspan="2">8 Elementary workers</td></tr>
<tr><td>2</td><td rowspan="2">1</td></tr>
<tr><td>1</td></tr>
</table>

The data obtained from StatsSA is generally based on SASCO (South African Standard Classification of Occupations), which is adapted from the International Standard Classification of Occupations. However, in order to be comparable to the merSETA study, the SASCO classifications are translated into the major OFO categories. No existing concordance was found between OFO and SASCO, and this was therefore done manually. The detailed analysis presented in Chapter 5 is however, according to the SASCO codes.

From the SASCO codes, 62 relevant occupations for which data were available were identified and grouped within the OFO major codes including (see Appendix C for a full list):[5]

- Managers, e.g.:
  - Directors and chief executives
  - Finance and administration managers/department managers
- Professional, e.g.:
  - Accountants and related accounting occupations
  - Mechanical engineers

[5] Although some occupations were relevant, sufficient data was not available to be included in the estimations (e.g. electronics and telecommunications engineers). More detail on this is provided in Section 3.3.1.

- Technical and trade workers (referred to as artisans and technicians for the rest of the document) , e.g.:
  - Electrical engineering technicians
  - Tool-makers and related workers
- Clerical workers, e.g.:
  - Bookkeepers
  - Production clerks
- Operators, e.g.:
  - Lifting-truck operators
  - Machine-tool operators
- Elementary workers, e.g.:
  - Hand-packers and other manufacturing labourers
  - Helpers and cleaners in offices; hotels, and other establishments

For the bulk of the document the results are shown according to the OFO major occupations. This is done as using the OFO major occupations is judged to be the most effective way to provide an overview of the general trends and calculations in the model.

1.4 Some notes regarding forecasting methodology

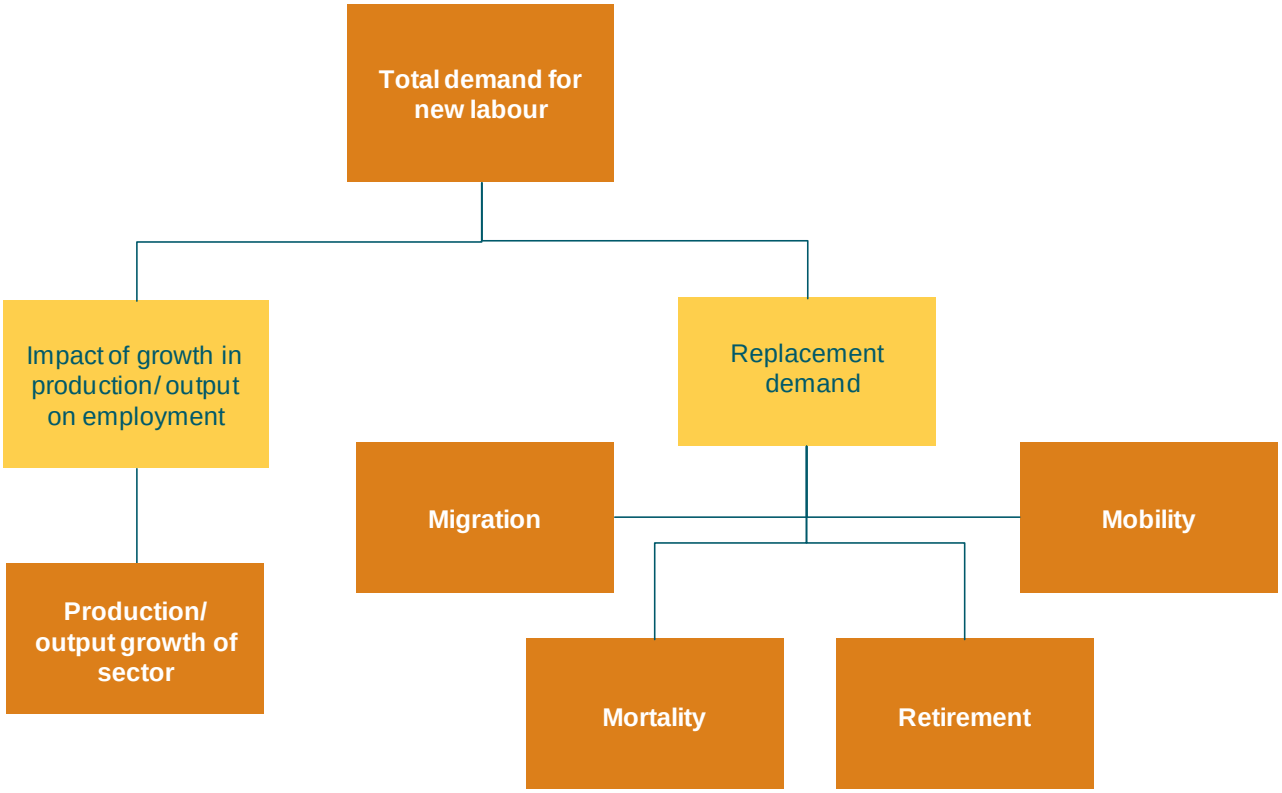
There exist several different models that deal with forecasting future supply and demand of skills and identifying potential gaps. The type of model often varies on the type and quality of data available. The models can be roughly grouped into 4 categories:

- Quantitative models
  - Relies heavily on detailed data
- Qualitative models
  - Relies on expert opinion, case studies, and holistic modelling
- Signalling models
  - Uses various different data sources as leading indicators of developing trends in the labour market
- Mix methodology models
  - Quantitative forecasting results are updated and refined through qualitative techniques

This project follows a mixed methodology approach, using quantitative forecasting and qualitative interviews to produce the final results. The mixed methodology approach is useful since the appropriate data is not always available, requiring qualitative inputs in order to make realistic assumptions

To calculate total new demand for labour several pieces of information are required (see figure below). Demand for new labour comes from two broad areas, growth in the sector (requiring more workers to increase output) and replacement requirements (the need to replace existing workers). Growth in production does not necessary translate into growth in employment as it depends on several factors including productivity and capacity. For example, if a company is currently not operating at full capacity, then ramping up production will not necessarily require more workers. Similarly, if a company can increase its productivity, then it can scale up production without requiring more workers. The response of employment to changes in production is called labour elasticity. Replacement demand is determined by four main factors, namely migration, mobility, mortality and retirements.

Figure 2: Inputs to calculate total demand of labour



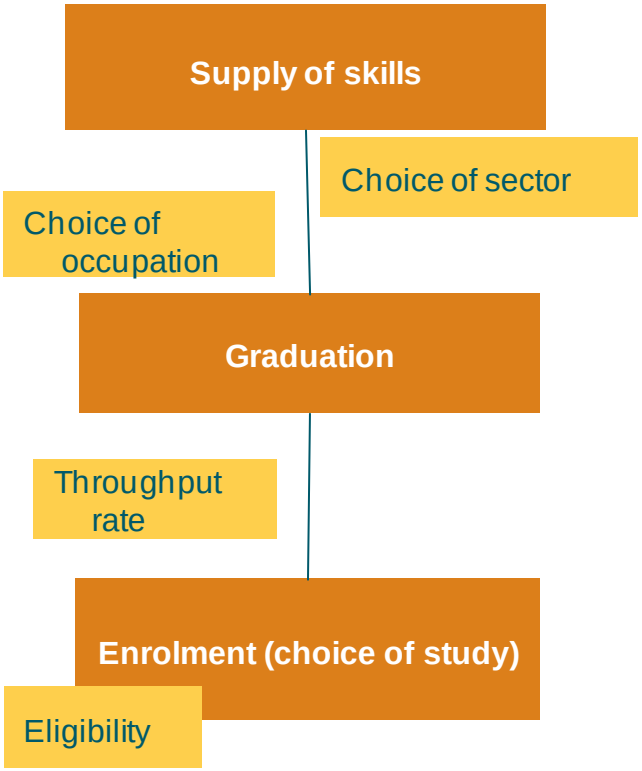
There is a growing awareness of the shortcomings of forecasting aimed to provide accurate and detailed results. Instead, skills forecasting should rather be general, highlighting potential shortfalls or constraints. A scenario-based methodology provides an overview of the outcomes from various different situations, but also highlights the impact of the underlying assumptions. Faced with data constraints and future uncertainty, several simplifying assumptions are necessary which have a major impact on the model.

The model used in this document relies on two sets of scenarios, namely growth of the sector and labour elasticity. The five growth scenarios (strong, good, average, stagnant, and decline) cover a wide spectrum of growth possibilities (varying 6%). Combined with the three labour elasticity models (baseline, 1:1, and underperformance) there are 15 possible scenarios.

The combination of the growth of the sector and the impact this has on labour (15 possibilities) is applied to the occupational data from StatsSA Quarterly Labour Force Survey (4th quarter 2010). The StatsSA data contains 62 occupations which are relevant to the metals fabrication, capital equipment and transport equipment sectors and for which data is consistently available. These occupations are also grouped into 6 major OFO categories. Applying the 15 scenarios provides the demand for labour by each occupation for each scenario between 2011 and 2015. Replacement demand is determined from various different sources. Loss of skills due to retirement is based on StatsSA Quarterly Labour Force Survey results (4th quarter 2010), migration is based on international mirror immigration data, and mortality is based on the StatsSA 2008 mortality tables. Based on a lack of data, mobility is assumed to be zero (as is often done in the literature).

The model to calculate the supply of skills is simpler than the model for demand (see figure below), but also has some intrinsic difficulties. The supply of skills is measured by extrapolating the growth of relevant graduates from FETs, HETs, and artisan trade test centres. Graduates are then sorted into applicable occupations according to their field of study and type of degree/ diploma.

Figure 3: Inputs to calculate total supply of labour



.
However, it is not possible to match all degrees to occupations, and does not make sense at a high level of disaggregation. In order to model supply in detail information on the choice of occupation and sector would be necessary. This kind of data, or estimates thereof, is not available. Thus graduation and enrolment rates (for FET colleges, only the enrolment data was shared) can only be compared to the demand of skills at an overall level.

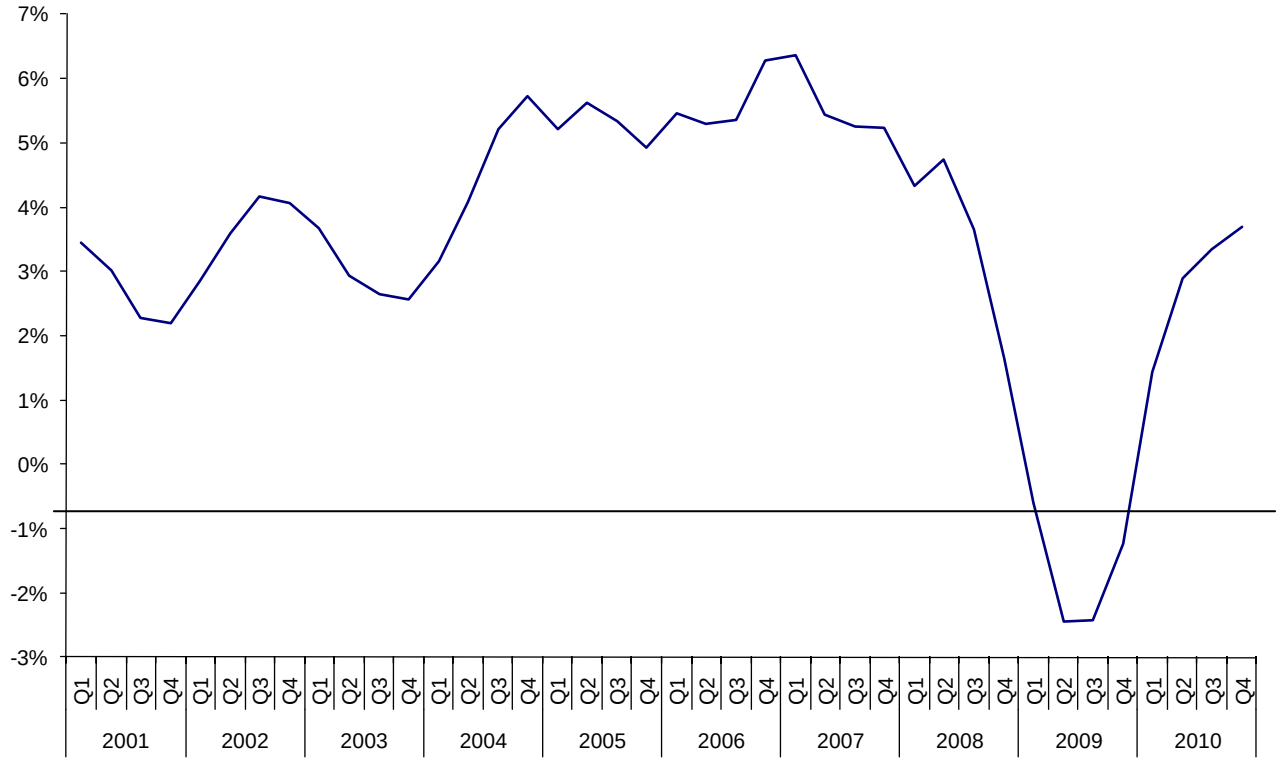
2 Economy and sectoral overview

This chapter provides an overall economic outlook for South Africa, as well as for the metals fabrication, capital equipment and transport equipment sectors. The overview of the metals fabrication and related sector focuses on production performance, employment performance and drivers of growth demand in the sector.

2.1 Overview of the South African economy

South Africa officially emerged from its first recession in 18 years in the second quarter of 2009, showing positive growth after two successive quarters of economic contraction in the 4th quarter of 2008 and the first quarter of 2009. Since then growth has recovered, and is expected to be 3.4% in 2011.[6] Growth is expected to be roughly similar in 2012, e.g. IMF predicts 3.8% growth for South Africa in 2012.[7]

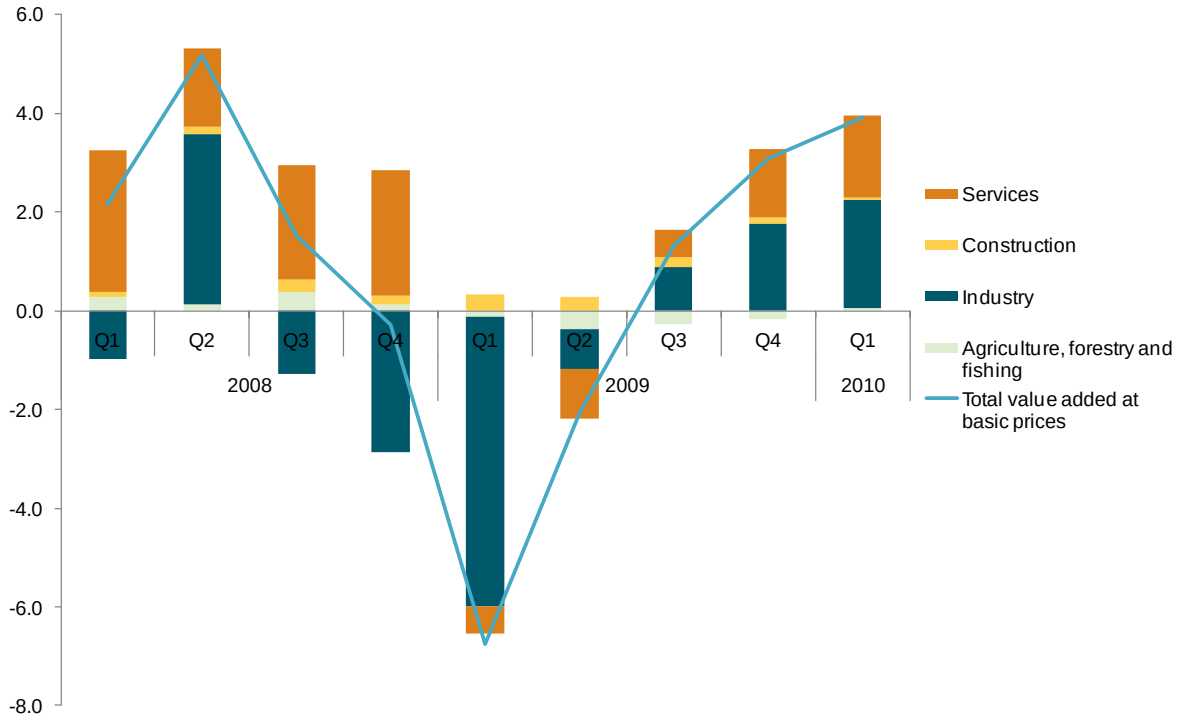
Figure 4: GDP growth, quarterly (year on year), 2000 - 2010[8]



The recession was led by the decline in the mining and manufacturing sectors, which had the largest and longest depressing impact on GDP (see figure below). The exit from the recession has seen industry recover somewhat, but still remaining below 2008 levels.

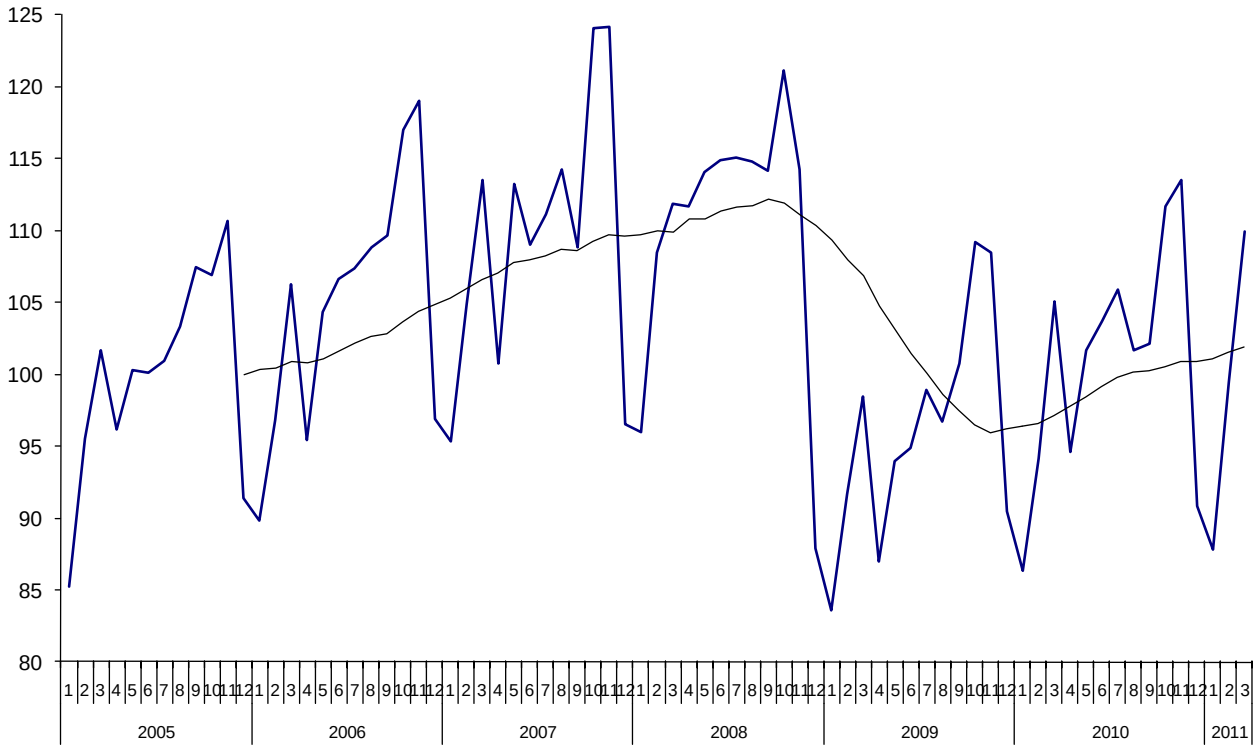
[6] Latham, D. 2011. Budget 2011: All the numbers. Available: http://www.businessday.co.za/articles/Content.aspx?id=135247
[7] http://www.stanlib.com/EconomicFocus/Documents/Global/IMF_forecast_April_2011.pdf
[8] Source: SARB

Figure 5: Contributions to GDP growth (annualised rates), 2008 to 2010[9]



The figure below highlights the impact of the recession and the subsequent start of the recovery on manufacturing.

Figure 6: Index of physical volume of manufacturing production: 2005 - 2011[10]



[9] Source: OECD calculations based on Statistics South Africa.
[10] Source: StatsSA. Manufacturing: Production and Sales

The drop in international and domestic demand resulted in a dramatic reduction in private investment and production volumes, which dropped to below 2005 levels. The rate of growth since the recovery from April 2009 is roughly the same as between 2005 and April 2008 – only at a much lower level. However, it is not clear whether this trend will continue, or plateau once previous production levels are met.

Impact on modelling skills:

Whilst the South African economy is once again exhibiting positive growth, the recovery is still "fragile and hesitant"[11]. The scale and impact of the recovery is dependent on several factors, including:

- Growth in global markets
  - A slowdown in Europe (due to peripheral countries' financial issues) is a particular worry
- Inflation in local as well as global markets (due to higher food and oil prices)
  - Signs that SARB will raise interest rates in near future, which will dampen demand
- Strong Rand continues to hamper export growth (particularly for manufacturers)
  - But has cushioned somewhat against inflation

Future expectations:

- Real GDP growth as forecasted by National Treasury[12]: 3.4% in 2011, 4.1% in 2012, and 4.4% in 2013[13]
  - However, Moody's argues South Africa's long-term potential growth rate is roughly 3.75%[14]
- Inflation is expected to remain within the 3% to 6% target of the South African Reserve Bank (SARB) for 2011 and 2012[15]
  - Expected to peak at 5.8% in the first quarter of 2012
  - Bureau of Economic Research expects inflation to be 6% in 2013
  - Biggest risks are food and administered prices (mainly oil)
- SARB is likely to try hold interest rates as low as possible in order to boost employment, but has become more hawkish on inflation – with an interest rate hike before the end of 2011 still possible[16]
  - This is likely to have a negative impact on business activity
- The Rand is currently seen as overvalued according to Minister of Trade and Industry, Rob Davies[17]
  - Expect a medium term downward correction
  - This is likely to boost exports, which will favour metals fabricators and related sectors
  - A depreciation will put upward pressure on inflation, with further interest rate hikes possible depending on the extent of the depreciation

A change in any of these factors will impact the growth of the metals fabrication, capital equipment and transport equipment sectors.

[11] Gill Marcus, SARB governor. Available: http://mg.co.za/article/2010-07-07-sas-economic-recovery-fragile-says-marcus
[12] National Treasury. 2011. National Budget Review. Available: http://www.treasury.gov.za/documents/national%20budget/2011/review/chapter%202.pdf
[13] Note: Since the time of writing the lack continued lack of global and domestic demand – with the threat of a double-dip recession in developed countries – has lead to a downward revision of these estimates
[14] Moodies. 2011. South Africa: Credit Analysis. Available: http://www.moneyweb.co.za/mw/action/media/downloadFile?media_fileid=11326
[15] SARB. 2011. Quaterly Bulletin March 2011
[16] http://www.ber.ac.za/runtime/popcontentrun.aspx?SiteIDRef=1&PageIDRef=1971
[17] http://www.iol.co.za/business/markets/currencies/davies-rand-overvalued-1.1079255

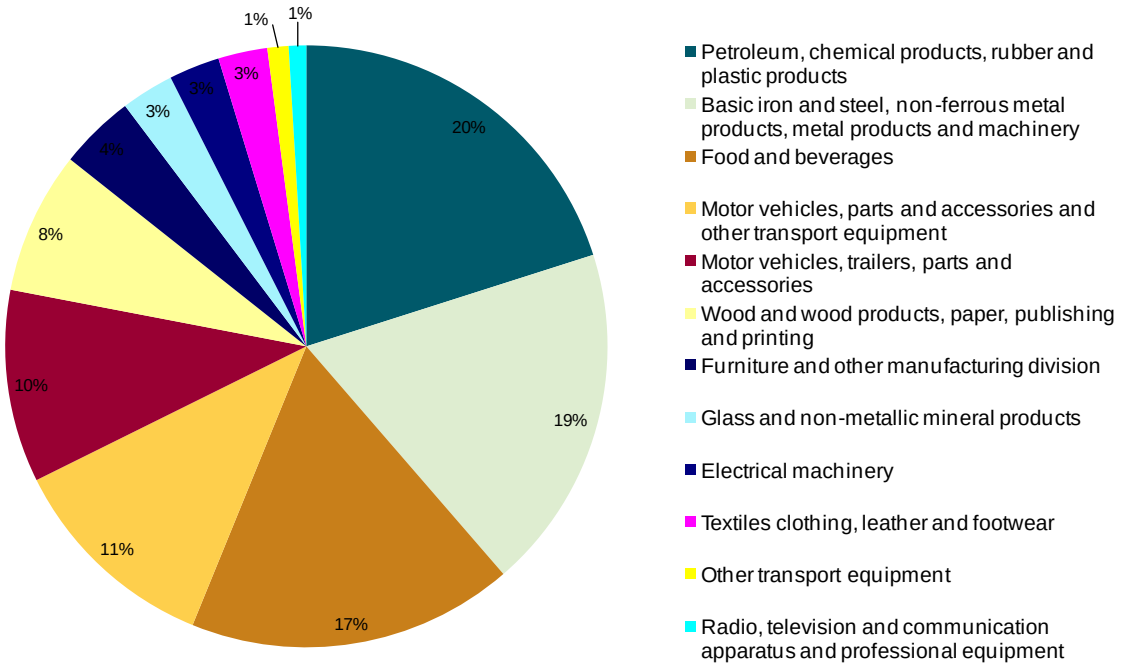
2.2 Metal fabrication, capital equipment and transport equipment sector

2.2.1 Production and sales

The metals fabrication and related sectors form a substantial part of manufacturing in South Africa, based on a rich endowment in several metals. South Africa has more than 80% of the known world reserves in platinum group metals and manganese, more than 70% of chrome deposits, and around 40% of gold and vanadium deposits.[18] The metals and related sectors value chain can be divided into four stages. [19] Stage 1 is the primary stage of mining the metals and falls outside the scope of this project. Stage 2 converts the ore or concentrate into an intermediate product (e.g. metal or alloy). These intermediate products are usually produced in a capital intensive manner at smelters or refineries. Stage 3 (the foundry stage) is of critical importance as it forms inputs into many manufacturing sectors. Between 40% to 50% of the value of South Africa's casting production is automotive components, whilst approximately 85% of all aluminium castings are used in the automotive industry.[20] Stage 4 processes the metals further into various finished products.

The figure below provides a breakdown of sales in manufacturing sectors and subsectors for 2010. The sale of basic iron and steel products, non-ferrous products, metal products and machinery form approximately 18% of overall manufacturing sales. Motor vehicles, parts and accessories and all transport equipment[21] account for approximately 11% of sales.

Figure 7: Sales from January 2010 to December 2010 by sector[22]



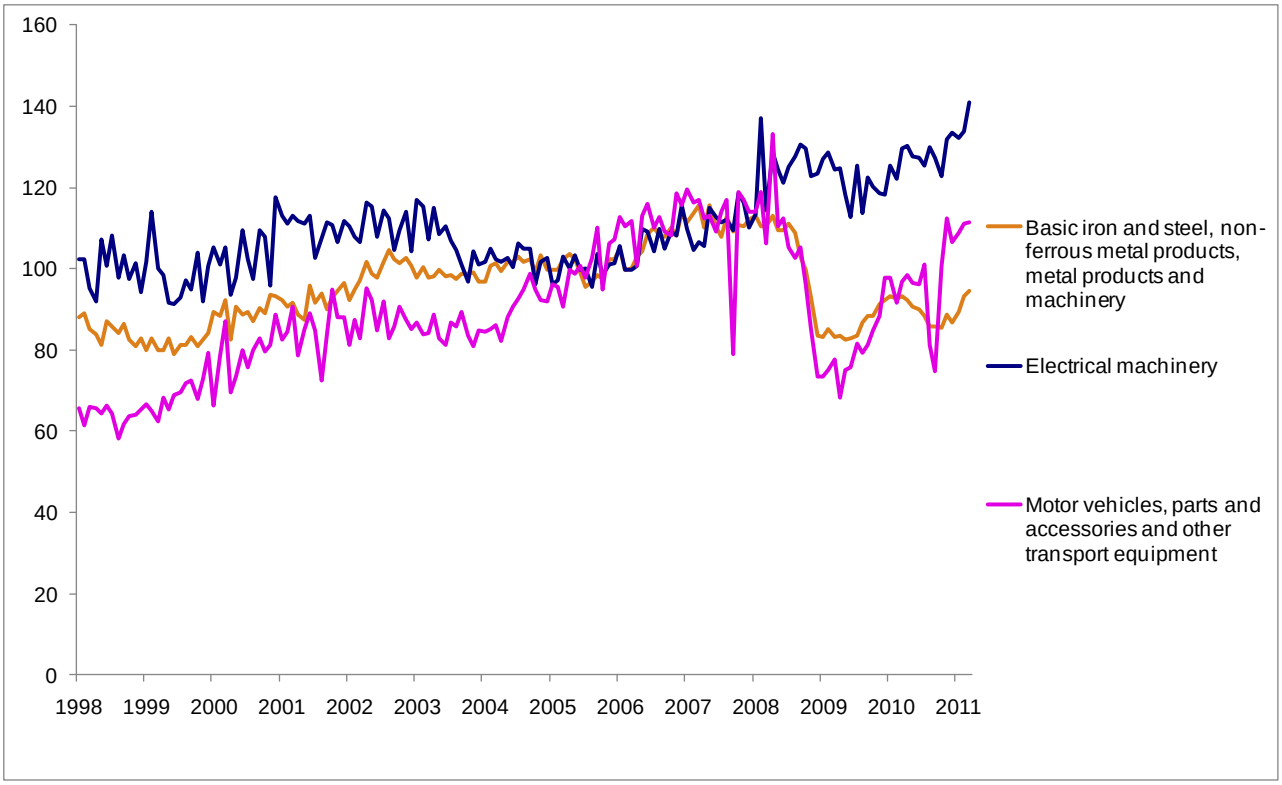
[18] Maree, J. Lundall, P and Godfrey, S. 2008. Industrial structure and skills in the metals beneficiation sector of South Africa.
[19] the dti. 2006. Metals Customised Sector Programme
[20] Maree, J. Lundall, P and Godfrey, S. 2008. Industrial structure and skills in the metals beneficiation sector of South Africa.
[21] Note this includes two categories
[22] Source: StatsSA. 2011. Manufacturing: Production and Sales. Various editions

Within the basic iron and steel, non-ferrous metals products, metal products and machinery category basic iron and steel products forms more than a third of sales. Machinery and equipment sales accounted for approximately 24%, whilst fabricated metal products accounted for approximately 23% of sales. Motor vehicles form the largest subsector in the motor vehicles, parts and accessories and other transport equipment sector (approximately 90%).

The production of basic iron and steel, non-ferrous metal products, metal products and machinery showed relatively strong growth between 1998 and 2007 (approximately 3.2% p.a.), but was severely affected by the recession, and has not yet recovered to 2005 levels of production (the index is based on 2005).

Growth in motor vehicle and accessories production showed strong growth up to 2000, then again between the 2004 to 2007 boom. The motor vehicle market, which is particularly dependent on disposable household disposable income and debt levels, was severely affected by the recession. Electrical machinery[23] has been relatively stagnant since 1998, but has shown some growth since 2005, and was relatively unaffected by the recession.

Figure 8: Monthly manufacturing production index, seasonally adjusted, 1998 to 2011 (2005 = 100)



From the graph above the sectors are all currently exhibiting positive production growth, and are expected to continue growing in the short to medium term. However, it is not clear whether it will mirror previous growth rates. Using linear extrapolation to determine growth rates is likely to be an oversimplification (e.g. using post-recession growth is misleading as the growth is off a low base, and could simply point to companies restocking inventory), therefore 5 growth scenarios are used instead. The likelihood of the scenario occurring will be expanded on in Chapter 5.

[23] Including non-applicable measures such as insulated wire and cables

Impact on modelling skills:

There are several industry related issues (rather than the economy wide issues mentioned above) which could also have an impact on the growth of the metals fabrication, capital equipment and transport equipment sectors:

- Current wage negotiations between the National Union of Metalworkers of South Africa and industry
  - Impact on industry profitability and therefore their willingness to hire more employees
- Increase in the electricity tariffs which came into effect on 1 July will place increase stress on the industry recovery, particularly for electricity heavy consumers such as foundries

A scenario model is used to deal with all the possible factors which could impact on the sectors. Five scenarios are used – varying from optimistic to pessimistic – to address the intrinsic lack of knowledge about the future. The five scenarios are presented below:

- **Scenario 1: New Growth Plan growth rates**
  - The economy recovers and grows strongly at 5%
    - Reaching target of 4% to 7% GDP growth set by the New Growth Plan
  - Assume metals and related sector grow 5% per annum between 2011 and 2015
  - Growth of 5% per annum is similar to the high growth period experienced in the metals sector (and wider economy) between 2004 and 2006[24]
    - Basic iron and steel, non-ferrous metal products, metal products and machinery: 5.2% annual growth[25]
    - Electrical machinery: 5.8% annual growth
    - Motor vehicles, parts and accessories and other transport equipment: 8.4% annual growth
- **Scenario 2: Good growth**
  - Economy recovers and shows good growth, but does not reach target of 4% to 7% growth set by New Growth Plan
  - Metal sector grows by 3% per annum
- **Scenario 3: Average growth**
  - Slow economic recovery with domestic and global demand remaining depressed
  - Assume metals and related sectors grow at 1% per annum
  - Growth of 1% per annum is similar to growth rates between 1998 and 2011
    - Basic iron and steel, non-ferrous metal products, metal products and machinery: 0.8% annual growth
    - Electrical machinery: 0.7% annual growth
    - Motor vehicles, parts and accessories and other transport equipment: 7.4% annual growth
- **Scenario 4: Stagnant**
  - Economy stagnates
  - Zero growth across all sectors
  - Shows impact of replacement demand
- **Scenario 5: Decline**
  - A double dip recession occurs, but not of the magnitude of the 2009 recession
  - Sector shrinks by 1% per annum

[24] Note that the growth rates for the metals and related sector presented in each scenario is assumed and is not based on a weighted average of the subsector growth. This is done for simplicity and because the growth rates are calculated from indices which do not allow comparison across subsectors.

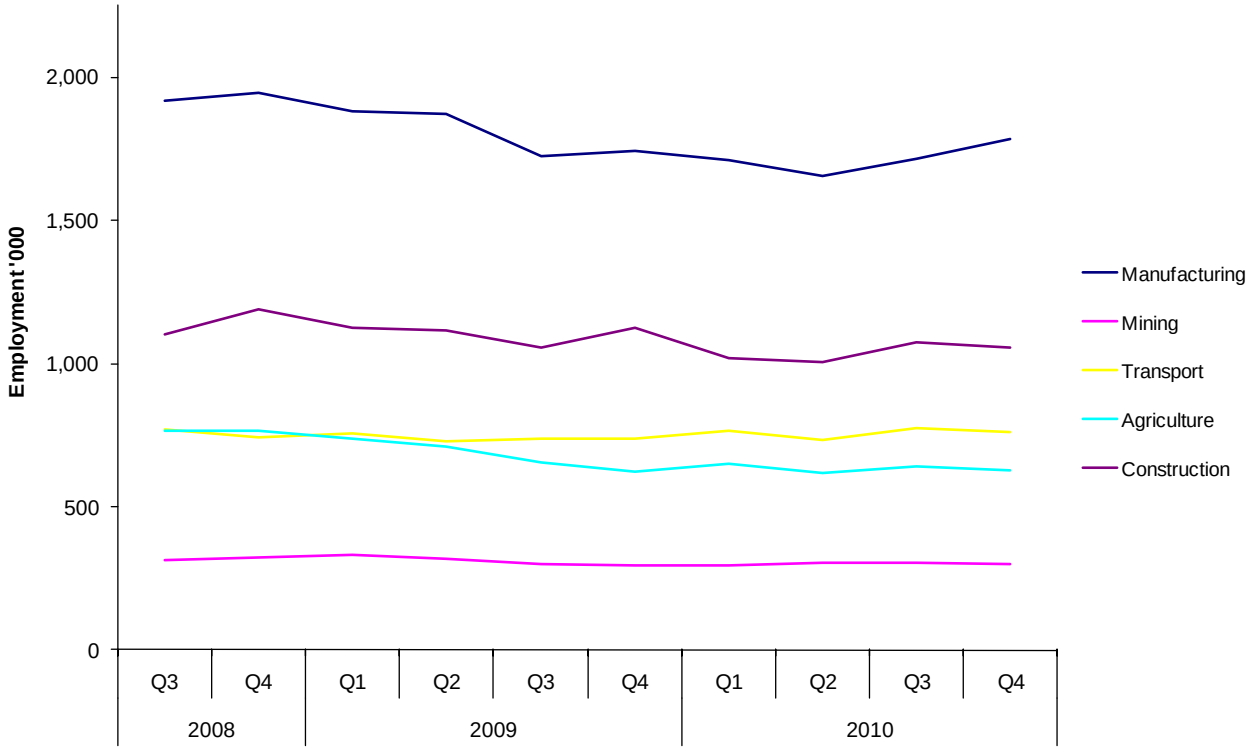
[25] Average annual growth rate is calculated from StatsSA Manufacturing production index, by annualising the calculated compound monthly growth for each year.

2.2.2 Employment profile

Note: The data used in this section is based on the StatsSA quarterly labour force survey. The survey is designed to measure key labour market indicators. However, the survey is not designed to form a representative sample at the level of detail used below (it is representative at a provincial level, and within metro/ non-metro level). The figures should therefore be viewed as indicative.

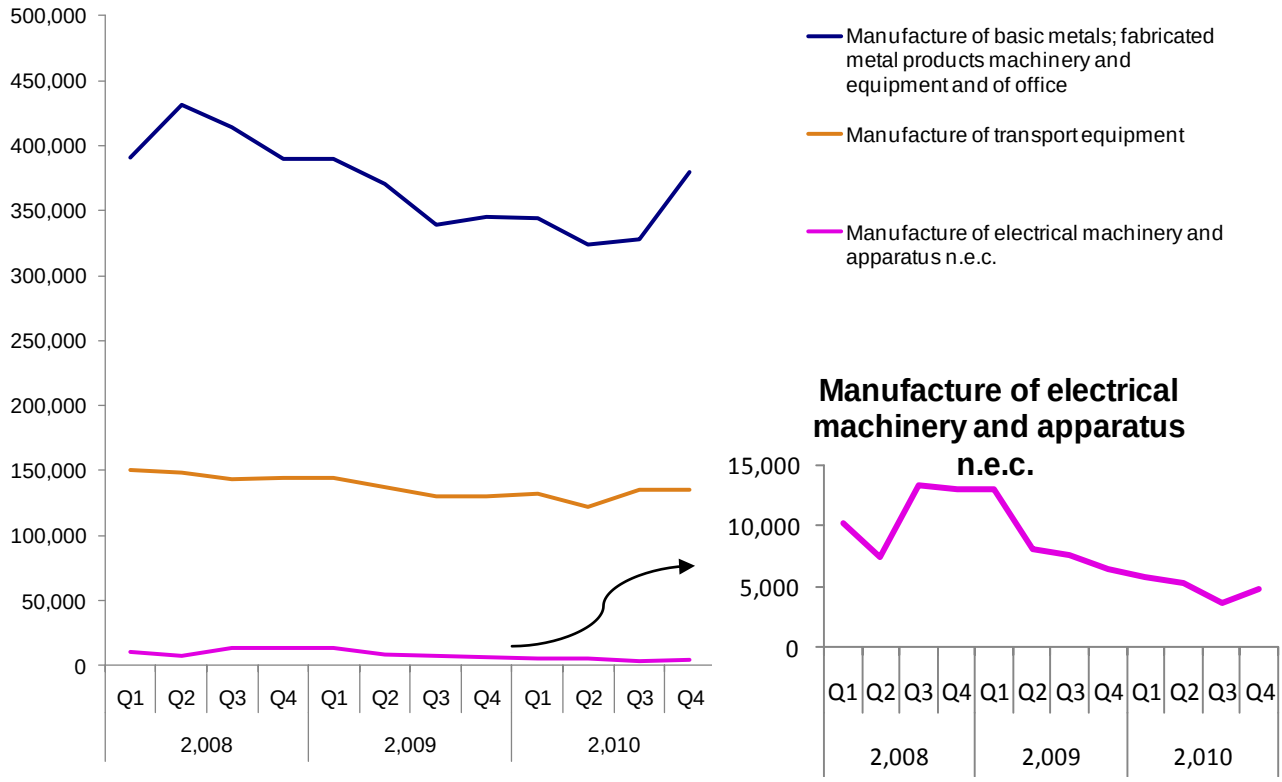
In terms of employment, the manufacturing sector accounts for approximately 15% of the South African working population. The table below provides the distribution of employment across mining, manufacturing and transport sectors. From the beginning of 2008 to 2010 manufacturing has shed 205,000 jobs (see graph below), but there are signs that the sector is recovering and taking on more employment again.

Figure 9: Employment by sector, 2008 - 2010



Employment within the metals fabrication, capital equipment and transport equipment sectors was also negatively affected by the recession (see figure below). Much of the effect of the recession (as seen in the production figures above and employment figures below) only becomes visible in 2009, as companies with bloated inventories from 2008 cut production, and employment levels with it.

Figure 10: Employment by subsector, 2008 to 2010 (plus inset of manufacture of electrical machinery on separate axis)



The figure above shows that basic metals, fabricated metal products, machinery and equipment shed 102,840 jobs (12% decline) between the second quarter of 2008 and the third quarter of 2010. This is roughly in line with a recent Steel and Engineering Industries Federation of South Africa (SEIFSA) statement that within its membership 78,000 jobs were lost in the metals industry.[26] The employment statistics of the fourth quarter 2010 provides some hope of a recovery. Although the manufacturing of transport equipment sector lost less numbers in absolute terms (approximately 15,000), it was comparable in relative terms (10% decline). Manufacture of electrical machinery and apparatus n.e.c, although generally providing employment for a small number of workers, lost 72% of employees between third quarter 2008 and third quarter 2010.

The decrease in employment figures could also be due to the increasing casualisation of labour. A recent Adcorp study found that since January 2000, traditional permanent employment has declined by 21% (approximately 1.9 million employees), whilst temporary, contract employment has increased by 64% (approximately 2.4 million employees).[27] The recession could have increased the rate of casualisation as companies struggled to find ways to keep profits and employment levels up.

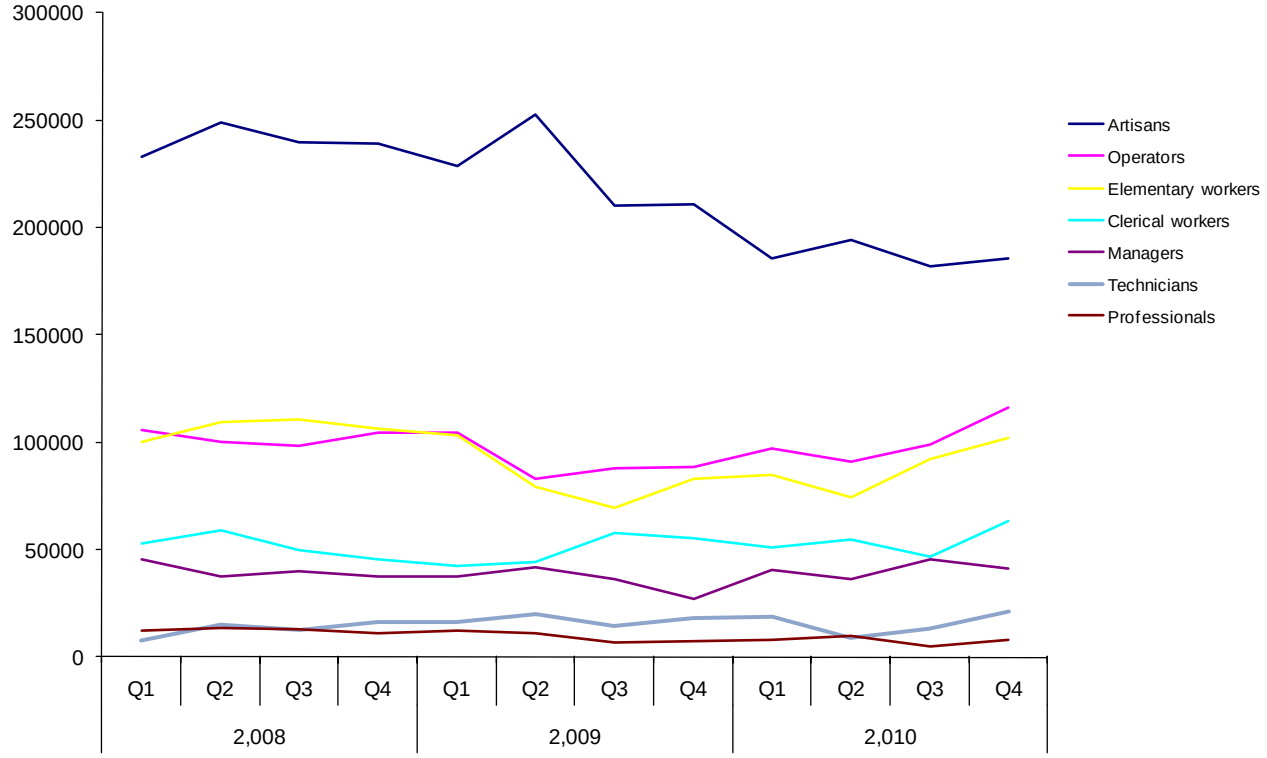
The QLFS also provides information on occupations, although again using this data is subject to strong *caveats*, since the survey was not designed for these purposes and the sample is therefore not random (and is often quite variable). The QLFS data contains 431 occupational categories, of which approximately 99 are applicable in the metals fabrication and related sectors. However, only 62 categories are used, due to a lack of data.

The figure below shows the trend in employment by occupation (major OFO categories). The majority of occupations showed a decrease in employment over the period, with operators

[26] Naidoo, B. 2011. Metal industry wage negotiations making progress. *Engineering News*
[27] http://www.politicsweb.co.za/politicsweb/view/politicsweb/en/page71654?oid=231322&sn=Detail&pid=71654

shedding approximately 20,000 jobs between 1st quarter 2008 and 2nd quarter 2009, before recovering back to pre-recession employment levels.

Figure 11: Employment by occupation, OFO major categories, 2008 to 2010[28]



Artisans form the biggest employment category, approximately 40% in 4th quarter of 2009. Operators and elementary workers form a combine to form 42% of employment, which is to be expected in an industry which is often still reliant on labour intensive production methods. Engineering employment (in the professional category) fell sharply between 2008 and 2010 from approximately 8,000 to 4,000.[29]

The table below compares the current (4th quarter 2010) employment levels against the start of the series (1st quarter 2008) – also often the peak of the series – and the estimates of Maree *et al* which are for 2005.

[28] Source: StatsSA, own calculations

[29] Note: Engineering figures are based solely on mechanical engineering as it was the only engineering category with constituent data over the period. This figure is therefore likely to be an underestimation of the number of engineers in the metal fabrication, capital equipment and transport equipment sectors

Table 3: Number of metals and related sector employees

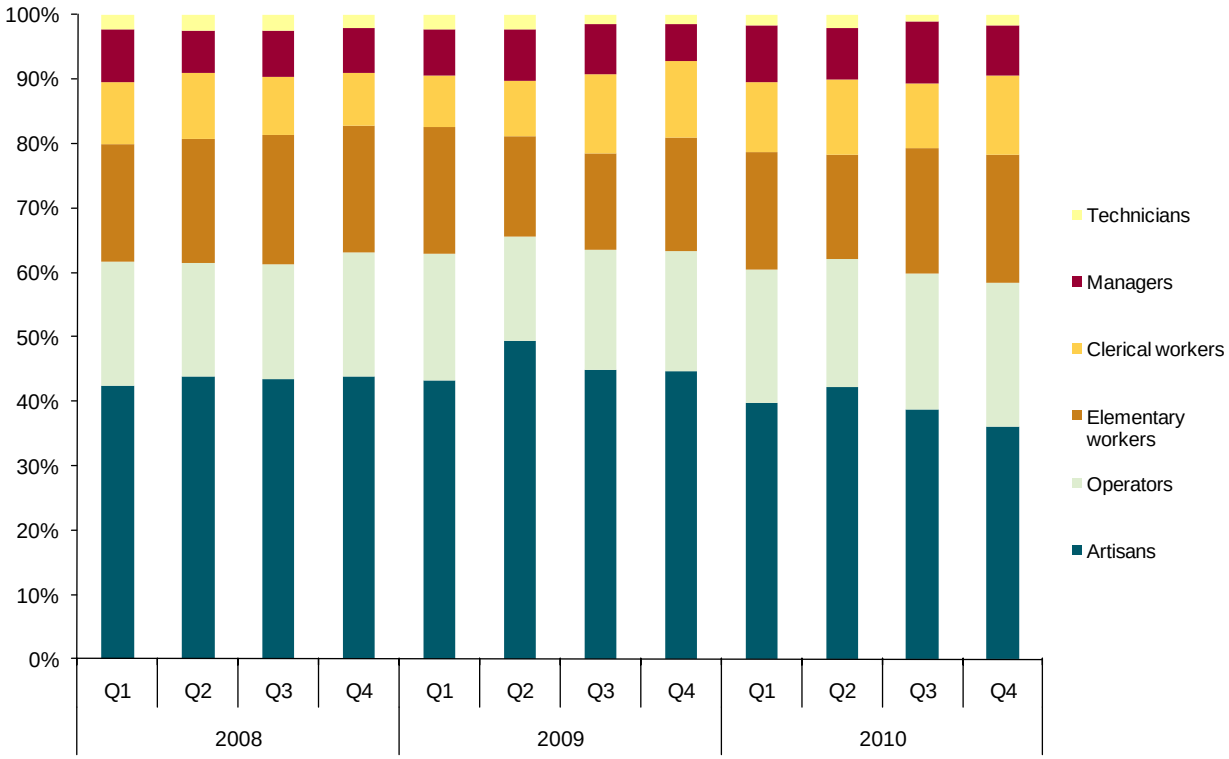
OFO Major group	4th quarter 2010, based on QFLS	1st quarter 2008, based on QFLS	Estimates based on Maree *et al*[30] (2005)
Managers	41,070	45,423	26,143
Professionals	7,942	12,469	4,166
Artisans	185,869	232,746	134,923
Technicians	21,487	7,761	21,856
Clerical and administration staff	63,209	52,630	'--
Operators	116,341	105,928	94,962
Elementary staff	102,315	100,297	47,202
Total	538,233	557,254	307,396

Maree *et al* (researching for the Department of Labour) focus on the "metals beneficiation sector" which excludes the manufacture of transport equipment, it is therefore a subset, and as such will have smaller numbers. However, the comparison above shows that the figures are similar. The Department of Labour's scarce skills study[31] has a much broader net for inclusion into the metals sector and as such calculates much greater numbers in terms of artisans employed in the metals fabrication and related sector industry. Both these studies latest data is from 2005, and reliant on the StatsSA Labour Force Survey – which was the precursor to the QFLS. The Labour Force Survey did not provide the level of detail in terms of occupations, specifying only six broad (applicable) categories. Furthermore, longer term comparisons are complicated in that the Labour Force Survey data does not break down industry by subsector (data are only available for manufacturing as a whole).

Despite the recent turmoil in the metals fabrication and related sectors, the ratios between occupational groups have remained relatively similar. During the first two quarters of 2009, the worst point of the recession, elementary workers and operators showed a drop in the ratios of occupation, while the rest of the occupations remained stable. Unskilled and semi-skilled workers were thus the first to be retrenched. However, the ratios have returned to pre-crisis levels. Based on the finding that the ratios are relatively stable over time (see graph below) it is assumed in the forecasting model that ratios of occupation will not change. This assumption ignores any technology changes which could impact on the ratio in the longer term.

[30] Maree, J. Lundall, P and Godfrey, S. 2008. Industrial structure and skills in the metals beneficiation sector of South Africa.
[31] Department of Labour. 2008. Scarce and critical skills research project

Figure 12: Ratios of occupations, 2008 - 2010[32]



Again, these results are relatively similar to Department of Labour's metals beneficiation study.[33] The study found managers formed 10% of the workforce in 2005 (versus 9% in figure above), professionals formed 1% (same as figure above), artisans formed 38% (versus 40% above), and elementary workers and operators form 46% (versus 41% above). Due to the use of different categories (clerical staff is omitted from the Department of Labour study) the numbers are unlike to match completely, but the closeness shows that the structure of occupation in the metals fabrication and related sectors has not changed much between 2005 and 2008.

[32] Source: StatsSA QFLS, own calculation
[33] Maree, J. Lundall, P and Godfrey, S. 2008. Industrial structure and skills in the metals beneficiation sector of South Africa.

Impact on modelling skills:

Since the QLFS data only starts in 2008, roughly the same time as the recession, it is difficult to draw any strong conclusions in terms of extrapolating the growth pattern into the future. It also complicates calculating the correlation between changes in production and changes in employment – called the labour elasticity[34] – for a number of reasons. Firstly, the period contains the first recession in 18 years and therefore correlations and trends from this period may not be applicable to more stable economic periods. Secondly, even if one does not attribute the recession as an 'exceptional' event, there is no *a priori* reason to believe that the labour and production growth operates symmetrically in periods of growth and contraction. For example, several companies stated that they tried to keep as much of their workforce during the downturn, through part-time shifts and other means. Thus employment (similar to wages) may be sticky downwards (i.e. less responsive).

Again, faced with a lack of data, a scenario model will provide the best form of analysis. Three scenarios are suggested, along with the 5 growth scenarios:

- **Scenario A: Labour absorbing growth: Unit elasticity (1:1)**
  - Employment exactly mirrors sector growth
  - Similar assumption as merSETA model
  - Shows the effect of the growth assumption more clearly
- **Scenario B: Baseline scenario: Sector growth to employment growth of 1: 0.83**
  - Based on recent academic study by Bhorat *et al*[35]
    - Manufacturing elasticity pre-crisis 0.83
    - Manufacturing elasticity post-crisis 0.81
    - Assume this ratio holds for metals fabrication and related sectors
- **Scenario C: Capital intensive growth: Sector growth to employment growth of 1: 0.5**
  - Post crises growth shifts towards more capital intensive methods
  - Based New Growth Path calculation for entire economy between 2001 and 2010[36]

Further assumptions:

- Ratios of occupation stay the same for entire forecasting period
  - Assumed to hold for OFO major categories (as shown in document)
  - Also assumed for full occupational model (in order to simplify the model)
- Due to variable growth and lack of long term data, no extrapolation is made using occupational data
  - All forecasts based on 4th quarter 2010 data

2.2.3 Factors impacting on the growth of the sectors

Infrastructure and construction are major drivers of growth in demand for metal products, as well as capital and transport equipment. For example, in South Africa the biggest consumers of carbon steel are building and construction (approximately 22%).[37] Infrastructure and construction activity is in turn highly linked with the current investment climate, including growth of the economy, present and future interest rates, and consumer spending/ household debt. Government projects (local and international) are also drivers of growth, local examples including construction and upgrading related to the FIFA 2010 Soccer World Cup.

[34] Labour elasticity refers to the percentage change of labour demand for a one percent change in the sector size
[35] Bhorat, H., van der Westhuizen, C., Goga, S. 2010. The Role of International Trade, Technology and Structural Change in Shifting Labour Demands in South Africa. International Centre for Trade and Sustainable Development. Issue paper No. 17
[36] Department of Economic Development. 2010. New growth path
[37] the dti. 2006. Metals Customised Sector Programme

Metal fabrication, capital equipment and transport equipment serve as inputs into much of industry, including **automobile, mining, and packaging.** The current state of these sectors, along with its future growth therefore also impacts on the demand for metal and related products. For example automobiles are the biggest industry consumers of stainless steel.[38]

Environmental legislation and regulation is increasingly becoming a factor for many manufacturers both locally and globally. The nature of metals manufacturing (especially at the milling stage where a number of steps are needed to purify materials under high temperatures) exposes the industry to stricter legislation**.** Recent examples of stricter legislation include the Waste Management Act (2008) and the 2010 National Waste Management Strategy.

Input prices have a large impact on production decisions. The market power and pricing of the upstream metal suppliers in the past has stunted the growth of the downstream sectors.[39] A survey by **the dti** found that 21.8% of manufacturers would increase employment by 10% for a sustained 10% fall in the steel price.[40] Input prices of raw materials remain a major issue for companies in the metals fabrication, capital equipment and transport equipment sectors.

Government economic development policies and strategies have a potentially large impact on the competitiveness and growth of the sector. The table below summarises some of the main initiatives dealing with growing and developing the metals fabrication, capital equipment and transport equipment sectors (skills initiatives are dealt with in chapter 4).

Project	Project aims	Stakeholders	Comment
New growth plan	▶ Aim to create 5 million new jobs by 2020 ▶ Sectors include: – Infrastructure – Agricultural value chain – Mining value chain – Green economy – Manufacturing sectors highlighted in IPAP2 – Tourism	▶ Department of Economic Development	▶ Metals fabrication, capital equipment and transport equipment included in strategies (under manufacturing)
Revised Industrial Policy Action Plan (IPAP2)	▶ Explicitly includes metals fabrication, capital equipment and transport equipment sectors ▶ Strategies include: – Identify fleet programmes for local manufacture – National Tooling Initiative	▶ **the dti**	
Metals CSP	▶ Aim to create a globally competitive metals sector ▶ Key action programmes include: – Promoting metals beneficiation – Maximise local content – Establish import monitoring system	▶ **the dti**	

[38] Maree, J. Lundall, P and Godfrey, S. 2008. Industrial structure and skills in the metals beneficiation sector of South Africa.
[39] FRIDGE. 2003. Study to facilitate the formulation of an integrated strategy for the retention and creation of employment in the South African metals and engineering sector.
[40] Creamer, T. 2011. SA to insist that Kumba honours cost-plus iron-ore deal. *Engineering news* Available: http://www.engineeringnews.co.za/article/sa-to-insist-that-kumba-honours-cost-plus-iron-ore-deal-2011-04-06

Project	Project aims	Stakeholders	Comment
CSDP projects and local content requirements	▶ Transnet aims to increase local content – US$230m locomotives order requires 50% local content ▶ Eskom plans to spend R131bn on CSDP focus areas between 2008 and 2013	▶ Transnet ▶ Eskom ▶ Department of Public Enterprises	▶ Eskom is providing training for coded welders, 100 a year for next six years ▶ Using Thai welders to meet short term demand
Automotive Production and Development Programme	▶ Aim to double production to 1.2 million vehicles by 2020 ▶ In line with WTO regulations	▶ **the dti** ▶ NAACAM	▶ Includes local assembly allowance
National Tooling Initiative	▶ Aim to grow the tool-die-and-mould making industry ▶ Key action programmes: – Skills development – Capacity expansion, SMME and BBBEE structuring – Technology recapitalisation – Competitiveness improvement and export development – PPP Governance structure development	▶ **the dti** ▶ DST ▶ merSETA ▶ Toolmaking Association of South Africa ▶ Sasol ▶ International Special Tooling & Machining Association (ISTMA) ▶ Bohler Uddeholm Africa (Pty) Ltd	▶ In 2007, NTI anticipated that interventions would grow turnover in the industry from R6bn a year to R20bn a year by 2014[41]
National Foundry Technology Network	▶ Aim to promote and develop SMMEs ▶ Ensure availability of technical foundry support ▶ Competitiveness improvement	▶ Aluminium Federation of South Africa ▶ Department of Trade and Industry ▶ IDC ▶ South African Institute of Foundrymen ▶ UJ ▶ CSIR ▶ Eskom ▶ UNIDO	▶ Conducted benchmarking on 103 foundries ▶ Formed basis of DST Technology Assistance Programme (TAP)
National Jobs Fund	▶ Create 150,000 new jobs ▶ Support in following areas: – Enterprise development – Infrastructure investment – Support for work seekers – Institutional capacity building	▶ National Treasury ▶ DBSA	▶ Newly created (June 2011) ▶ Allocate R2bn for first round (closes 31 July 2011)
Greenfield locomotive manufacturing plant	▶ Create capability to provide local supply for Trasnet's fleet renewal plan	▶ Global OEM ▶ Transnet ▶ Department of Public Enterprises	▶ Still in initial stages ▶ Transnet is due to invest R110.6bn on rail, ports and pipelines over five years
IDC Jobs Scheme	▶ R10bn fund ▶ Aim to create an additional 40,000 to 50,000 employment opportunities ▶ Sectors: – Green economy – Manufacturing – Mining value chain – Agriculture – Infrastructure	▶ Industrial Development Corporation	▶ Recently launched (February 2011) ▶ Loan at prime less 3% ▶ Mainly aimed at entrepreneurs ▶ Approved R140m new investments by April 2011

[41] http://www.engineeringnews.co.za/article/national-tooling-initiative-plans-to-more-than-triple-industryx2019s-turnover-by-2014-2007-02-05

Project	Project aims	Stakeholders	Comment
Multi-metals complex	▶ Feasibility studies into R15bn integrated metals plant ▶ Beneficiate: – Titanium – Zirconium – Vanadium – Magnesium – Silicon ▶ Create approximately 7,000 jobs	▶ National Empowerment Fund ▶ Industrial Development Corporation ▶ Magnesium Metals ▶ Group Magnezit	▶ Only at initial discussion stage ▶ Unlikely to happen in short to medium term

Impact on modelling skills:

Construction spending is likely remain depressed in the short to medium term, as commercial and residential property markets struggle to recover due to a large supply of existing properties in the market and high household debt levels. Other investment spending has fallen to 18.9% of GDP, down from 24.6% of GDP achieved in 4th quarter 2008.[42]

Infrastructure spending by government, as a portion of total spending, is likely to decline in the medium term following the large focus leading up to the FIFA Soccer World Cup in 2010. However, total infrastructure spending is still expected to increase at an annual rate of 4.7% between 2010 and 2013 (totalling R811.2bn).[43]

Government initiatives are likely to have a positive impact on growing the sector (through increased demand and increased competitiveness), but again the exact impact is difficult to model. In the face of such uncertainty, a scenario based model remains the best option.

The impacts of the demand drivers for the short to medium term are unclear, mainly due to the difficulties in assessing the rate and extend of the global and local recovery.

[42] http://www.stringfellow.co.za/sa-gdp-1st-quarter-2011/
[43] http://www.moneyweb.co.za/mw/view/mw/en/page302588?oid=512963&sn=2009+Detail&pid=287226

3 Assessment of critical skills requirements for the sector

This chapter summarises and analyses data obtained from various secondary resources, as well as primary research in order to provide a assessment of the critical skills required in the metals fabrication and related sectors.

3.1 Comments on current skills and education in industry

3.1.1 Literature review

Most skills studies which have been conducted in recent years point to a shortage of skills, particularly in technical fields such as engineers and artisans.

In 2001 the Bureau of Market Research investigated skills shortages in South Africa and the level of skills development.[44] The study used a mix of qualitative and quantitative methods, e.g. interviews, workshops, and secondary national data. The study concluded that there will be a lack of IT specialists, electronic engineers and specialist managers.[45] It also noted that the educational system needed to be more closely aligned to the needs of employers.

In 2003, the Nedlac Fund for Research into Industrial Development Growth and Equity (Fridge) commissioned a study to research and analyse the metals and engineering sector in order to recommend strategies for growth and job creation.[46] The availability of skills was found to be a constraint to the sector, particularly in the more 'design-intensive' sectors where South Africa has a competitive advantage due to lower engineering costs.

Woolard, Kneebone and Lee[47] updated an earlier HSRC study[48] for the period of 2001 to 2006. Data from the Labour Force Surveys (by StatsSA) were used in order to obtain employment by occupation and sector, across the whole economy. They found that employment in engineering had been declining, but that it was not clear whether this was due to a decline in demand or a lack of supply. They argue that there is an oversupply of mining engineers and technologists, and a shortage of electronic, chemical and industrial engineers.

In a report commissioned by the Department of Labour, Maree *et al* investigated the industrial structure and skills in the metal beneficiation sector of South Africa.[49] They found that demand for the technicians, craft workers and operators rose substantially over between 1999 and 2005, whilst demand for elementary workers declined. Educational supply of skills is found to be slow to respond to pressures arising at the demand level. An inadequate supply of skills was found to have inhibited the growth and development of the sector.

A scarce and critical skills research project surrounding artisans/ trades was undertaken in March 2008, also commissioned by the Department of Labour.[50] Data were obtained from Labour Force Surveys as well as October Household Surveys. The quality and availability of data again impeded the study, which cautions that the results should be seen as illustrative. It found that there is a

[44] Bureau of Market Research, (2001) Key Skills Shortages and the fast Tracking of Skills Development, Bureau of Market Research: University of Southern Africa.
[45] Wilson, R. A, I. Woolard and D. Lee. 2004. Developing a National Skills Forecasting Tool for South Africa. IER/HSRC/Department of Labour.
[46] Nedlac. 2003. FRIDGE Metals and Engineering industry study
[47] Woolard, I, Kneebone, P & Lee, D (2003) Forecasting the Demand for Scarce Skills, 2001 – 2006, Human Resources Development Review 2003: Education, Employment and Skills in South Africa, Human Sciences Research Council, Cape Town: HSRC Press.
[48] Whiteford AC, van Zyl E, Simkins C and Hall, E (1999). Labour market trends and future workforce needs. Pretoria: Human Sciences Research Council.
[49] Maree, J. Lundall, P and Godfrey, S. 2008. Industrial structure and skills in the metals beneficiation sector of South Africa.
[50] Department of Labour. 2008. Scarce and critical skills research project

severe shortage of artisanal labour in key markets, including metal, machinery and related trades which has the second largest demand for artisans.

In a recent release of the latest monthly Employment Index™, Adcorp – one of South Africa's largest employment service companies – reviews the skill shortage for high-skilled workers.[51] Using applicant to job ratio data, position fill rate data, and recruitment lead time, Adcorp estimates that there are a total of 829,800 unfilled high-skilled positions in South Africa across a wide range of occupations. This includes a shortage of 432,100 technicians, and 178,400 professionals (e.g. medicine, engineering, accounting, and law). In contrast, low skilled positions are in oversupply, for example an estimated surplus of 967,600 elementary workers. The high-skill shortage has lead to a significant increase in wages, approximately 286.4% since 2000 in inflation-adjusted terms. Adcorp argues that immigration controls, specifically the Immigrations Act of 2002, has had an impact on the skills shortage. They argue that the Act made it particularly difficult for foreigners to work in South Africa. Recent amendments to the Act, promulgated in March 2011, increases the difficulty further by prohibiting the use of immigration agents and quota work permits – widely used by South African companies. Adcorp argues that the impact of the amendment will be especially felt by companies with a recurring need for a particular skill, since these are the companies which most rely on immigration practitioners and quota work permits (rather than once-off requirements). [52]

3.1.2 The skills shortage in context

Companies consulted have generally confirmed the results above, with artisans and technicians seen as the main skills shortages. Business response to these shortages vary, some identified the shortage early on and have instituted training programmes, whilst some companies are only now instituting formal training processes. The shortage has led to artisans being able to demand high wages, which has made the hiring of artisans uneconomical in some instances. Companies also report high mobility of artisans, with companies constantly 'poaching' talent from one another. This has also made some companies more reluctant to provide further training. However, there are cases of companies taking on more ambitious training programmes, knowing that they are providing training for their own company as well as "the rest of South Africa."

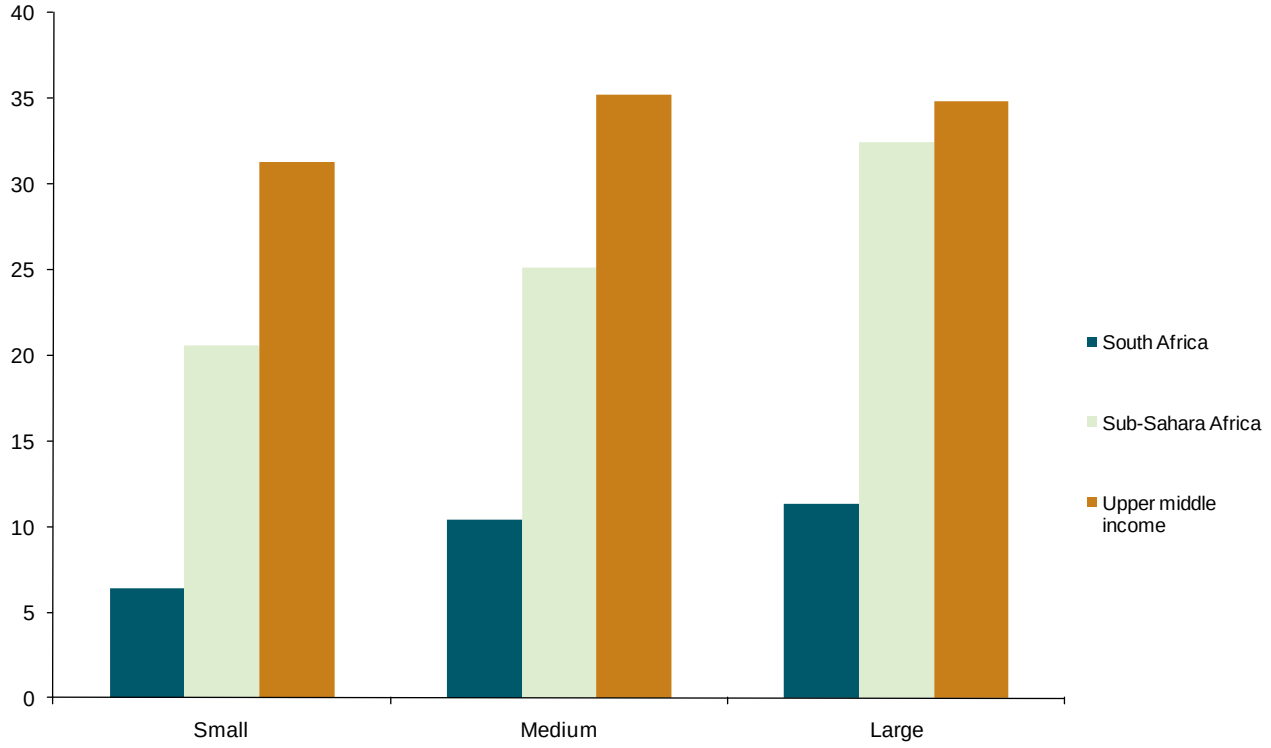
Companies are also concerned with the quality of students entering the workplace. Students' practical and theoretical knowledge are often seen as inadequate, including their ability to problem solve. A paper by Pauw *et al*[53] found that not only are students inadequately prepared for the labour market, but often for tertiary studies too. A lack of soft skills and workplace experience has made employers reluctant to employ graduates, preferring experienced candidates.

However, the comments around skills shortages from companies should be viewed in context. Many companies (locally and internationally) have issues in obtaining (and retaining) talent. Despite the concern raised by the private and public sector around skills, when compared to other issues and concerns the lack of skills does not seem to be the major problem affecting companies.

The World Bank Enterprise Survey completed in 2007 puts some perspective on the extent of the problem. Only 6.7% of respondents claimed that an inadequately educated work force is a major constraint to business, ranking it 5th behind crime, theft and disorder; electricity; access to finance; and corruption. The figure below shows the breakdown by business size response to the question "To what degree is an inadequately educated workforce an obstacle to the current operations of this establishment?"

[51] Adcorp. 2011. Adcorp Employment Index
[52] Adcorp. 2011. Adcorp Employment Index
[53] Pauw, K., Oosthuizen, M., and van der Westhuizen, C.. 2008. Graduate unemployment in the face of skills shortages: a labour market paradox. *South African Journal of Economics* Vol 76 (1)

Figure 13: Percentage of firms identifying labour skills level as a major constraint[54]



Although the impact of workforce education increases by firm size, only 11% of large firms listed it as a problem in 2007. This is substantially less than Sub-Saharan counterparts, as well as companies in upper middle income countries (e.g. Brazil, Poland, and Lebanon). It should be noted that this survey was conducted for the entire economy, and does not necessarily apply to the metals fabrication sector (although 72% of firms surveyed were in manufacturing, so it is at least indicative).

StatsSA's "Manufacturing: Utilisation of production capacity by large enterprises" is a quarterly survey of large enterprises (those with turnover greater than R100 million per annum). It assesses the utilisation of production capacity (use of manpower, plant and machinery in manufacturing) as well as reasons for under-utilisation in companies. The figure below focuses on the reasons for under-utilisation between 2003 and 2011. Although the survey only represents large enterprises, it still represents a large part of the manufacturing sector, for example merSETA estimates that 49% of all manufacturing firms have more than 50 employees.[55]

[54] Source: World Bank Enterprise Survey
[55] merSETA. 2009.Sector Skills Plan 2010 - 2015

Figure 14: Reasons for underutilisation: basic iron and steel, non-ferrous metal products, metal products and machinery division, 2003 to 2011

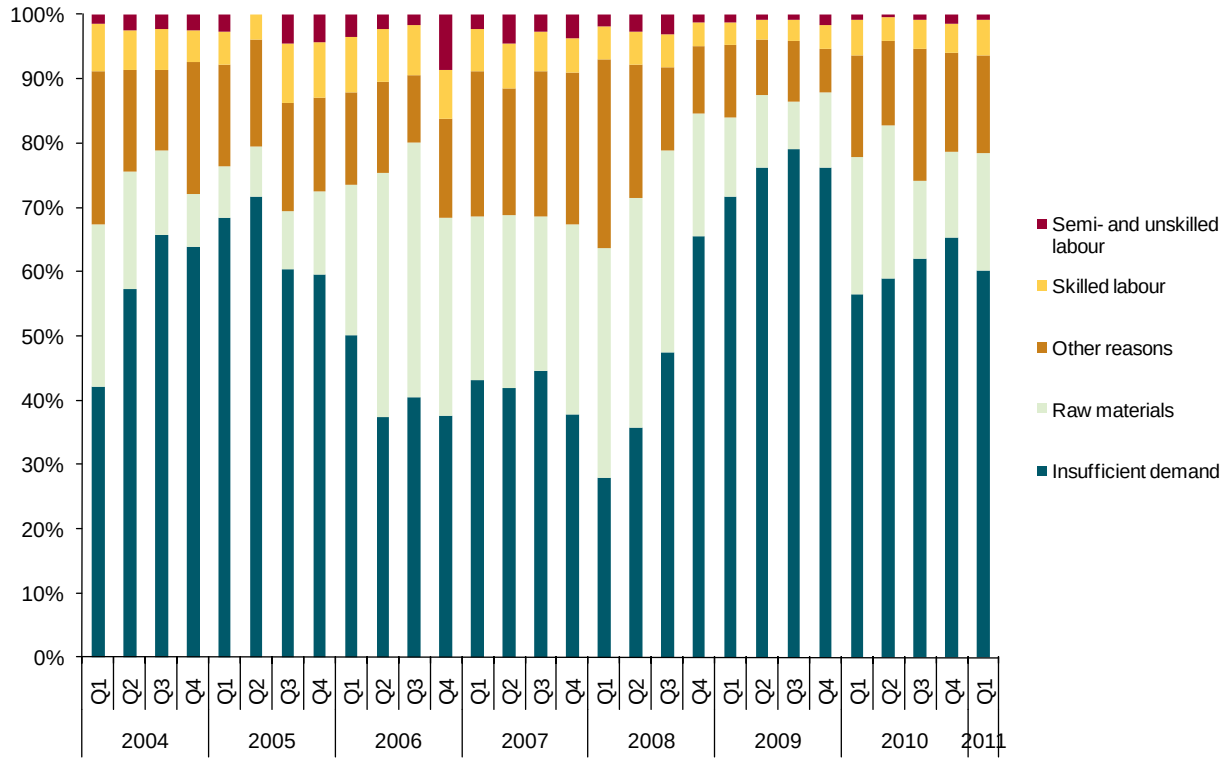
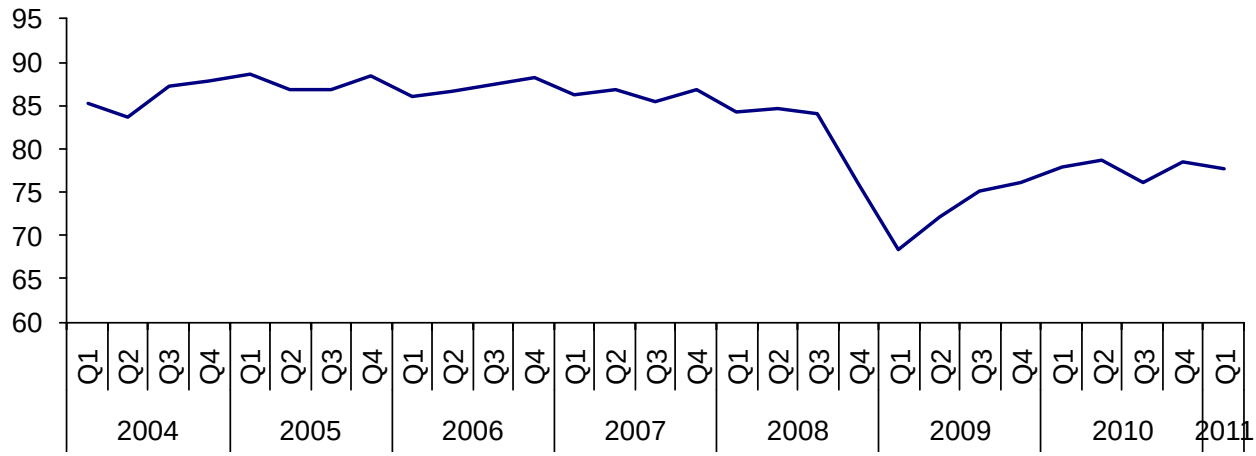


Figure 15: Utilisation: basic iron and steel, non-ferrous metal products, metal products and machinery division, 2003 to 2011



The two major issues in the basic iron and steel, non-ferrous metal products, metal products and machinery sector is a lack of demand and raw materials. Raw materials became an increasingly more significant problem during the economic growth phase of 2005 – 2008 (as the demand existed), but during the economic downturn lack of demand became much more pressing. Throughout the measured period the lack of skilled labour[56] was responsible for, on average, 6% of the total underutilisation with little fluctuation (standard deviation of 2%). Unskilled and semi-skilled was, on average, only responsible for 2% of underutilisation in large companies.

[56] Employees in this category must have undergone at least two years study or training after having completed grade 12.

Figure 16: Reasons for underutilisation: Motor vehicles, parts and accessories and other transport equipment division, 2003 to 2011

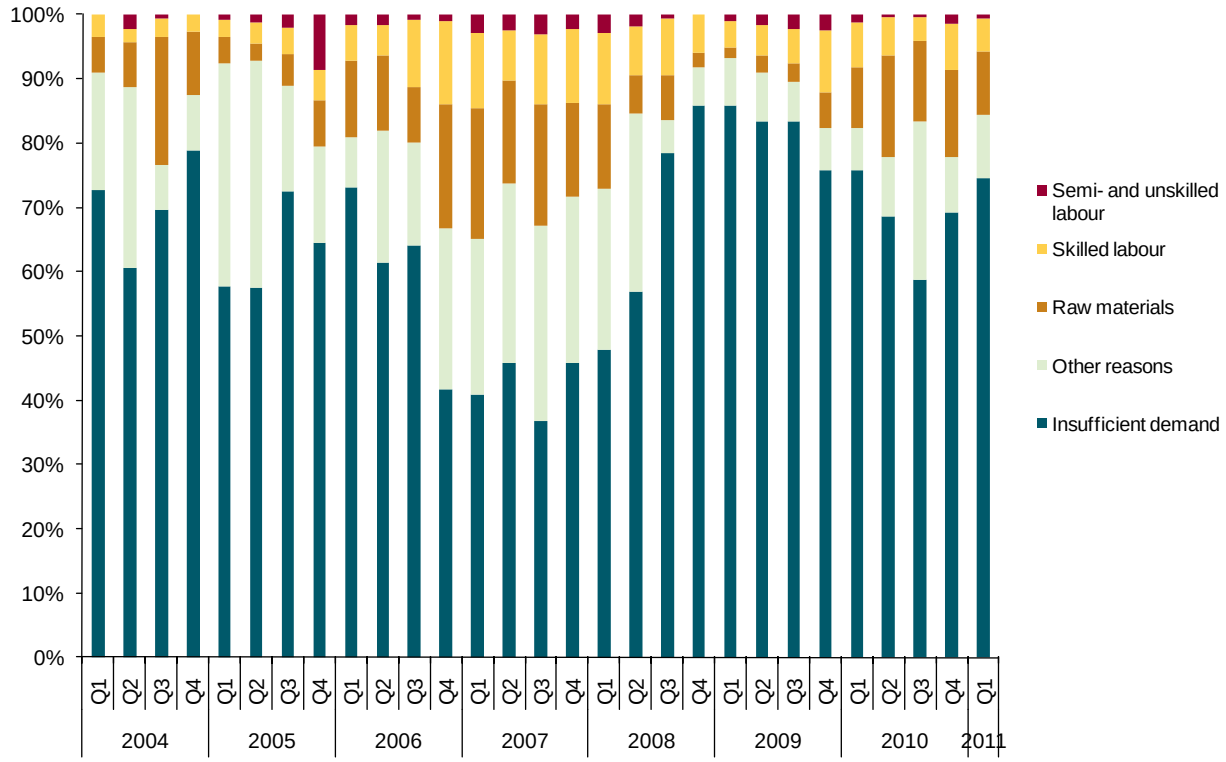
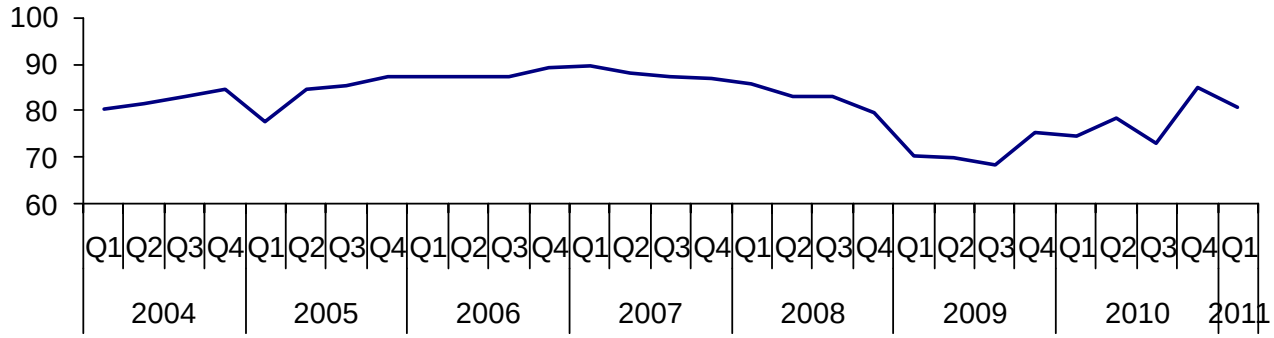


Figure 17: Utilisation: motor vehicles, parts and accessories and other transport equipment division, 2003 to 2011



Similar to the sectors above, the major problems for the motor vehicle, parts and accessories and other transport equipment division are lack of demand and raw material. As expected, during the boom time of 2005 to 2008 lack of demand as a reason for underutilisation fell and the rest of the categories become more significant. This period is a useful base of analysis as finding markets and creating demand is a core function of business. Between 2005 and 2008 the issue of raw materials became more apparent (on average 24% of underutilisation was ascribed to raw materials). The impact of a lack of skilled labour also increased, but still remained small (the highest figure was 13% in 4th quarter 2006). Unskilled labour was responsible for very little of underutilisation.

Impact of the skills shortage

Literature on the skills shortage generally finds that the skills shortage does exist, mainly in higher skilled technical areas such as artisans, technicians and engineers. This is confirmed by industry interviews, which points to artisans as being the main scarce skill. However, a comparison between the skills shortage and other constraints facing industry finds that the skill shortage does not appear to be the main constraint facing companies. This is an important finding: resolving the skills gap will not necessarily result in increased growth of the sector.

3.2 Profile of skills required

Metals and related products manufacturing is a relatively unskilled and semi-skilled intensive process, relying mainly on machine operators for actual production. Companies consulted generally have 6 to 8 operators working in a team under one team leader. Team leaders in turn report to group leaders (in smaller outfits this extra level is often not used); with 2 or more team leaders reporting to a group leader. Group leaders in turn report to department managers. Department managers (varying from specific products/ processes to logistics, HR, maintenance, and planning and procurement) report to the plant manager. The plant manager will report to the business unit (e.g. board or executive directors).

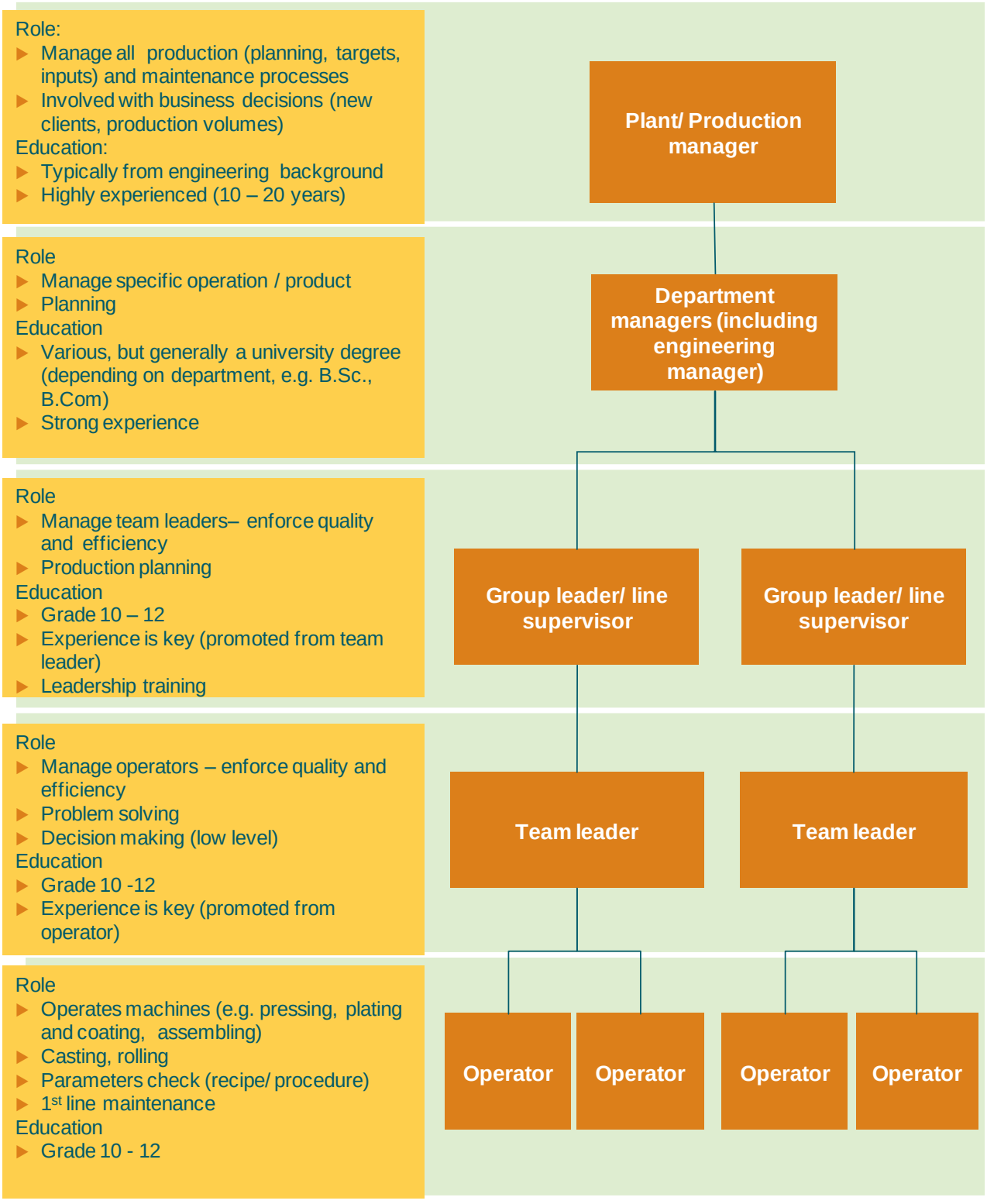
Operators require minimal education; some companies accept Grade 8 as minimum education, although some companies do set internal standards of Grade 12. Operators are involved in the manual production of the products, such as pressing, crane and hoisting, plating, and assembling. These processes require motor skills, dexterity, as well as an understanding of dimensions. The operator will have to become familiar with the process and how the machines work, which is done through on-the-job training. The training is in-house and informal; no certificate or diploma is obtained. Training is often through shadowing a more experienced operator.

Team leaders are promoted from operators who showed potential by exhibiting leadership skills, problem solving and decision making capabilities. Companies generally do not advertise the post outside the firm; great emphasis is put on promoting internally.

Similar to team leaders, **group leaders** are promoted internally. These are individuals with several years of experience as an operator, and again as a team leader. Group leaders are therefore highly familiar with processes and requirements of manufacturing in the particular department. The group leaders are involved in production planning and decision making, as well as enforcing quality standards and efficiency (making sure production targets are met). Some companies offer leadership training.

The figure below provides a high level summary of the roles and education required at each level.

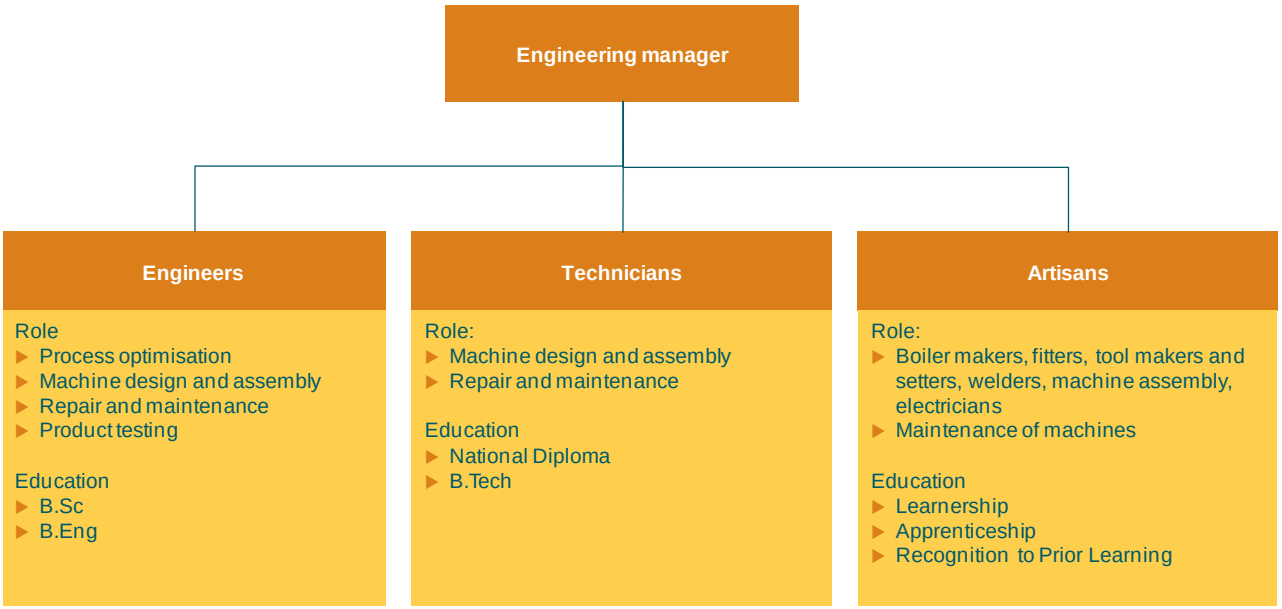
Figure 18: Profile of roles and skills required: Operations



Department managers are in charge of an explicit aspect of the operations, such as logistics, planning and procurement, maintenance, HR, and specific production processes or products. Departmental managers can have varying educational backgrounds, depending on their field. For example, a logistics manager can have a business background (B.Com) or an HR manager can have an industrial psychology degree. Departmental managers relating to the actual processes generally have an engineering degree (e.g. mechanical, electrical, or chemical engineering). The engineering manager (also referred to as maintenance manager) plays a particularly important

role, expanded on in the figure below. The engineering manager would slot in at the departmental managerial level in the figure above.

Figure 19: Profile of roles and skills required: Engineering unit



The main role of this department is often maintenance, but it is also involved in process optimisation, and machine design and assembly. The teams, similar to the operator teams are generally small. Engineers and technicians also often perform R&D activities – especially in firms which do not have a specialised R&D department. Furthermore, technicians are often used in the quality department (not shown here), ensuring that all processes and products meet the required standards.

It is at this level that most firms experience the skills shortage. Obtaining artisans, technicians and engineers was consistently highlighted as the main area of skills shortage. Furthermore, many companies commented that the engineers, technicians and artisans in their workforce are relatively old and nearing retiring age. For example, Ikhaya Fundisa Techniskills Academy CEO Sean Jones argued that the average age of artisans is 56 (in 2010), which means that the bulk of the knowledge in this occupation is nearing retirement.[57] Although having such experience in the workforce currently benefits the companies, there is a concern that they will not be able to adequately replace the staff once they retire.

3.3 Future skill requirements

This section below provides the forecasting results for the major OFO occupational categories. The section also shows in more detail the assumptions required as well as the data sources used (and the quality thereof). It is split into the two main areas required to determine labour demand, namely sector growth and replacement demand.

3.3.1 Sector growth

Growth in employment is calculated through 5 sector growth scenarios and 3 labour elasticity scenarios, thus giving 15 scenarios in total, shown in the table below.

[57] http://m.engineeringnews.co.za/article/training-technicians-2010-06-11

Table 4: Growth scenarios

Sector growth	Labour elasticity		
	Scenario a: Unit elasticity	Scenario b: Baseline scenario, 0.8 elasticity	Scenario c: Underperformance, 0.5 elasticity
Scenario 1: 5% p.a.	5.0%	4.2%	2.5%
Scenario 2: 3% p.a.	3.0%	2.5%	1.5%
Scenario 3: 1% p.a.	1.0%	0.8%	0.5%
Scenario 4: 0% p.a.	0.0%	0.0%	0.0%
Scenario 5: -1% p.a.	-1.0%	-0.8%	-0.5%

All these scenarios are applied to the latest employment figures by occupation from StatsSA Quarterly Labour Force Survey, 4th quarter 2010. Occupation is split into two levels, 6 categories according to OFO major groupings and 62 categories as classified by the Quarterly Labour Force Survey (using SASCO classifications). Several other SASCO categories are applicable to the metals and related sectors (approximately 99), but do not have adequate data available and are therefore not used. The lack of data could be as a result of the sampling methods used, and may mean the data used here, and therefore the forecasts, are downward biased. However, it is also possible that some of the data from the unused categories is captured under the categories included here. The OFO major groupings are useful as they provide an overview of the growth impacts over the next five years (2011 – 2015). The full results, based on the Quarterly Labour Force Survey are presented in the Appendix C.

The method suggested here still requires many simplifying assumptions. Sector growth and labour elasticity is assumed to affect all occupations equally. This will not necessarily be the case in reality, as growth might favour certain production techniques, which may lead to more growth for these occupations. For example, a shift towards more automated manufacturing away from the more labour intensive methods means that fewer operators may be required. The scenario analysis does allow one to 'mix-and-match', applying different scenarios to different occupations which can take such measures into account if deemed necessary. Such procedures fall outside the scope of this document.

The figures below show the impact of the 5 growth scenarios on the major OFO categories. For simplicity only the baseline labour elasticity scenario of 0.8 is used.

Figure 20: Managers employment forecast, baseline labour scenario, 2011-2015

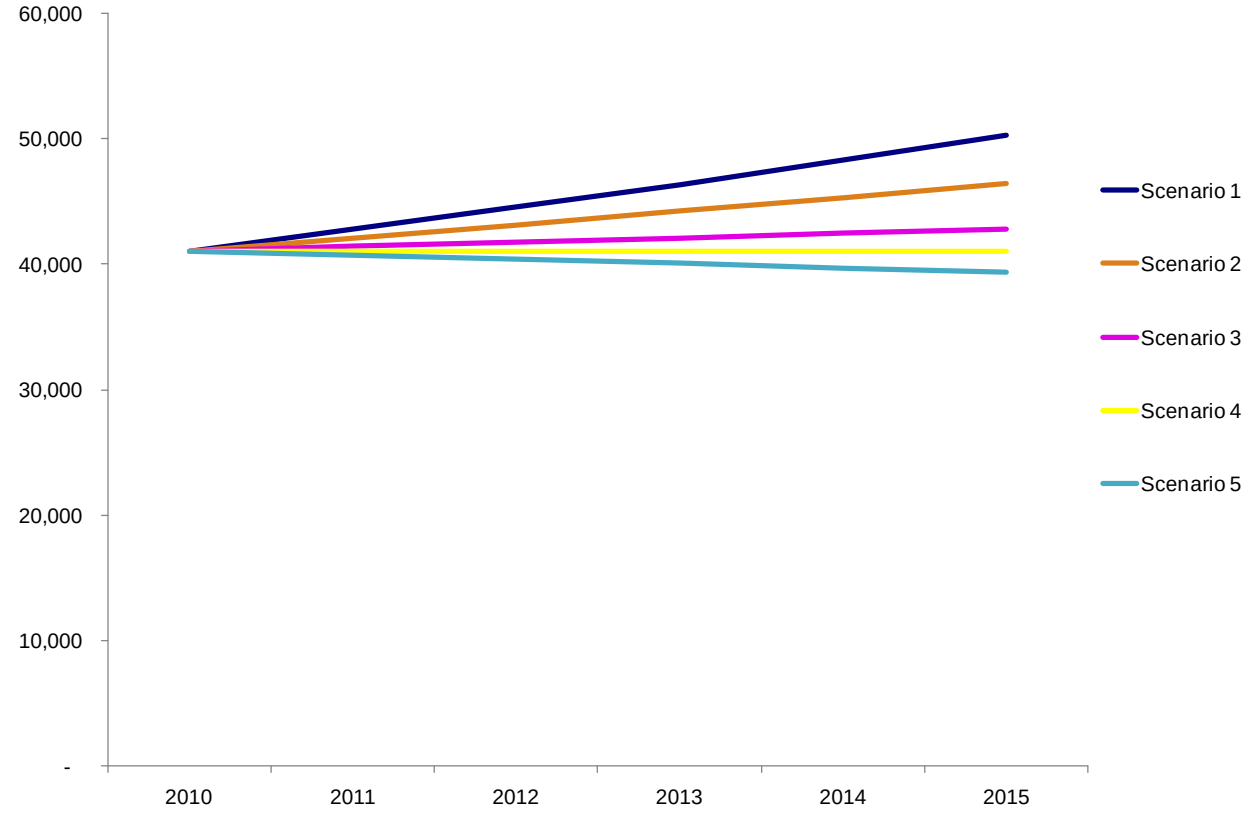


Figure 21: Professionals employment forecast, baseline labour scenario, 2011 – 2015

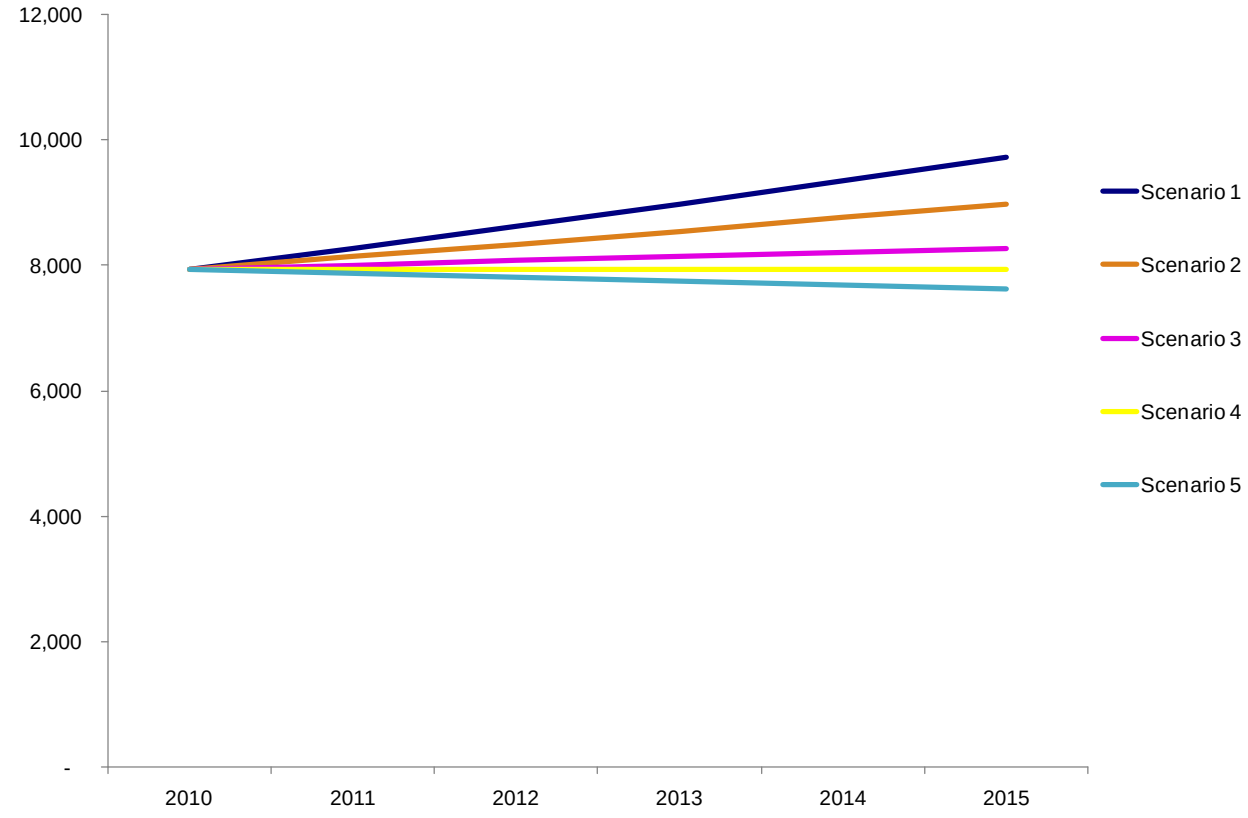


Figure 22: Artisans employment forecast, baseline labour scenario, 2011 - 2015

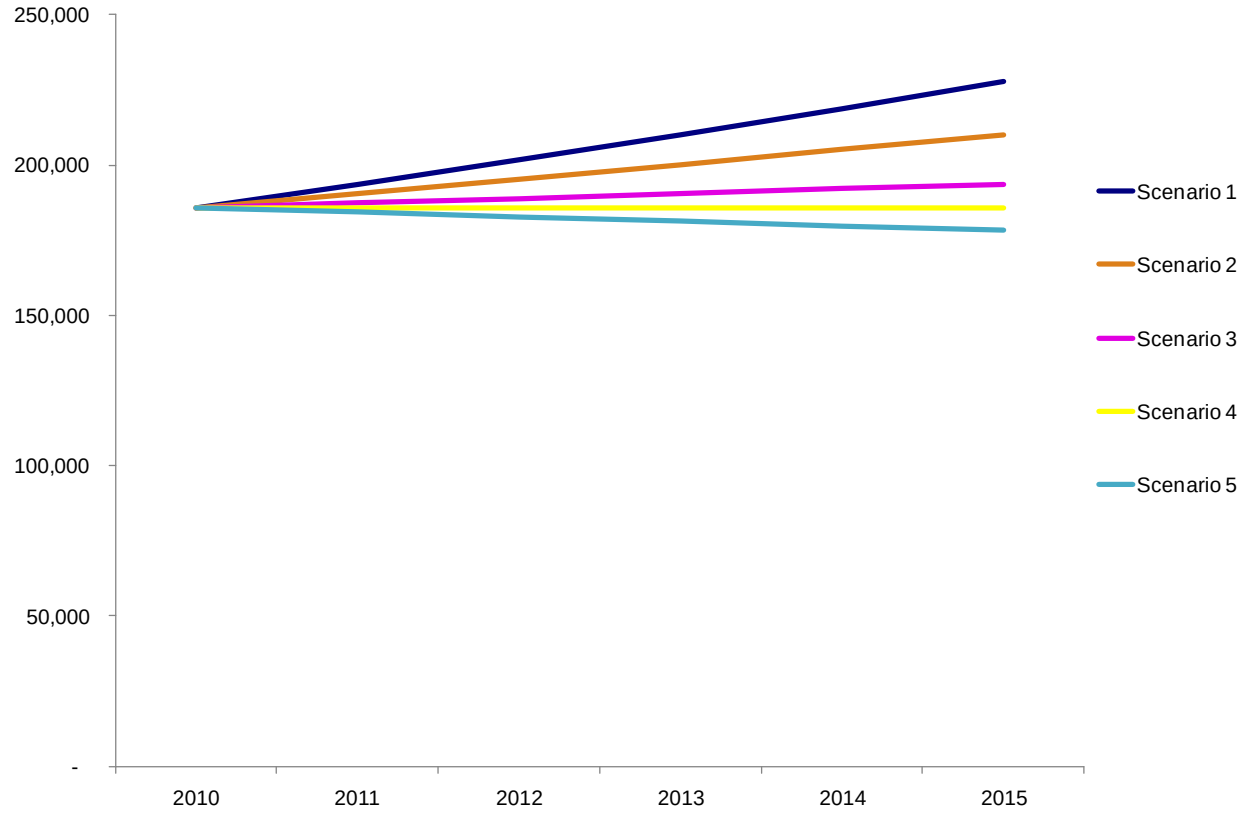


Figure 23: Technicians employment forecast, baseline labour scenario, 2011 - 2015

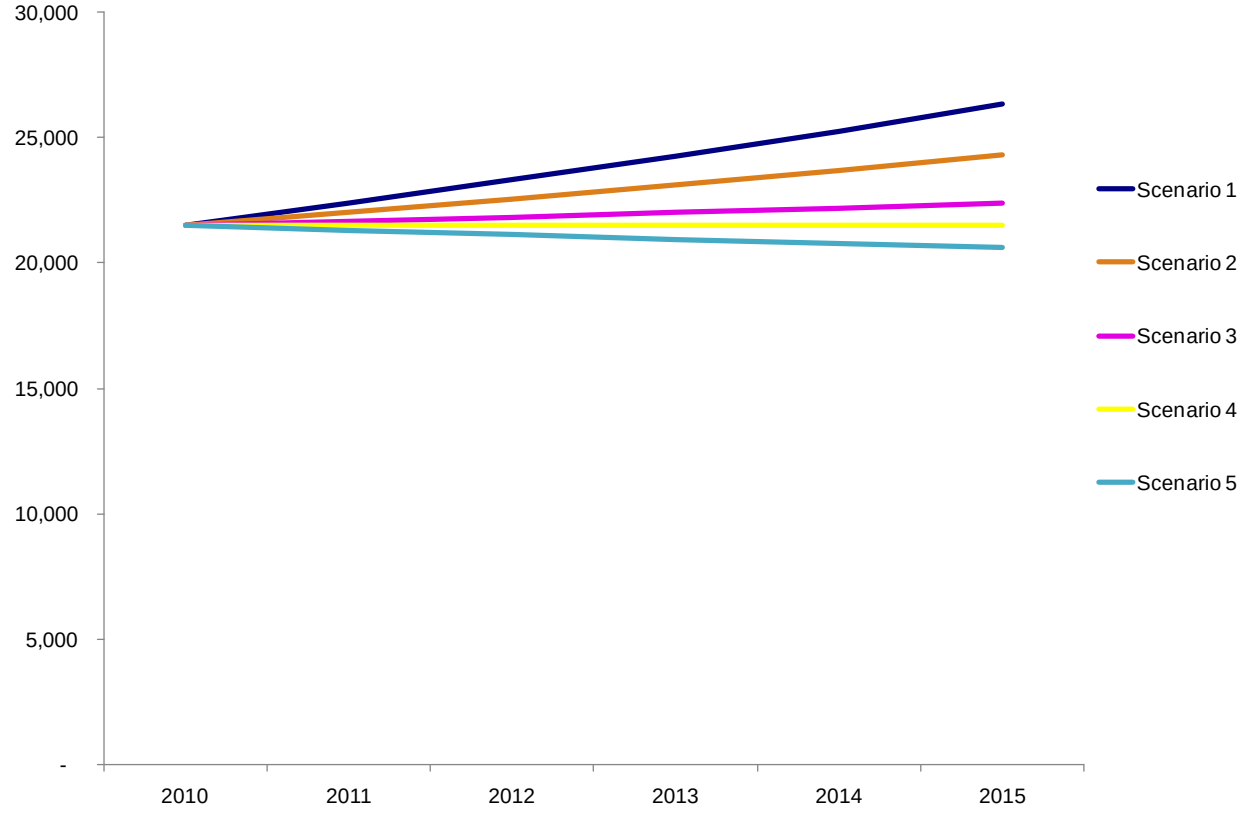


Figure 24: Clerical and admin employment forecast, baseline labour scenario, 2011 - 2015

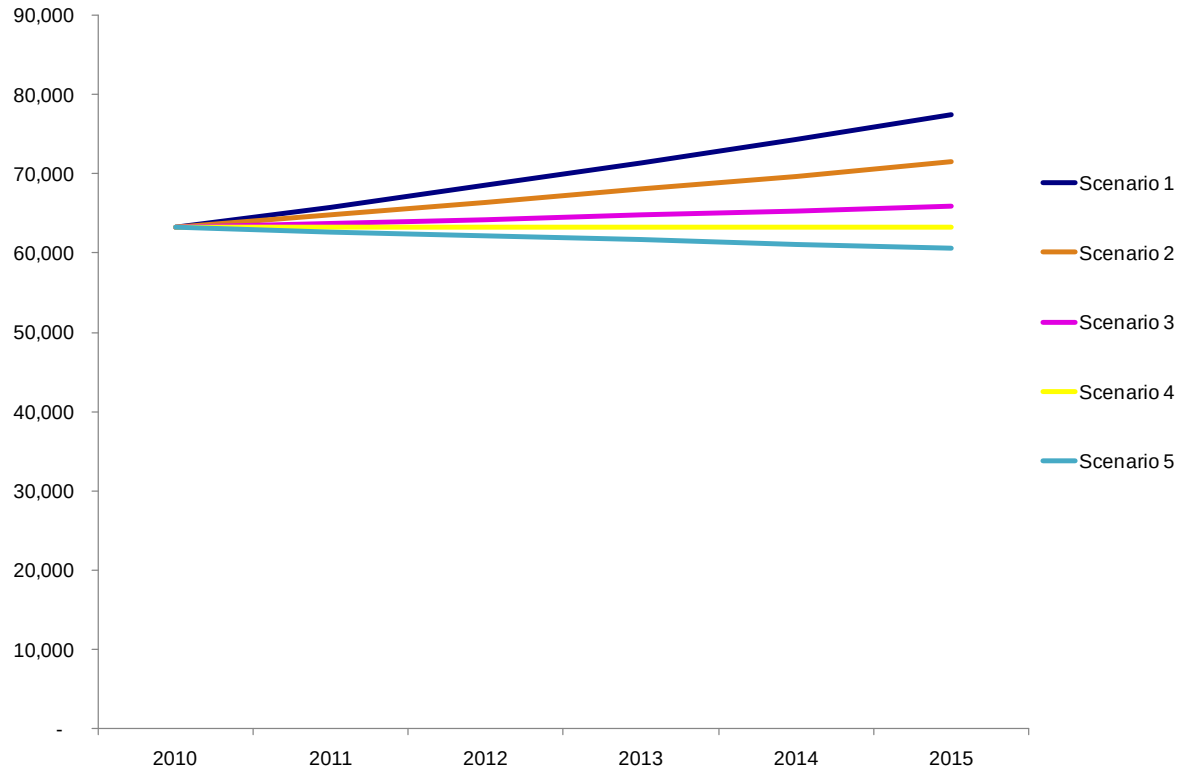


Figure 25: Operators employment forecast, baseline labour estimation, 2011 - 2015

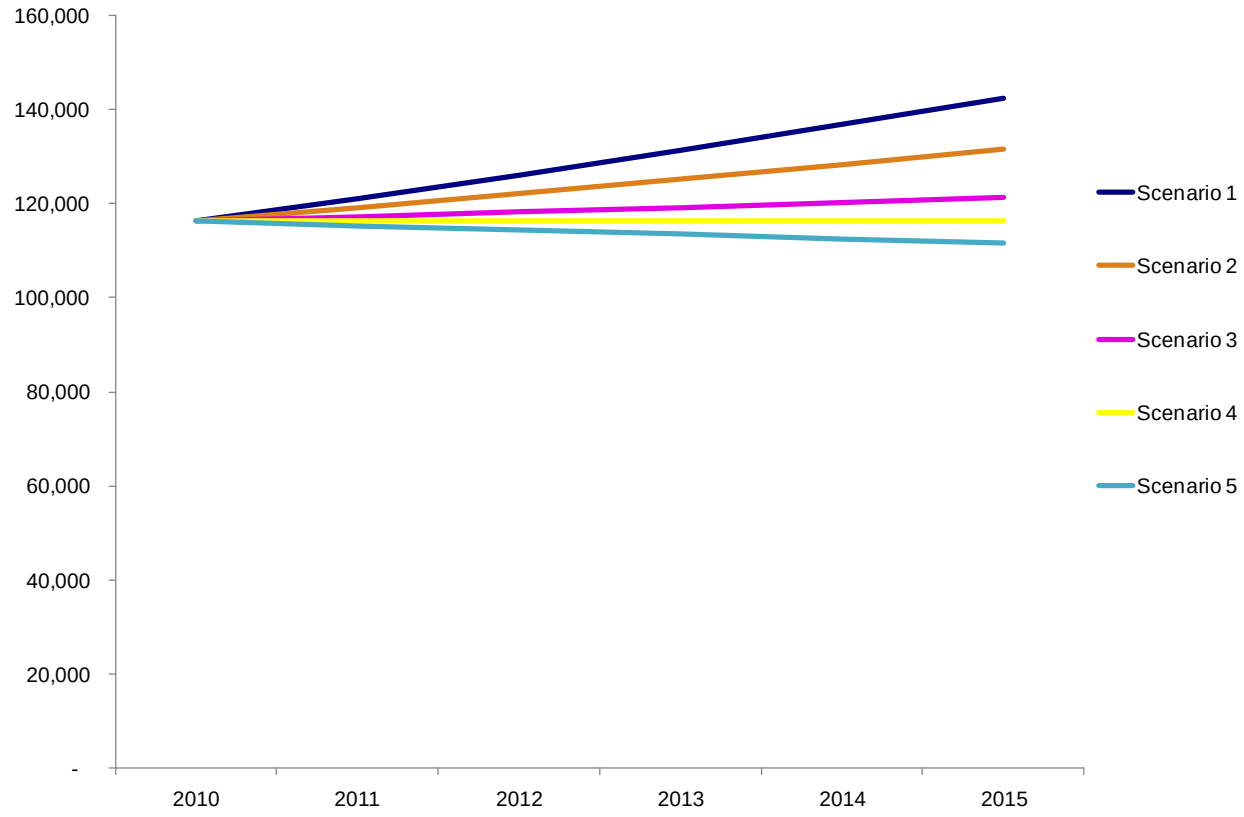
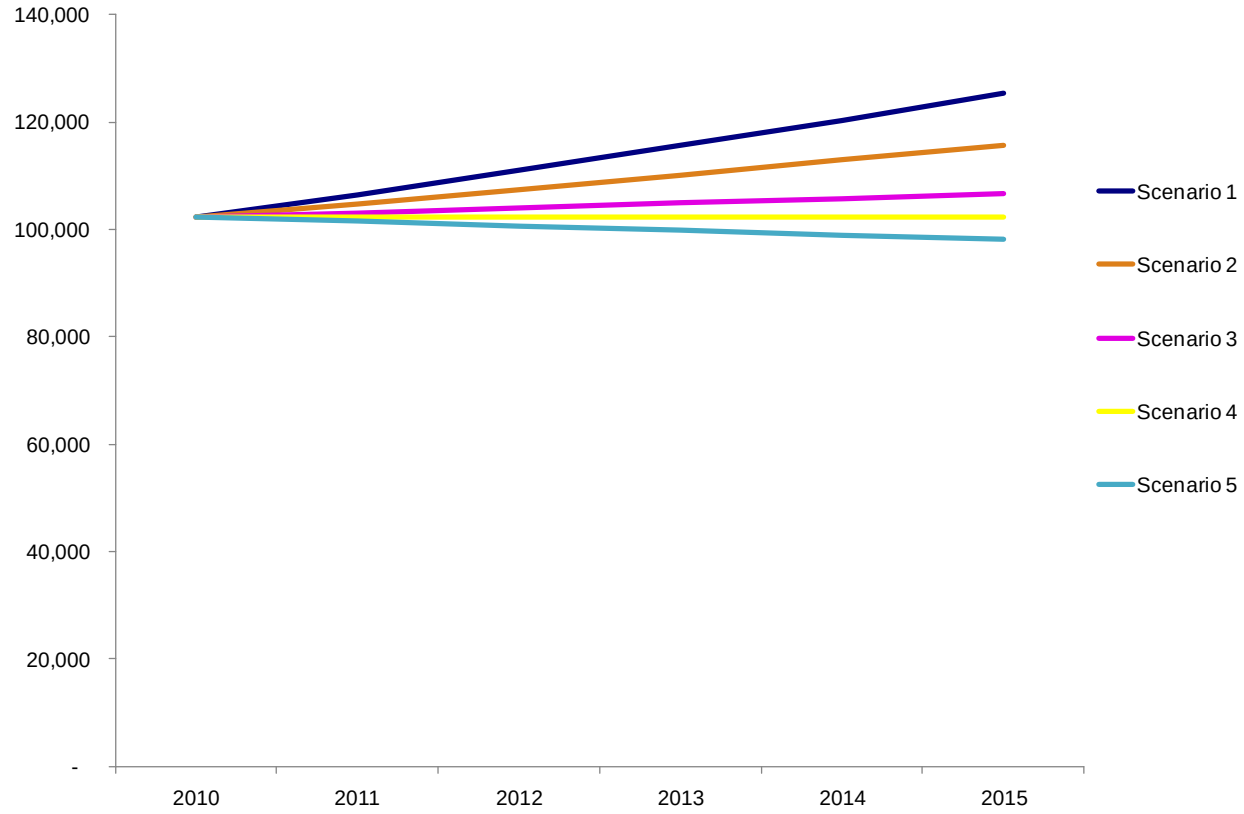
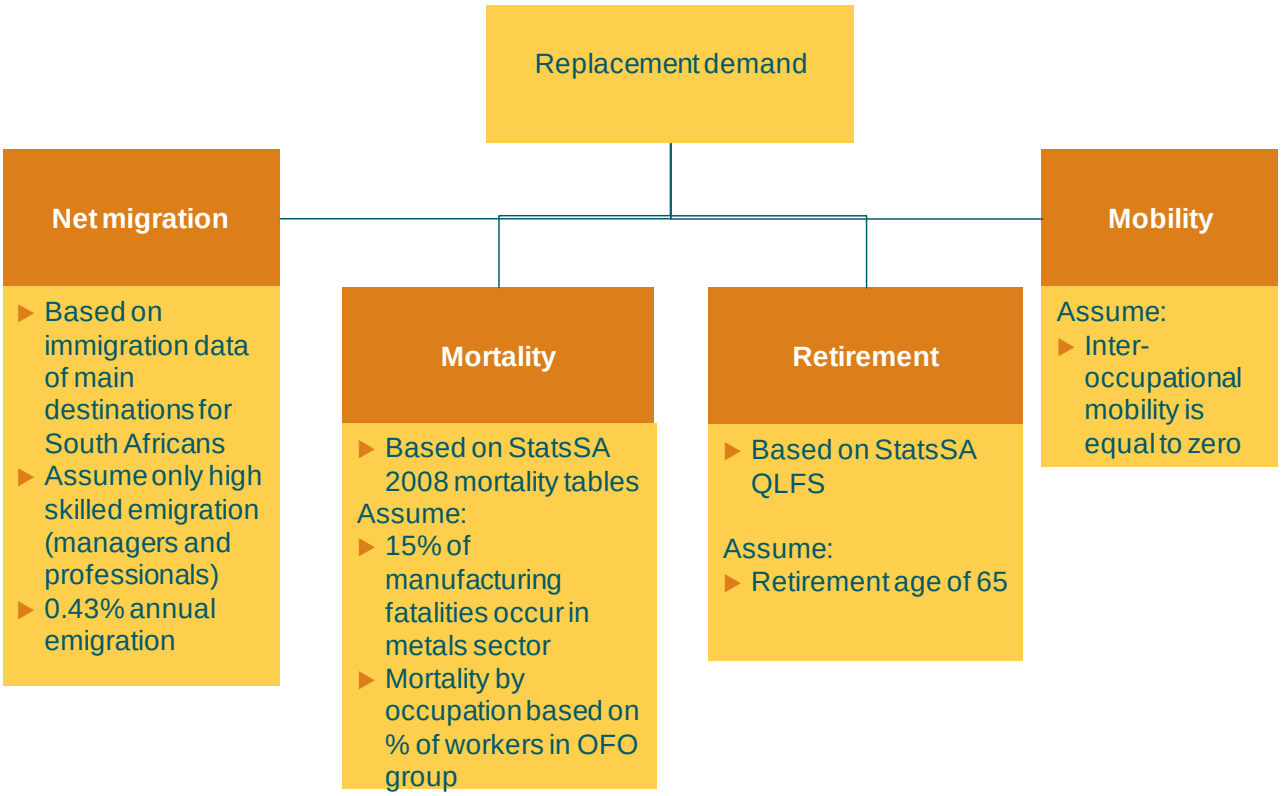


Figure 26: Elementary workers employment forecast, baseline labour estimation, 2011 - 2015



3.3.2 Replacement demand

Replacement demand arises from four main areas, retirement, mortality, mobility, and migration. The occupational demand due to each of these areas is calculated below.



Retirement estimates are based on the Quarterly Labour Force Survey of the 4th quarter 2010. Again, it should be mention that the QLFS data, as applied here, is not a representative sample, and number should be seen as indicative. It is assumed that individuals retire at age 65, and therefore all individuals who are 60 or older in 2010 will reach age of 65 by 2015 and is included in the estimation. To check the accuracy of the retirement estimation, the results are matched against StatsSA's mid-year population estimates of the national demographic profile.[58] The age group 60-64 forms 2.6% of the total population, and it is assumed that this also holds for the metals and related sectors. The results differ substantially for certain categories such as managers and artisans. Using the QLFS data for the retirement demand has the advantage that it is consistent with the growth in employment forecasts above as well as being more detailed in the metals fabrication and related sectors, and is therefore applied. The table below shows retirement totals at 2015 for the major OFO occupational categories.

[58] StatsSA. 2010. P302 Mid-year population estimates. Available: http://www.statssa.gov.za/publications/statsdownload.asp?PPN=P0302&SCH=4696

Table 5: Total metals and related sector retirement estimates at 2015

OFO Major group	Number of metals and related sector employees in 4th quarter 2010, based on QFLS	Number of retirements based on 4th quarter QFLS	Number of retirements based on mid-year population estimates
Managers	41,070	6,418	1,084
Professionals	7,942	423[59]	423
Artisans/ Technicians	207,356	3,541	5,047
Clerical and administration staff	63,209	6,918	1,127
Operators	116,341	2,858	2,966
Elementary staff	102,315	3,545	2,541
Total	538,233	22,271	13,188

Mortality rates are calculated by using StatsSA 2008 mortality tables. The data is only available in terms of high level industry (e.g. manufacturing, services) and high level occupations (e.g. professional, managers). Several assumptions are therefore necessary in order to estimate the mortality rates for metals and related sectors at a more detailed occupational level. Since metals and related sectors account for approximately 15% of employment, it is also assumed that these sectors have 15% of the mortalities.[60] The mortality profile by occupation is assumed to hold in the metals and related sectors. In order to calculate the mortality rates at a more detailed occupational level, the number of mortalities is assigned to occupational levels based on the percentage of workers employed within a particular OFO major group.

Examples: Calculating annual mortality rate

Major OFO categories

- Mortality for plant and machine operators in manufacturing in 2008: 623 workers
- Estimated mortality for operators in metals and related manufacturing in 2008: 623 * 15% = 93.45

Detailed occupational categories

- % Metal melters and casters and rolling-mill operators of total operators: (5,902 / 112,382)*100 = 5.25%
- Estimated mortality for metal melters and casters and rolling-mill operators: 93.45* 5.25% = 5 (rounded up to nearest whole number)

[59] No data was available for professional retirements, thus mid-year population estimates were used
[60] This assumption ignores that some industries are inherently more dangerous than others, for example mining versus food processing.

Table 6: Number of mortalities for metals and related sectors, by major OFO classifications

OFO Major group	Manufacturing annual mortality	Annual mortality in metals, capital equipment and transport equipment annual mortality (15% of total)	Total mortality in metals and related sector between 2011 and 2015
Managers	152	23	114
Professionals	92	14	69
Artisans	983	147	737
Technicians	146	22	110
Clerical and administration staff	122	18	92
Operators	623	93	467
Elementary staff	955	143	716
Total	**3,073**	**461**	**2,305**

Net migration is often assumed to be zero (or a constant rate) due to difficulty in obtaining accurate data.[61] Woolard *et al* assume an emigration rate of 20% of the entire working adult population.[62] The Department of Home Affairs has not been contactable to provide data on migration; therefore the study is forced to rely on earlier estimates. Unfortunately the most recent estimates date back to 2003 and the data are largely seen as incomplete and inaccurate.[63] For example the HSRC study in 1999 assumed that StatsSA underestimated true emigration by 50%.[64]

According to recent computations by the OECD – but based on 2000 figures – there were 362,000 South Africans living abroad.[65] Tertiary educated emigration rates are calculated as 17.6% per annum, whilst secondary educated emigration rates are calculated as 1.7% per annum. However, this is likely to be upwardly biased because of the time period – capturing migration between 1994 and 2000. The emigration rate of 17.6% per annum seems especially high, meaning nearly one in five of every tertiary educated person emigrates per year.

Although there is a lack of data in South Africa regarding migration, developed countries tend to keep much better records. Mirror data from developed countries can therefore be used to get an estimate of emigration. The table below provides a summary of the available data.

[61] Wilson, R. A, I. Woolard and D. Lee. 2004. Developing a National Skills Forecasting Tool for South Africa. IER/HSRC/Department of Labour
[62] Woolard, I, Kneebone, P & Lee, D (2003) Forecasting the Demand for Scarce Skills, 2001 – 2006, Human Resources Development Review 2003: Education, Employment and Skills in South Africa, Human Sciences Research Council, Cape Town: HSRC Press.
[63] Wilson, R. A, I. Woolard and D. Lee. 2004. Developing a National Skills Forecasting Tool for South Africa. IER/HSRC/Department of Labour
[64] Whiteford AC, van Zyl E, Simkins C and Hall, E (1999). Labour market trends and future workforce needs. Pretoria: Human Sciences Research Council.
[65] OECD. 2010. Database on immigrants in OECD and non-OECD countries (DIOC-E)

Table 7: Annual immigration into host countries of South Africans, for latest available years

Recipient country	Number of immigrants from South Africa	Year	Notes
United Kingdom	**11,000**	2009	Long-term international migration
	20,000	2008	
	17,000	2007	
Australia	**11,081**	2009-10	Permanent Migration Visas Granted Skill Stream visas accounted for 89% (9,855 persons)
United States	**2,705**	2010	Persons obtaining legal permanent resident status
	32,221	2000 to 2009	
New Zealand	**2,895**	July-Mar 2011	Residence approvals, 2,180 of which under highly skilled migrant category (July-Mar 2011)
	3,314	July-Mar 2010	
	2,623	July-Mar 2009	
Canada	**1,316**	2009	Permanent residence
	1,227	2008	
	1,297	2007	
The Netherlands	**948**	2010	Inflow of foreign population
	1,041	2009	
	1,255	2008	
Germany	**897**	2006	Inflow of foreign population
	944	2005	
	970	2004	
Sweden	**175**	2010	
	170	2009	
Norway	**67**	2001	
	72	2000	
Ireland	**23**	2005	Acquisition of citizenship
	15	2004	
TOTAL	**31,107**		

Assuming that emigration patterns are relatively stable (so that summing across different years is possible) there are roughly 31,107 individuals emigrating from South Africa per year. In order to translate this into metals sector migration further simplifying assumptions are necessary. Firstly, it is assumed that only highly skilled persons emigrate (in this case only managers and professionals) as they have the monetary means and are able to qualify for highly skilled working visas. Secondly, it is assumed the proportion of metals sector emigration to total emigration is equal to the proportion of skilled workers in the metal sector to total skilled workers in South Africa. Based on these assumptions, 201 managers and 22 professionals emigrate annually (at a rate of 0.43% per annum).

Similar to migration data, there is a paucity of data on **inter-occupational mobility.** Due to their skills set engineers, artisans and technicians are generally mobile across all manufacturing industry. Engineers (and to a lesser extent artisans) are also upwardly mobile within the sector, often moving into middle and upper management once they have adequate experience. Unskilled workers are also mobile within the industry, but are generally not upwardly mobile. For the purposes of this project, it is not possible to map inter-occupational mobility, which is therefore assumed to be zero.

4 Assessment of current training and education provision

This section deals with the supply side of skills into the metals fabrication, capital equipment, and related sectors. It deals with the current education framework and possible routes to obtain skills. It also provides an overview of current government and private training initiatives. Finally, enrolment and graduation patterns are analysed for trends.

4.1 *Current educational framework*

The National Qualifications Framework Act (Act 67 of 2009) provides an overarching framework of the ten educational levels through the National Qualifications Framework (NQF). The NQF includes three sub-frameworks: a General and Further Education and Training Qualifications Framework (GFETQF), an Occupational Qualifications Framework (OQF), and a Higher Education Qualifications Framework (HEQF).[66] The GFETQF deals with NQF levels 1 to 5[67], and is overseen by Umalusi. In turn the HEQF deals with NQF levels 5 to 10 and is overseen by the Council on Higher Education. The Occupational Qualifications Framework operates in parallel to the other frameworks, operating at all NQF levels. The OQF is set to be overseen by the Quality Council For Trades and Occupations (QCTO), whose aim is to ensure that there are occupational qualifications to respond to labour market needs. This "fit for purpose" approach is an attempt to directly address new and existing industry requirements in terms of skills. The aim is thus to qualify a person in a certain occupation, rather than a field of learning.

Comments on the new Quality Council For Trades and Occupations

The QCTO was established in order to centralise the work done by Education & Training Quality Assurance (ETQA) bodies. These bodies – mainly SETAs – developed their own qualifications, which led to uneven sectoral quality and duplications of tests and qualifications.[68] The creation of the QCTO is an attempt to deal with the lack of consistent approaches across SETAs and other service providers, as well to provide a stronger link between labour market skills needs and the qualifications available.[69] If successful, the QCTO will ensure consistent standards are applied across occupational qualifications, as well as creating curriculum and qualifications which are responsive to market skill requirements.

However, the sub-frameworks of OQF and how it links to HEQF and GFETQF has not yet been gazetted. In order for the entire education system to function efficiently it is necessary to clarify possible overlaps and contradictions between the frameworks. In particular, clarity is needed on how OQF will interact with Umalusi on the theoretical component of occupational qualifications. There is a threat that the organisational structures may make the system more complex, making industry – which the entire structure is aimed at – less willing to partake in this kind of learning. It is also unclear how QCTO will interact with the newly created National Artisan Moderation Body.

There are also concerns that QCTO may not have the capacity to deal with quality insurance which was previously handled by 23 ETQAs.[70]

The new framework updates the old NQF framework established in 1995, by splitting level NQF 8 into two levels, Master's degree and Doctoral degree (previously in level 8). Diplomas and higher certificates are also split from occupational certificates (previously level 5). The new NQF

[66] Umalusi. 2011. The General and Further Education and Training Qualifications Framework. Available: http://www.umalusi.org.za/ur/publications/2011.02.28%20-%20GFET%20Qualifications%20Framework%20%20draft%2011%20final.pdf
[67] The GFETQF is generally only up to NQF level 4, except for the Advanced National Certificate (Vocational), which is NQF level 5, but falls under GFETQF
[68] Department of Higher Education and Training. 2011. QCTO Update
[69] Department of Labour. *Date unknown.* Quality Council For Trades & Occupations: Legislative overview
[70] http://www.skills-universe.com/forum/topics/changes-in-the-etd-environment

framework therefore has ten levels, versus the eight in the old NQF. The table below shows the new NQF.

Table 8: NQF framework

NQF Level	Equivalent Qualification Types			Location of learning	Certificates		
10	Doctoral degrees			▸ Universities ▸ Universities of technology ▸ Professional Institutions ▸ Research Institutions ▸ Other Council on Higher Education registered organisations	National skill certificate		National Occupational certificate
9	Masters degree						
8	Honours degree/ Post-graduate diploma						
7	Bachelor degree/ Advanced diploma						
6	Diploma/ Advanced certificates						
5	Higher certificate		Advanced National Certificate (Vocational)	▸ FET college			
4	Grade 12	Adult National Senior Certificate	National Certificate (Vocational) 4	▸ Formal High Schools (private or state) ▸ FET college ▸ Labour market schemes ▸ Registered SETA training authority ▸ Union ▸ Workplace		National occupational access certificate (mathematics and science)	
3	Grade 11		National Certificate (Vocational) 3				
2	Grade 10		National Certificate (Vocational) 2				
1	Grade 9	Adult Basic Certificate of Education		▸ Primary and high school ▸ Adult learning centres			

4.1.1 Further Training and Educational Institutes

NQF levels 2 – 4 generally refer to adolescents (age 16 – 19), but is also applicable to previously unskilled employees (who follow the Adult Basic Education and Training route). There are two pathways in obtaining diplomas: a general academic pathway resulting in obtaining a **National Senior Certificate**, and a general vocational pathway, resulting in the award of a **National Certificate (Vocational)** or NC(V). These certificates can be obtained at high schools or FET colleges.

The National Certificate (Vocational) provides Grade 9 learners an alternative to the academic levels of Grade 10 – 12, by offering the National Certificate (Vocational) Level 2 to 4. This provides industry focused training on NQF levels 2 to 4.[71] The NC(V) was created to address the issue of scarce and high-demand skills and the 11 curriculum programmes fall into the priority areas of AsgiSA.[72] Three of these programmes are applicable to the metals fabrication and related sectors, namely electrical infrastructure construction, engineering and related design, and mechatronics. Two other engineering related courses are in the process of being introduced at various FETs, namely process instrumentation and process plant operation. The aim of the certificates is to train

[71] http://www.cct.edu.za/content.asp?PageID=15
[72] Department of Labour. 2008. Scarce and critical skills research project

individuals for a particular sector (but not for particular companies). In order to enter the programme a student needs one of the following prerequisites[73]:

- Grade 9 certificate
- An approved bridging programme designed for the specific purpose to access NQF Level 2
- A Recognition of Prior Learning Assessment (RPL)

Completing a NC(V) Level 4 course does allow access to continue all higher education routes: higher certificate, diploma, or Bachelor's degree. However, the minimum requirements are much more stringent for Bachelor's degrees than for higher certificates.[74]

NC(V) course summary

- NC(V) are year-long courses, awarding a certificate for the successful completion at the end of each year
  - Minimum completion of NC(V) Level 2 – 4 is 3 years
- Each year requires the completion of 7 subjects
  - 3 fundamental courses
    - Language
    - Life Orientation
    - Mathematics or Mathematical Literacy
  - 4 vocational subjects (e.g. physical science – level 2, fitting and turning – level 3, engineering fabrication – level 4)
- Must obtain minimum of 30% to pass a maths or maths literacy, 40% in the other fundamental projects, and 50% in the vocational subjects
- In order to become an artisan, a student graduating from an NC(V) level still needs to do their workplace experience through an internship or skills programme, and write a trade test before becoming a registered artisan

The **National Certificate** (sometimes referred to as NATED) used to offer six levels of study (N1 – N6). However, beginning in 2007, the National Certificate (Vocational) has replaced the National Certificate (N1 – N3) at FET colleges. The N1 certificate was akin to Grade 8, and the N3 was on par with Grade 12. A student could obtain a National Senior Certificate by passing four N3 courses, plus two additional language courses. The higher level of the National Certificate (N4 – N6) is on Level 5 according to NQF. In 2011 the N1 – N3 were reintroduced into the curriculum.

A student can qualify for a National N-Diploma in Engineering Studies on completion of a minimum of 12 subjects (from N4 – N6), together with two years in-service training in a related field. If certain prescribed subjects are taken up to N6 level, then a student can also qualify to be examined for the Certificate of Competency (Government Ticket) in the electrical or mechanical engineering field.

National Certificate course summary

- Each N course requires the completion of 4 subjects
  - Each N course lasts a trimester
  - For N6, at least two of the N6 subjects must have relevance to the vocation of the candidate
- Pass requirement is a minimum of 40% per subject
- Following completion of N6 and 18 months relevant practical experience qualifies student for a National Diploma
- Can undergo artisan training to be able to sit a trade test, to become qualified artisan

[73] http://www.northlink.co.za/ncvengineering.asp?nav=academics
[74] Department of Higher Education. 2009. Further Education and Training Colleges: Report on the Conduct of National Examinations 2009

4.1.2 Higher Education and Training Institutes

Higher education degrees, NQF 5 – 10 are obtainable at Universities or Universities of Technology. Universities generally offer bachelor's degrees (B.Sc. and BEng), whilst Universities of Technology offer national diploma's (NDip) and bachelors of technology degrees (BTech) – although some universities also offer NDip or BTech degrees (e.g. University of Johannesburg). Entrance requirements are a National Senior Certificate, with mathematics and science as courses or a NC(V) Level 4, also with the appropriate courses.

National diplomas offered include mechanical, electrical, mechatronics, chemical, industrial, and metallurgical. Students completing any of these diplomas are then able work as an engineering technician in their related field.[75]

Universities offer degrees on a wide variety of topics, the most applicable being B.Sc. (Eng) and B.Eng. degrees. Graduating students can be employed as engineers and can register as professional engineers with the Engineering Council of South Africa after a minimum of 3 years of experience (if certain requirements are met). Post-graduate degrees are also offered at HET institutions, allowing the student to specialise further in a particular field.

The following engineering programmes are applicable to the metals fabrication, capital equipment and transport equipment sectors:

- Aerospace and Aeronautical Engineering and Technology
- Automotive Engineering and Technology
- Chemical Engineering and Technology
- Electrical Engineering and Technology
- Engineering Mechanics
- Engineering Science
- Industrial Engineering and Technology
- Instrumentation Engineering and Technology
- Manufacturing Engineering and Technology
- Materials Engineering and Technology
- Mechanical Engineering and Technology
- Metallurgical Engineering and Technology
- Other Engineering and Engineering Technology

NDip course summary

- A National Diploma takes minimum 3 years to complete
  - 2 years theoretical courses
  - 1 year practical, spent in workplace (usually 2nd year)
- Qualifying at NQF level 6
- Qualify to register as a technician

BTech course summary

- One year course
- Minimum requirement is NDip
- Graduates can register with register with ECSA as Professional Technologists

BSc (Eng)/ BEng course summary

- Bachelor degrees (B.Sc., BEng, BTech) are 4 year degrees
- Qualifying at NQF level 7
- Graduates can work as engineers
- Graduates qualify for post graduate degrees (MSc, PhD)

[75] Engineering Council Of South Africa. 2010. Diplomas Accredited as Meeting the Educational Requirement for Registration as a Candidate and Professional Engineering Technician

4.1.3 Routes to become an artisan[76]

The introduction of the NC(V) system has created some confusion around the routes to become an artisan. The phasing out of the N1 and N2 negates the traditional path to becoming an artisan, as apprentices previously acquired their theoretical knowledge through N1 and N2. Furthermore, no workplace training exists that is currently required within the NC(V) training curriculum.

There are currently four routes to becoming an artisan:

1. Learnership Route

The learnership route registers the student with a SETA on an NQF registered artisan trade qualification. The programme lasts between 2 to 4 years and has multiple entry and exit points. The student moves up NQF levels 2, 3, and 4 during the learnership and can exit the programme once any of the levels are obtained. It is important to note that the employer can also terminate the contract at the completion of any level. On each level there is 40% on the job training, and 60% institutional training. Artisan certification occurs after a trade test is completed.

The learnership route places a greater focus on institutional training and employer, and is designed to include more generic competencies along more occupation specific knowledge.

2. Apprenticeship route

A learner can register an apprenticeship with a SETA for an NQF registered artisan trade qualification. The apprentice spends between 80 weeks to 4 years on a single apprenticeship contract, depending on the learning programme. The contract is an agreement between the candidate, SETA and employer. The apprenticeship ends in a trade test which, if passed, qualifies the apprentice as an artisan. This route only has one entrance and exit point.

The main focus of apprenticeship training is practical, on-the-job experience which is updated with theoretical knowledge. The focus of apprenticeship is also often more targeted than in learnerships.

3. Recognition of Prior Learning (RPL) Route

An individual with relevant previous learning or experience can register as a Recognition of Prior Learning (RPL) student with the Institute for the National Development of Learnerships, Employment Skills and Labour Assessment (INDLELA). This requires the individual to spend a pre-determined period on a single contract that ends in a trade test. The RPL will help the individual to compile a portfolio of evidence (recognition for parts of the programme already completed) which is assessed by INDLELA prior to a trade test. Once the trade test is passed the individual will be a recognised artisan.

The RPL route is an important route for South Africa for several reasons. Many previously disadvantaged workers, due to apartheid practices, have extensive experience in the industry and fulfil the roles of artisans (or parts thereof), but are not accredited. These individuals are constrained, since – on paper at least – they are not easily employable in other companies. The current low levels of formal in-house training rates by companies makes RPL an important route, as many employees might have informal experience or knowledge, but do not have the accreditation to prove it.

4. Internship or Skills Programme Route (NCV plus)

[76] This sub-section draws heavily on: Department of Labour. 2008. Scarce and critical skills research project

A learner that has a relevant NC(V) can register an internship or skills programme with SETA for an NQF registered artisan trade qualification. This requires the learner to spend a pre-determined period in the workplace on a single internship or skills programme. The programme ends in a trade test, after which the learner is registered as an artisan. This route only has one entry and exit point.

Comments on artisan training:

The different routes to becoming an artisan give students different levels of exposure to theory and practical knowledge. This has been problematic, as it has led to the routes being received differently in the labour market. In particular, the learnership programme, introduced in the late 1990s, has faced strong criticism from industry. The programme is seen to produce artisans of low quality, lacking fundamental knowledge and experience. The system also had a low throughput rate, with some learnership skills development programmes having a completion rate as low as 34%.[77] A learnership programme, while often beneficial for soft skills, is not seen as a valuable training route for artisans.

Not only do the artisan routes result in different quality of graduates, but the type of occupational study also produces different quality artisans. For example, there are several different tests to become an electrician, depending on the industry. These tests are not always of the same quality. Furthermore industry is not aware of the different specifications, and hires an electrician expecting a certain skills set – which may not have been included in the candidate's training. Currently the system is being changed to move back to one test per occupation, and to standardise the tests across all trade test centres, with the National Artisan Moderating Body acting as moderators and assurers of quality of the programme and testing.

The scrapping of the N programmes is seen by educational institutions and industry as having a negative impact on artisan training. The N courses gave the theoretical basis aligned with the apprenticeship programmes and entry into trade. The N courses were scrapped due to the shift to learnerships, making the N courses irrelevant. However – partly due to the perceived failure of learnership programme – the phasing out of the N programme left a gap in the training and supply of artisans.[78] This has been acknowledged with the reintroduction of the N courses starting March 2011.

All four routes require testing at trade test centres. The trade test centres are also currently seen as a constraint to produce more artisans, in terms of quality (some testing centres are believed to be of low quality, passing students too easily) and quantity. Some trades at Indlela test centres reported having a waiting period of 12 to 18 months.[79] However, this is blamed in part on the number of students who want to take the test even though they are not qualified to do so. For example, employees falsify their service letters (which prove that they qualify for the Recognition to Prior Learning) in order to sit the trade test. This places strain on trade test centres' capacity.

[77] DBSA. 2010. Thinking 'out the box' by thinking 'in the box'. Considering skills development: Challenges and recommendations.
[78] DBSA. 2010. Thinking 'out the box' by thinking 'in the box'. Considering skills development: Challenges and recommendations.
[79] http://www.nbi.org.za/print_page.php?pg=40&pgm=M&id=10890

4.2 Adequacy of curriculum to supply industry

4.2.1 FET curriculum

The NC(V) curriculum introduced to FET institutions in 2007 is characterised by a broad approach to education and training.[80] Since there are only four NC(V) engineering programmes (plus two new programmes) offered at FETs which have to serve the entire economy the curriculum is designed to be general and broad in nature. The table below shows the course contents of the Engineering and related design and Electrical infrastructure construction.

National Certificate: Engineering and related design

Level 2	Level 3	Level 4
Engineering Fundamentals Engineering Technology Engineering Systems **OPTIONAL** Physical Science OR Fitting and Turning OR Automotive Repair & Maintenance OR Engineering Fabrication	Engineering Practice and Maintenance Materials Technology Engineering Graphics and Design (CAD) **OPTIONAL** Physical Science OR Fitting and Turning OR Automotive Repair & Maintenance OR Engineering Fabrication	Engineering Processes Professional Engineering Practice Applied Engineering Technology **OPTIONAL** Physical Science OR Fitting and Turning OR Automotive Repair & Maintenance OR Engineering Fabrication

National Certificate: Electrical Infrastructure Construction

Level 2	Level 3	Level 4
Electrical Principles and Practice Workshop Practice Electronic Control and Digital Electronics **OPTIONAL** Electrical Systems and Construction OR Physical Science	Electrical Principles and Practice Electrical Workmanship Electronic Control and Digital Electronics **OPTIONAL** Electrical Systems and Construction OR Physical Science	Electrical Principles and Practice Electrical Workmanship Electronic Control and Digital Electronics **OPTIONAL** Electrical Systems and Construction OR Physical Science

The table above shows that much of the compulsory courses are general in nature (e.g. Engineering Processes; Electrical Principles and Practice), aimed to provide the basic tools needed to operate in the engineering field. Optional subjects can allow a student to focus on a more specific stream within the NC(V) degree, for example Fitting and Turning or Automotive Repair and Maintenance. However, more general subjects can also be taken for the optional courses (e.g. Physical Science). The NC(V) therefore provides a general grounding which must be further developed in the workplace in order to attain the necessary occupational skills.[81]

The Department of Higher Education and Training aims to review the FET curriculum every 3 years. It is currently reviewing engineering and related design, electrical infrastructure construction, and mechatronics curriculum. The new syllabus will be introduced in 2013. The revision allows industry and academics a chance to comment on the current curriculum and shortcomings at various workshops. The structure (when courses are taught and the order of subjects) as well as content is reviewed in this process. There is however a concern that although the curriculum review is every 3 years, the time taken to introduce new curriculum is in fact much longer. Once a gap in the curriculum is identified it can take up to 2 year to get new curriculum approved. Since the diplomas can take between 3 to 4 years to complete it means that the first graduates with the new curriculum could potentially be 5 to 6 years after the gap is highlighted.[82]

[80] http://www.saide.org.za/Sectors/FurtherEducationandDevelopment/tabid/1452/Default.aspx
[81] DBSA. 2010. Improving quality and expanding the further education and training college system to meet the need for an inclusive growth path.
[82] Airey, L. 2011. Strengthening Skills Development- Partnerships between HE&T, Industry & Social Partners.

The initial introduction of 14 programmes was based on identified scarce skills. The goal of DHET is to increase the number of programmes available, providing students with more study options. The recent introduction of the two new engineering programmes (process instrumentation and process plant operations) forms part of this strategy. Industry pressure was also a factor in introducing these specific courses. The curriculum was designed through a tender process, awarded to experienced curriculum designers and developers. The designers were tasked to consult widely with industry and FET institutions (to ensure that the curriculum is implementable), including international experts for benchmarking. The curriculum was then submitted to SAQA to ensure that it meets certain standards and criteria. Finally industry was approached again to ensure available in-service training options are available to students.

The review and introduction of programmes provides a system for regular interaction with industry and stakeholders, through which they can comment on gaps in the curriculum and lobby for the introduction of new technologies. However, this system may not always function as intended, since there is often a disconnection between industry and FETs.[83] This disconnect was highlighted during the change to the NC(V) curriculum, with many industry stakeholders claiming that they were not consulted. If industry is unaware (or uninterested) in changes in curriculum then the updating and aligning of the curriculum becomes much less accurate and responsive.

The main concern from industry is, however, the quality of graduates rather than the curriculum. Graduates are seen to have poor theoretical and practical knowledge, often lacking the fundamental skills necessary to operate within an occupation. This again puts the onus on industry to provide training. The combination of a generalist curriculum and a poor quality of education makes it difficult to interpret industry views on the curriculum, as one is a structural disparity between what industry wants and what FET institutes are able to provide and the other is around the quality of education, but it is often grouped together by industry.

This in part explains the high level of tertiary qualified individuals that remain unemployed, amounting to 200,000 in 2005. [84] Of the tertiary qualified unemployed 82% hold diplomas or certificates. This figure reflects individuals studying fields with lower employment prospects (e.g. diplomas or certificates in business, commerce and management), but it also reflects that FET diplomas or certificates have a poor image with employers, which see these graduates as having a poor knowledge base.

The NC(V) curriculum has suffered from certain constraints since its introduction in 2007. Firstly, the target audience was not always clear, as NC(V) can be used as an alternative to Grades 10 to 12, but can also serve as further education for individuals who require technical knowledge following matriculation. This issue affects students and their educational choices, but also leads to a loss of credibility of the courses in the eyes of industry. Secondly, there is evidence that the content of the NC(V) does not always accurately aligned with skills requirements in industry. For example, in response to a gap in the Civil Engineering and Construction curriculum five of the largest companies in the construction sector financed the rewriting of the NC(V) curriculum. Thirdly, there are serious concerns around the quality and standards of the curriculum taught. Comments from industry is that students lack the basic knowledge needed to perform tasks (despite having learnt it) or only know the simplest of applications are not able to troubleshoot problems as they arise. This issue has many potential sources, including a lack of adequately qualified teachers at FETs. Finally, several concerns are raised about the NC(V) curriculum[85]:

- NC(V) curriculum is inflexible and is not able to accommodate part-time or modularised learners
- Current curriculum content is inadequate base for trade testing

[83] Department of Labour. 2008. Impact assessment of learnerships and apprenticeships
[84] DPRU. 2006. Graduate unemployment in Post-Apartheid South Africa: Nature and possible policy responses.
[85] FET Round Table. 2010. Challenges facing the FET College system

- Absence of systematic connection to workshop and workplace learning, despite the curriculum explicitly calling for experience

The N (or NATED) curriculum was replaced (before being reinstated) by the NC(V) as the N programmes were seen as narrow in content, designed to meet low-wage industry demand and outdated.[86] However, pressure from students and industry has led to the reintroduction of these courses. The part-time nature of the courses (generally 9 months work and 3 months of studying) allows students to work, thus alleviating some of the pressures faced by industry. Furthermore, the N courses were seen to be closer aligned with trade tests. The reintroduction of the N courses did not however deal with the inferior and outdated curriculum.[87] At the time of reintroduction Department of Higher Education and Training argued that it would not be a blanket reintroduction, but that industry would have to fund the courses they needed to be reinstated.[88] From discussions with education institutes it is not clear whether this is in fact the case.

4.2.2 HET curriculum

Similar to the NC(V) courses there are a limited number of NDip, BTech, and B.Eng courses which have to supply the whole economy. However, the level of specialisation is much greater, particularly for university degrees in engineering which has 12 applicable degrees and further specialisation is possible in post-graduate degrees.

Engineering programmes are accredited by Engineering Council of South Africa, which is a signatory of the Washington Accord of 1989. Signatories of the Washington Accord have undertaken to ensure that participants recognise academic equivalence of engineering programmes. ECSA provides broad-level output requirements (rather than detailed curriculum input requirements) and does an inspection visit at accredited universities every five years. Accredited university programmes are therefore aligned to international standards every 5 years.[89]

The Sydney Accord – signed in 2001 – recognises equivalence in the accreditation of qualifications in engineering technology[90]. Based on this Accord, ECSA aims to ensure that Engineering Technologists are recognised as having received academic equivalence training (compared to other signatories). Similarly, the Dublin Accord – signed in 2002 – applies to an Engineering Technician.

ECSA therefore provides the broad outline of requirements, with the HET institutions able to design specific programmes and curriculum around this. These institutions also have some autonomy to choose the focus of the programme or department. For example, some universities may choose to place greater value in the theoretical aspects of engineering, whilst other institutions may place the focus on practicality instead. However, the role of ECSA does ensure that regardless of the specific focus of an institution a certain standard is maintained and that certain fundamental criteria are met. HET institutions generally have programme planning committees which meet annually to review the curriculum. New content and curriculum requires faculty and departmental approval. In some cases industry representatives are invited to serve on the programme and planning committee meetings to provide input.

The majority of HET institutions consulted did not mention curriculum as a constraint to meeting the skills gap. Instead there was a consistent concern over the quality of secondary education students are receiving. Students are underprepared to deal with the university curriculum and

[86] Mbanguta, Z. 2002. Towards a new engineering education policy for South African Further Education and Training colleges: easy articulation to universities and technikons and recognition by the engineering Professional Council of South Africa. World Transactions on Engineering and Technology Education 1(1):39-45.
[87] http://mg.co.za/article/2009-12-04-outdated-technical-courses-to-return
[88] http://mg.co.za/article/2009-12-04-outdated-technical-courses-to-return
[89] http://www.ecsa.co.za/documents/List_of_AccrUniv_E-20_PE_2011.pdf
[90] http://www.washingtonaccord.org/

struggle to complete the degrees in the allocated time. This puts pressure on the system, as numbers of students – particularly in second and third year courses – swell above a manageable limit. Some universities have had to decrease the number of first years taken in due students getting 'stuck' in second and third year. Many HET institutions have also noted that the staff capacity has not increased in line with the drastic increase in number of students. Furthermore, obtaining and retaining adequately trained staff has also become increasingly difficult. Despite a lack of capacity, there is increasing pressure on universities to increase the take-in of students, particularly in engineering.

There are still concerns raised from industry regarding the curriculum at HET institutions. The main concern is a lack of practical experience before entering the work sphere. As is the case with FETs, this is partly due to the structure and aim of engineering education. By nature the courses offered by South African universities are more general, since a small number of students have to serve the entire economy and as such needs a broad set of tools and knowledge. This is in contrast to other countries which are able to provide much more specialisation – even at an undergraduate level – due to the number of engineers in the system.

Comments on curriculum

The curriculum of engineering and related studies – particularly NC(V) – is focussed on providing broad-based education. This is necessary as the infrastructure and capacity does not exist to provide detailed courses at this level. Graduates entering the workplace for the first time will therefore not have all the required knowledge needed to fulfil the occupational needs. More training and on-the-job experience is necessary before the graduate is likely to be competent in a given occupation. This places a burden on industry, which already trains less than comparable countries (see below). It is important to keep this structural mismatch in mind when reviewing industry comments around curriculum development.

There are policies in place for review and updating of the curriculum at FET and HET institutions, including allowance for industry input. However, the mechanism for input does not always function as intended. Industry stakeholders often feel that they were not consulted adequately or were not given enough notice to comment. In turn, academic institutions comment that industry is often uninterested in academic issues such as curriculum.

There is evidence that the current curriculum (at various educational levels) is not suitably aligned to industry needs. In several cases industry has responded to gaps in curriculum by introducing new curriculum through targeted programmes (e.g. National Foundry Technology Network – see below) or by jointly reviewing and altering curriculum with the Department of Higher Education and Training. These programmes have generally been successful in addressing critical issues. Industry led programmes have the advantage of being targeted and ensuring relevance, and compliments the broader training offered at FETs and HETs.

4.3 Private and public training initiatives

There are currently several private and public training initiatives aimed at addressing skills shortages in the work place.

The Human Resource Development Strategy for South Africa (HRD-SA) 2010 – 2030[91] was approved in March 2009. It replaces the previous HRD strategy from 2001. The aim of HRD-SA is to increase the aggregate levels of skills in the workforce, in order to benefit individuals and society alike. The work initiated under JIPSA will also migrate to HRD-SA, and the JIPSA

[91] Department of Education . 2009. Human Resource Development Strategy for South Africa (HRD-SA) 2010 – 2030

secretariat will become incorporated into the Human Resource Development Support Unit.[92] However, whereas JIPSA was focused on addressing scarce skills shortages; HRD-SA deals with wider education issues (e.g. enhancing maths and science education in schools). Several high priority skill areas were identified for immediate attention:

- Training high level engineering and planning skills, particularly for the transport, communications, and water and energy sectors
- Artisanal and technical skills
- Mathematics, science and language competence in public schooling

The South African government plans to spend approximately R215 billion on education and skills development in the medium term (up to 2014). This funding is spread across existing schools, FETs, and HETs, but also allows for new programmes. One of the priorities of this spending is adding 30,000 more engineers into the South African economy by 2014.[93] This has resulted in the creation of several initiatives to draw school learners – particularly black youth and women – into the engineering profession. The initiatives are mostly coordinated under the Engineering Council of South Africa's (ECSA's) 'Engenius' initiative.

The Engenius initiative, coordinated by the Engineering Council of South Africa (ECSA) aims to promote national collaboration and support amongst stakeholders in the engineering field (e.g. government departments, SETAs, higher education institutions, and private and public enterprises). There are currently approximately 58 organisations which have partnered with ECSA in Engenius. The Engenius also focuses on promoting engineering to primary and high school learners. This is done through several media including DVD promotional videos, website (still under construction), dispersing information about bursaries through mobile phones (sms), running engineering-related design competitions, and presentations at schools and science fairs.

The National Tooling Initiative has several key projects, including skills and expertise development. The Toolmaking Association of South Africa researched best practice from the National Institute of Metal Workers (USA), and adopted many of its standards, including curriculum. Based on the new toolmaking curriculum, NTI set up a pilot programme to train artisans. The programme started in 2011 with a 9 months bridge programme. This is followed by apprenticeships in seven sites throughout the country (funded by **the dti**, the budget for 2011 is R120m). Currently the programme has 500 students (96% of which passed the bridging course), with numbers set to increase every year. The new curriculum is based on the apprenticeship model, with the whole programme being modular. Testing is done for each module, and once a certain number of credits are obtained the student can sit a trade test. So far the project has shown great potential, including buy-in from industry.

Programmes such as NTI and the National Foundry Technology Network were founded to support subsectors which are often struggling to grow or to maintain current market share. The programmes focus on various aspects of competitiveness such as technology uptake and skills development. In terms of skills development the programmes attempt to update or introduce new standards, as the current curriculum is seen as generic that are not adapted to the tooling or foundry subsectors. These essentially industry-led programmes have so far been successful in identifying shortcomings in the curriculum, lobbying for changes, and setting up new training programmes. Such a targeted and focussed approach to curriculum review, with co-operation between industry and academic institutions is a model that is replicable and offer medium term solutions for skills issues, with the key success factor being buy-in from industry.

[92] http://www.nbi.org.za/welcome.php?pg=206
[93] Seggie, E. 2011. New push to make engineering attractive and to meet 2014 graduate target. *Engineering News*

National Foundry Technology Network (NFTN)

The NFTN was created in part due to RALIS survey results on the bottlenecks to growing the foundry sector. The survey found that:

"[Skills] is the single most important concern of the foundry industry. The challenges that the foundry industry is facing go beyond the issues commonly connected with the skills shortage problem that affects South Africa.

Companies suffer from a shortage of skills at all levels, from shop floor to top management, and with the latter in particular with respect to succession when current managers retire in the near future. Moreover, there is a particular shortage of maintenance and non-foundry staff (e.g. electricians)."[94]

The NFTN was established in 2008 to respond to this critical shortcoming of skills in the industry. Four other results areas were also identified, all different aspects of creating a more competitive industry.

Since its inception NFTN has since reviewed the curriculum offered for various levels required in the foundry sector. Based on these results it has created a learning pathway/ career path framework – which starts at the shop floor and shows how one can climb the ladder to higher positions. The foundry qualifications (NQF 2 – 4) were also redesigned to match industry needs more closely. This was approved by SAQA in July 2009. Before this foundry related qualifications provided generic training in occupations. Aligned with this was the creation of the creation of national curriculum to support melters, moulders and patternmakers. Three leanerships and trade tests were also established, and piloted at three large firms.

The work of NFTN was driven by the fact that there was no dedicated FET (or other) courses servicing the foundry industry. Furthermore, companies had disincentives to upgrade the skills of its workers, since this made poaching easier and in many cases it is cheaper to poach higher skilled workers than to train them in-house. Thus an overarching training structure, which can provide coordinated training was necessary. The NFTN has conducted feasibility report for a training centre in Western Cape and is currently conducting a feasibility study for a training centre in Gauteng. These centres will train metal casting trade workers, engineering production systems workers, and metal engineering process workers (ranging from NQF 1 – 4). The focus will be on sand casting using both green and chemically bonded sand as well as permanent mould gravity die casting.[95]

There are several key aspects to success for NFTN (and similar projects). Industry buy-in and constant feedback is critical. Industry input is needed in the review of curriculum, identification of key skills required, provision of learnership/ apprenticeship practical experience, as well as assistance with funding. Government assistance from various departments is also necessary, including **the dti,** Department of Labour, Department of Higher Education and Training, Department of Science and Technology, as well as the relevant SETAs. The project team needs to be diverse, combining industry experience, strong project management experience with experience in curriculum design and teaching. Finally, data (quantitative and qualitative) is necessary in order to make informed decisions on the performance of the sector, and to identify the main constraints.

The table below provides an overview of some of the programmes in place to increase skills and education.

[94] Cunningham, S and Meyer-Stamer, J. 2008. Report on the RALIS Exercise in the Foundry Industry
[95] GTZ ESDS Programme and Tshumisano Trust. 2009. Preliminary Feasibility Study and Business Plan on Establishing a Foundry Industry Training Centre in the Western Cape

Table 9: Relevant projects aimed at improving skills and education

Project	Project aims	Stakeholders	Comment
Accelerated artisan training programme[96]	▶ Condense a 3 – 4 year apprenticeship into 18 months – Upfront institutional training (26 weeks) – Practical workplace experience (54 weeks) – End in trade test	▶ merSETA	▶ Requires intake of 10 or more candidates – Limited to larger companies ▶ Training requires ratio of one qualified artisan to two apprentices
National Tooling Initiative	▶ Aim to grow the tool-die-and-mould making industry ▶ Key action programmes: – Skills development – Capacity expansion, SMME and BBBEE structuring – Technology recapitilization – Competitiveness improvement and export development – PPP Governance structure development	▶ **the dti** ▶ DST ▶ merSETA ▶ Toolmaking Association of South Africa ▶ Sasol ▶ International Special Tooling & Machining Association (ISTMA) ▶ Bohler Uddeholm Africa (Pty) Ltd	▶ In 2007, NTI anticipated that interventions would grow turnover in the industry from R6bn a year to R20bn a year by 2014[97]
National Foundry Technology Network	▶ Assess skills development needs ▶ Provide interventions to increase skill levels – Ensure constant flow of skilled trainees entering the industry	▶ Aluminium Federation of South Africa ▶ **the dti** ▶ IDC ▶ South African Institute of Foundrymen ▶ University of Johannesburg ▶ CSIR ▶ Eskom ▶ UNIDO	▶ Support includes: – Rollout of green training centres – Provide training NQF 2- 4, NQF and up and onsite training
Engenius	▶ Aim to grow engineering profession ▶ Promote engineering to primary and high school learners	▶ ECSA ▶ Government departments ▶ SETAs ▶ HETs ▶ Private enterprises	
College Industry Partnership	▶ Aim to promote partnerships between FETs and industry ▶ Support alignment between vocational education and skills required in the workplace	▶ National Business Initiative ▶ Major companies in the construction, mining and engineering sectors	
Technical Skills Business Partnership	▶ Aim to train 5,400 artisans, operators and miners – Excluding current in-house training	▶ National Business Initiative ▶ Anglo Platinum ▶ ArcelorMittal ▶ Eskom ▶ Gold Fields ▶ Sasol ▶ Transnet	▶ Recession has resulted in a delay in reaching targeted numbers

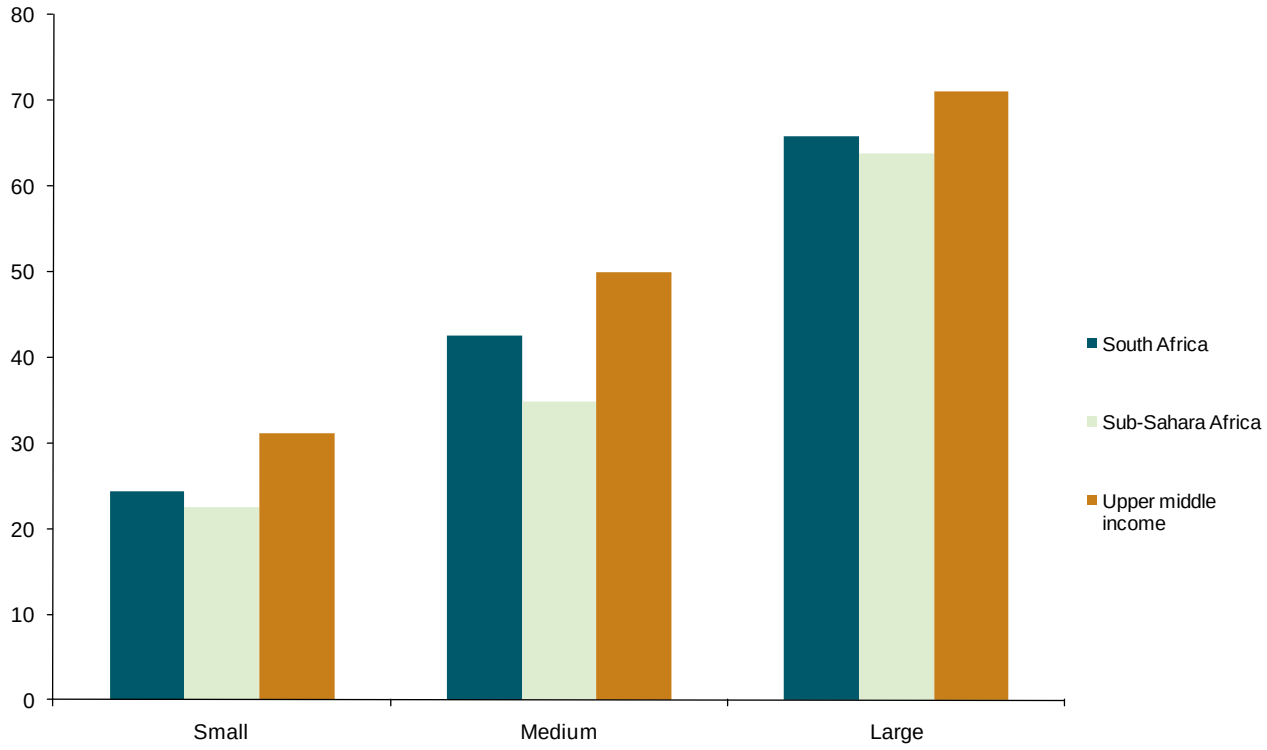
[96] http://www.merseta.org.za/Default.aspx?tabid=103
[97] http://www.engineeringnews.co.za/article/national-tooling-initiative-plans-to-more-than-triple-industryx2019s-turnover-by-2014-2007-02-05

Project	Project aims	Stakeholders	Comment
SAWomEng GirlEng	▶ Aims to increase number of women in engineering ▶ Provides mentoring and coaching to young girls ▶ Introduce girls to the world of engineering	▶ SAWomEng ▶ UCT	▶ Started in 2009
Candidate Academy	▶ Supports engineering graduates to obtain ECSA professional registration	▶ Civils Masakheni – Saice Section 21 company	▶ Registration, without support, can take up to 9 years ▶ Aim to reduce time to 4 years
Artisan Development Network[98]	▶ Aim to increase number of artisans in the system ▶ Learners will receive 6-month theoretical training ▶ Then receive 12 month experiential learning on a learnership programme ▶ Further learnership will be undertaken to complete 4 year artisan development programme	▶ Department of Public Works	▶ Launched in 2011 ▶ Budget of R32m, mainly aimed at built environment, but includes training on – Fitting and turning – Mechanical – Electrical and welding

Several companies also have in-house training programmes, developed to deal internally with the skill shortage (particularly for artisans and technicians). Companies that have had training courses in place for a long period generally have a good pool of artisans and technicians to choose from and are less affected by shortages in the market. Formal training processes are viewed as expensive (and there is always a threat of the employee leaving for a higher paying job once training is completed), which explains why some companies rely on informal, on-the-job training rather than using formal training routes. The figure below is based on World Bank Enterprise Survey data and provides the percentage of manufacturing firms which offer formal training. It is notable that despite the shortage in skills South African manufacturing firms provide less formal training than other comparable upper middle income countries.

[98] http://www.info.gov.za/speech/DynamicAction?pageid=461&sid=15943&tid=27527

Figure 27: Percentage of manufacturing firms offering formal training, by size, 2007[99]



The lack of focus on in-house training was also found by Maree *et al*, who found that industry has sought to rid itself of the expense of training.[100] This is argued to be a short-sighted strategy, and has required importing skills in the past as a stopgap. Interviews with industry and industry associations have also revealed that the skills agenda has become de-prioritised as companies are still trying to cope with the poor results over the past two years and the prevailing lack of demand.

The above figure only reflects formal training. Informal training, especially in smaller firms may be much more prevalent. As expected, larger firms tend to provide more formal training as they have better systems in place (e.g. HR and administration departments) and larger budgets.

[99] Source: World Bank Enterprise Survey. South Africa. 2007
[100] Maree, J. Lundall, P and Godfrey, S. 2008. Industrial structure and skills in the metals beneficiation sector of South Africa

Comment on training initiatives

Clearly the issue of a lack of skills has been identified by government and private sector alike, with several programmes in place to deal with shortages in engineering, technicians, and artisans. However, due to the nature of the education required, most of these projects have long lead times. Artisan training can take between 2 to 4 years, whilst engineering training takes 4 years. Thus the benefits of these programmes (if successful) will not be observed immediately. Programmes such as Engenius, which promotes mathematics, science and ultimately engineering at a high school (or primary school) level will take even longer.

Targets mentioned in the programmes are also often very ambitious. For example the South African Institution of Civil Engineering (Saice), although positive about the initiative to add 30,000 engineers, does not believe it is possible by the target date.[101] There is a threat that overly ambitious target setting results in inadequate training, as it changes the goal from training artisans, technicians and engineers who can contribute to the economy to training enough artisans, technicians and engineers to meet targets (and therefore the quality of the training is no longer the priority).

4.4 Role of merSETA

The role of SETAs is to fulfil the goals of the National Skills Development Strategy. In order to meet these goals SETAs have several functions. They are to develop (and update) a sector skills plan, which is implemented through establishing learnerships and apprenticeships; allocating grants; and provide quality assurance. At its core the SETAs are seen as a central mechanism for mediating the relationship between supply and demand of skills.[102]

merSETA is the relevant SETA for the metals and related sectors, as established through the Skills Development Act (Act 98 of 1998). It focuses on skills development in 5 subsectors, namely:

- Metal and engineering
- Auto manufacturing
- Motor retail and component manufacturing
- Tyre manufacturing
- Plastics

merSETA receives funding from the Department of Labour (collected as the Skills Levy by SARS) which it uses to fund its various operations. Its two main channels to facilitate training are through mandatory and discretionary grants. The bulk (50%) of merSETAs funds are channelled into mandatory grants, which is paid to a company for training undertaken over the financial year. This is based on the submission of a WSP and ATR.

Discretionary grants (which form 20% of merSETAs budget) are offered to companies for undertaking certain training programmes which lead to national qualifications. These grants cover learnerships and apprenticeships; internships; basic adult education; and skills programmes. Skills programmes funded include Accelerated Artisan Training Programme (AATP), Voucher Implementation Programme, and HIV/AIDS Project. The AATP (see table 9 above) has had relative success since its introduction, with 1,984 apprentices in training since 2009. merSETAs success at encouraging apprenticeships has resulted in 39% of the total apprenticeship population coming from the metal and related sectors.[103]

[101] Seggie, E. 2011. New push to make engineering attractive and to meet 2014 graduate target. *Engineering News*
[102] DPRU. 2008. SETA review
[103] merSETA. 2009. AIDC Conference 2009

Despite some successful programmes, merSETA does face certain constraints and challenges. Although the relationship between employers and merSETA is good on average,[104] the sub-sectors covered comprise of approximately 44,000 companies.[105] As such several companies, especially smaller ones, complain that there is a lack of communication with merSETA. It is also sometimes accused of slow response times and delaying payment to companies for training already completed. In terms of delay of payments merSETA is often not at fault. Delay in the payments to merSETA from DHET means that merSETA cannot make payments to companies. For example, payments have not been made between July and October 2011 due to delays in funding from DHET.

A DPRU review of the SETAs in 2008 gave merSETA a low operations score (55 out of 100) measured in terms of good governance, ability to achieve targets outlined the sector skills plan, and quality assurance.[106] merSETA scored high in good governance (having received a unqualified audit report for the past decade) as well as achieving planned targets. However, in terms of quality assurance merSETA received a poor score. The score was based on whether merSETA captured key data (e.g. learner pass rates); performs analysis of data; whether merSETA-ETQA validates learner results; and moderates assessors. It is unfortunately not clear the exact weighting of these elements into the score, or which element merSETA was seen to perform poorly in. It is worth noting that the quality assurance element will be taken over by the newly established QCTO. In terms of accreditation merSETA is also sometimes blamed for creating a bottleneck in the system due to bureaucracy. For example some colleges have struggled to registered learnernships and apprenticeships. However, much of the issue lies with the SETA system and the structure of the learnership programme, rather than merSETA.

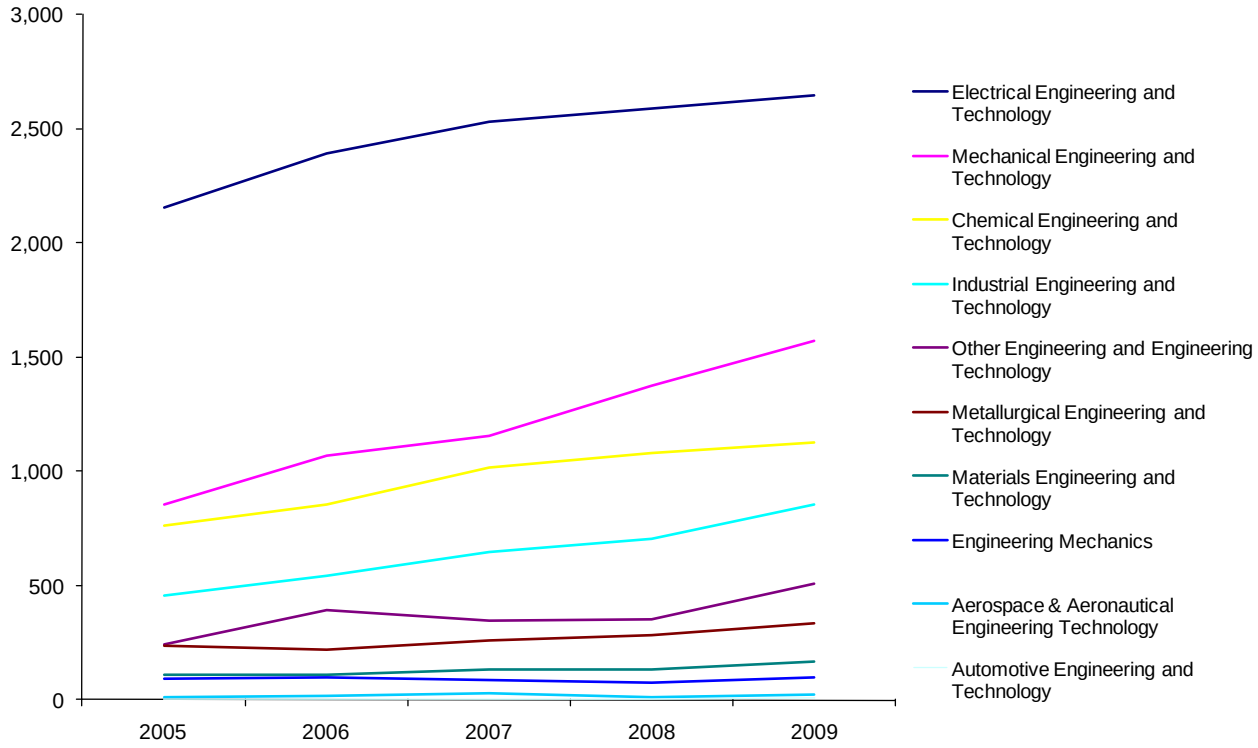
Despite some shortfalls (much of which structural), stakeholders consulted were generally positive of the role and impact of merSETA. This matches recent research, which has found merSETA to be functioning well.[107]

4.5 Enrolment and graduation patterns

Engineering programmes which are applicable to the metals fabrication, capital equipment and transport equipment sectors make up approximately half of the possible engineering programmes offered at HETs. However, 75% of students graduating in 2009 with a HET diploma or degree were in applicable fields (7,328 graduates). The figure below shows the graduation rate for the applicable fields between 2005 and 2009. Note that this data includes all graduates, from National Diploma to Doctorate degrees.

[104] Department of Labour. 2008. Impact assessment of learnerships and apprenticeships
[105] merSETA. 2009. Skills Development Workshop South Coast Area
[106] DPRU. 2008. SETA review
[107] Department of Labour. 2008. Impact assessment of learnerships and apprenticeships

Figure 28: Total graduates from HETs in selected engineering fields, 2005 - 2009



In 2009, 27% of engineering graduates received their diploma/ degree in electrical engineering (36% of selected courses), whilst 16% received their diploma/ degree in mechanical engineering. Overall, engineering graduates grew strongly from 6,624 in 2005 to 9,782 in 2009, roughly 10% per annum (compound annual growth). This increase was driven by a large increase in graduates in mechanical engineering, which nearly doubled between 2005 and 2009 (compound annual growth rate of 16%). This is a positive result for the metals fabrication, capital equipment and transport equipment sector.

Table 10: Growth in mechanical engineering and technology by type of degree/ diploma, 2005 - 2009

Type	Number of graduates, 2005	Number of graduates, 2009	Growth (compound annual)
Undergraduate Diploma/ Certificate (1 or 2yrs)	1	0	--
Undergraduate Diploma/ Certificate (3yrs)	397	649	13%
Undergraduate Bachelor degree (1st B Deg 3yrs)	0	11	--
Undergraduate Bachelor degree (1st B Deg 4yrs or more)	345	757	22%
Postgraduate Diploma/ Certificate	4	9	22%
Postgraduate Bachelors Degree	0	0	--
Honours/NH Dip	23	34	10%
Masters/ Masters Dip research	53	70	7%
Masters/ Masters Dip non-research	15	29	18%
Doctorate	19	13	-9%

The major source of growth in graduates comes from an increase in diplomas (NDip) and Bachelor's degrees (B.Sc.(Eng), BEng or BTech). Honours and Masters degrees also showed good growth.

Unfortunately, only enrolment data was available for public FET colleges. The number of enrolments at public FET colleges has generally increased between 2009 and 2010, with the notable exceptions of N1 and N2 engineering courses which saw substantial decreases (as FET colleges no longer offering N1 – N3 courses, but are allowing students already in the system to complete their studies). It is not clear how the reintroduction of the N1 – N3 in 2011 will impact the new NC(V) system, for example NC(V) Level 4 examinations were written for the first time in 2009.

Table 11: Number of enrolments from public FET colleges

Field	Level	Number of enrolments, 2009	Number of enrolments, 2010	% Change	% of total enrolments
Engineering and Related Design	NC (V) Level 2 Students	11,869	12,667	7%	16%
	NC (V) Level 3 Students	3,705	6,212	68%	17%
	NC (V) Level 4 Students	729	1,790	146%	15%
Total		**16,303**	**20,669**	**27%**	**16%**
Electrical Infrastructure and Construction	NC (V) Level 2 Students	12,173	12,919	6%	16%
	NC (V) Level 3 Students	3,274	5,402	65%	15%
	NC (V) Level 4 Students	587	1,807	208%	15%
Total		**16,034**	**20,128**	**26%**	**15%**
Mechatronics	NC (V) Level 2 Students	403	391	0.5%	0.5%
	NC (V) Level 3 Students	--	243	0.0%	0.7%
	NC (V) Level 4 Students	--	--	0.5%	0.0%
Total		**403**	**634**	**57%**	**0.5%**
Engineering	N1	5,658	743	-87%	99%
	N2	8,516	3,370	-60%	99%
	N3	15,205	16,697	10%	80%
	N4 – N6	60,364	63,775	6%	44%
Total		**89,743**	**84,585**	**-6%**	**50%**

The throughput rate of students (number of students graduating in the minimum number of years) is generally very low, some institutions report throughput rate as low as 20%. This can be seen in the sharp drop-off in numbers from NC(V) Level 2 into higher levels, although this improved in engineering and related design and electrical infrastructure courses. Part of the issue is that the NC(V) Level 2 is regarded as a big jump from Grade 9.

Students taking courses relating to engineering form approximately 32% of total students in the NC(V) courses (excluding civil engineering). Engineering and related design and electrical infrastructure and construction have the second and third highest attendance rates, with only office administration attracting more learners. The majority of enrolments in the N courses are from the engineering courses. These are encouraging signs that students are starting to see the value in studying these fields.

Private FETs only form a small part of total FET attendance and graduation. The uptake of engineering related courses (excluding civil engineering) is substantially lower at private FET

colleges, NC(V) engineering and related design enrolment only formed 1% of total enrolment. Again, the N courses have a much better enrolment percentage.

Table 12: Private FET colleges, enrolment by type of programme, 2010

Programme	Course	Number of enrolments, 2010	% of total enrolments
Occupational Qualification	Manufacturing, Engineering and Technology	3,514	9%
NC(V)	Electrical Infrastructure and Construction	107	3%
	Engineering and Related Design	19	1%
N courses	Engineering	4,036	55%

Some NC(V) and N students can go on to do further diplomas, or they can choose to enter the workplace directly as operators, or in some cases more skilled occupations. Graduates, with the applicable engineering subjects, can also go into a training programme to become an artisan (through one of four routes discussed above).

According to merSETA a total of 5,030 artisans graduated in 42 different artisan trades in 2010 (see table below). Despite many artisan trades on offer, the top 10 courses account for 80% of all graduates. These trades tend to be more general, applicable across most of manufacturing (e.g. electricians, fitters, and welders).

Table 13: Number of artisan graduates by trade, 2007 - 2010[108]

Artisan trade	Number of graduates 2007	Number of graduates 2008	Number of graduates 2009	Number of graduates 2010	Number of graduates 2011 (part thereof)	Total number of qualified artisans between 2007 and 2010
Electrician	402	533	614	738	395	2,287
Fitter	276	369	567	686	362	1,898
Motor Mechanic	331	420	503	579	305	1,833
Diesel Mechanic	189	304	414	396	217	1,303
Millwright (Electromechanician)	196	260	370	401	178	1,227
Boilermaker	129	162	364	470	223	1,125
Fitter and Turner	124	185	251	280	140	840
Welder	79	66	146	281	122	572
Tool Jig & Die Maker	130	165	149	113	52	557
Earth Moving Equipment Mechanic	51	95	103	176	68	425
Turner	75	79	120	119	35	393
Automotive Electrician	52	81	105	97	77	335
Instrument Mechanician	37	49	86	121	71	293
Spraypainter	61	85	63	56	79	265

[108] Source: merSETA

Artisan trade	Number of graduates 2007	Number of graduates 2008	Number of graduates 2009	Number of graduates 2010	Number of graduates 2011 (part thereof)	Total number of qualified artisans between 2007 and 2010
Automotive Body Repairer	52	76	71	89	36	288
Refrigeration Mechanic (Industrial)	45	64	81	54	19	244
Rigger	13	18	28	59	73	118
Automotive Machinist	23	30	27	30	23	110
Tractor Mechanic	5	14	20	47	15	86
Armature Winder	19	27	24	26	4	96
Forklift Mechanic	8	15	17	33	23	73
Lift Mechanic	22	28	22	10	11	82
Refrigeration Mechanic (Commercial)	9	29	18	19	16	75
Diesel Fuel Injection Mechanic	7	20	27	20	9	74
Diesel Fitter	17	8	16	18	7	59
Motorcycle and Scooter Mechanic	7	7	20	15	5	49
Refractory Mason	2	10	5	17	13	34
Electrician (Engineering)	15	6	1	17	4	39
Moulder	14	3	5	15	2	37
Electronics Equipment Mechanician	12	6	12	3	4	33
Vehicle Body Builder	17	4	6	4	5	31
Machine Tool Setter	10	5	13	4		32
Turner Machinist	7	10	4	9	1	30
Automotive Engine Fitter	2	3	3	9	4	17
Patternmaker	6	5	4	4	1	19
Sheet Metal Worker	1	9	1	7	2	18
Plastics Mould Maker	7	2	1	1	1	11
Roll turner	3	1	2	3		9
Pipe Fitter	1			2		3
Domestic Appliance Mechanician			1	1		2
Universal Grinder	2					2
Earthmoving equipment mechanic				1		1
Grand Total	**2,458**	**3,253**	**4,284**	**5,030**	**2,602**	**15,025**

Overall, artisan graduations doubled between 2007 and 2010, growing at a compound annual growth rate of 27%. This, in part, reflects some success of the government and private sector initiatives to increase the number of artisans. In order to meet the New Growth Path's goal of 50,000 artisans by 2015, this growth rate would have to continue between 2011 and 2015. It is not

clear whether such rapid growth is sustainable, especially since some trade test centres already have long delays to sit the trade test.

There does not currently appear to be any clear idea of how many artisans are operating in the economy, or the metals fabrication, capital equipment and transport equipment sectors. During the shift from Jipsa to HRD-SA it was estimated that there were 47,000 artisans in South Africa, however some were still in training and the numbers were still said to require reviewing.[109] A National Register of Artisans, such as the one which was mothballed in the early 2000s, will help anchor discussions around skills shortages. It will also allow role-players to more effectively comment on issues such as Eskom bringing Thai welders due to a lack of local welders.[110]

Impact on skills forecasting

Although it is possible to narrow the possible fields of study down to the most relevant programmes for the metals and related sectors, it is not possible to determine whether a graduate will actually work in this sector. For example, electrical engineers can serve almost the entire manufacturing industry, and much of the wider economy. The figures above therefore represent the maximum number possible of graduates entering the metals and related sector.

As with some of the data in Chapter 3, some strong assumptions are required in order to fit the available data into the model:

- Forecasting is only done for occupations which data was available for (engineers, artisans, and technicians), excluded groups are:
  - Managers
  - Clerical workers
- Elementary workers and operators are excluded
  - Since no prior training is required, there is an assumed oversupply of elementary workers
  - This assumption ignores that certain operator roles do require an NC(V) or NSC degree or some specialised training
- Supply of technicians is based on number of undergraduate diplomas from HETs in the engineering field
  - Simple growth rates between 2005 and 2009 are applied (9.5% compound annual growth between 2005 and 2009)
  - Ignores any capacity issues of increasing intake and output of students at educational institutions
- Supply of engineers is based on number of bachelor, masters and PhD degrees
  - Future growth rate is assumed to be 8.5% (the growth rate required to obtain governments goal of 30,000 new engineers by 2014)
    - Government target is based on survey of available capacity
    - Target cannot be disaggregated into type of engineer
    - Assume all engineering fields grow by 8.5%
  - Includes BTech degrees which does not qualify student as engineer – rather a technologist – as it is not possible to separate it from the other bachelor degrees
- Each occupation is assumed to receive engineers or technicians according to the proportion of employment of that occupation within the major OFO category
  - This is a simplifying assumption

[109] http://www.nbi.org.za/welcome.php?pg=40&pgm=M&id=11150
[110] http://www.pmg.org.za/report/20110622-eskom-labour-related-issues-kusile-medupi-power-stations

5 Gap analysis

This chapter combines the results from Chapter 3 and 4 and provides some evidence about potential skills gaps in the metals fabrication, capital equipment and transport equipment sectors. The results are shown using the high level OFO major categories and full results are included in Appendix C.

5.1 Comparison of forecasted demand and supply

The scenarios presented below provide an overview of how the demand for labour is likely to change given a particular sector and labour growth rate. In terms of the sector growth, the middle scenarios (Scenario 2 and Scenario 3) are the more reasonable assumptions. Historically, the sector has not shown rapid growth (with the exception of the automobile sector), and growth has often been slower than GDP growth. Scenario 1 is the best case scenario, a type of growth that all initiatives strive for, but one that will be tough to obtain in the current economic climate. This scenario does however provide insight into the employment requirement should initiatives such as the New Growth Plan become successful. Scenario 4, with zero sector growth, shows the replacement demand due to migration, retirement and mortality. In some instances, the number of new workers required to maintain the *status quo* are substantial. Scenario 5, a double dip recession, appears (at the time of writing) to be unlikely.

It is unlikely that employment will respond to sector growth on a 1:1 ratio. In order for this to happen all resources would have to already be used at full capacity, and there can be no productivity growth. The baseline scenario of a labour elasticity of 0.8 appears to be quite high, but it is a reasonable estimate due to increased political pressure for labour-intensive job growth. It is also the historic manufacturing labour elasticity. Scenario c, underperformance of labour versus sector growth, is unfortunately also a possibility. Some companies still have moratoriums on any new hiring, and many are focussing efforts on improving productivity rather than taking on new staff. Despite strong growth in manufacturing output in the 1st quarter of 2011, the Manpower survey estimated a net employment outlook of 3% for the 2nd quarter of 2011 (the percentage of employers anticipating an increase in hiring activity less the percentage of employers expecting to see a decrease in employment in the next quarter).[111]

The table below shows a summary of the forecasted skills required due to growth in the sector by year. Total migration, retirement, and mortality are shown as totals for the entire period. For the table, a growth rate of 3% per annum (growth scenario 2) and a labour elasticity of 0.8 (labour scenario b) is assumed.

[111] Manpower. 2011. Manpower Employment Outlook Survey South Africa

Table 14: Summary of forecasting by year for growth scenario 2 (3% growth per annum) and labour scenario b (labour elasticity of 0.8)

Type	2010 Q4	Additional labour for the year					Total migration	Total mortality	Total retirement	TOTAL new demand
		2011	2012	2013	2014	2015				
Managers	41,070	1,023	1,048	1,074	1,101	1,128	883	114	6,418	12,789
Professional	7,942	198	203	208	213	218	171	69	423	1,702
Artisans	185,869	190,497	195,241	200,102	205,085	210,191	-	759	3,541	28,622
Technicians	21,487	22,022	22,570	23,132	23,708	24,299	-	88	-	2,899
Clerical workers	63,209	1,574	1,613	1,653	1,694	1,737	-	92	6,918	15,281
Operators	116,341	2,897	2,969	3,043	3,119	3,196	-	467	3,545	19,236
Elementary workers	102,315	2,548	2,611	2,676	2,743	2,811	-	716	1,849	15,954

The tables below show the total number of new jobs demanded for each major OFO occupation for all years in the study. The figures thus represent the total number of *new* employees required in each occupation for the *entire* period (2011 – 2015).

5.1.1 Managers

Table 15: Total new managers required per scenario, 2011 – 2015

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	18,762	16,674	12,812
Scenario 2	13,956	12,789	10,589
Scenario 3	9,510	9,148	8,452
Scenario 4	7,415	7,415	7,415
Scenario 5	5,402	5,739	6,398

Managers are often promoted from within the company based on work experience and strong leadership and organisational skills. Although they are often required to have some post-graduate degree, experience is given much greater weight. Thus, it is not sensible to analyse the supply side in terms of students. Companies are generally able to find high level management, but there is anecdotal evidence of some constraints at the middle management level. Employees who could fill middle management positions often do not have the correct soft skill set to do the job effectively. However, this is a clear-cut case for increased in-house training by companies.

The table below shows the top 5 occupations based on forecasted demand (based on scenario 2b):

Table 16: Highest new occupational demands for managers, 2011 - 2015

Occupation	Total employment 4th quarter 2010	Total new demand 2011 - 2015
Directors and chief executives	7,838	3,980
Finance and administration managers/department managers	14,300	3,678
General managers of business services	4,335	2,866
Production and operations managers/department managers in manufacturing	8,204	1,273
Personnel and industrial relations managers/department managers	2,422	376

5.1.2 Professionals

Table 17: Total new professionals required per scenario, 2011 – 2015

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	2,857	2,453	1,706
Scenario 2	1,928	1,702	1,277
Scenario 3	1,068	998	863
Scenario 4	663	663	663
Scenario 5	274	339	466

Of the 1,702 extra professionals required under growth scenario 2 and the baseline labour elasticity scenario, 1,058 are mechanical engineers and 268 are electrical engineers.

In 2009 5,580 engineering students graduated, which have to serve the entire economy. Assuming a growth rate of 8.5% annually[112] (in order to obtain 30,000 graduates between 2011 and 2014), approximately 38,921 engineers will graduate between 2011 and 2015. Despite government arguing that there is capacity for such growth in numbers, education institutions have generally responded by stating that capacity is already a constraint – and therefore the growth rate of graduates may not remain as high as assumed here for the whole period.

However, it is necessary to take into account the emigration of newly graduated engineers. Using the same assumption as in Section 3.3.2, 0.43% of graduates are assumed to emigrate annually.[113] Based on this 1,674 engineers will emigrate, leaving a total of 37,247 engineers to meet the demand of the entire economy.

The forecasted **new demand for mechanical engineers is 795** between 2011 and 2015. Based on a growth rate of 8.5% annually, 6,291 mechanical engineers will graduate between 2011 and 2015. Of this 6,020 will stay in South Africa. Metals sector demand will require approximately 13% of graduating mechanical engineers. This is similar to the percentage of mechanical engineers currently in the metals and related sectors versus the economy as a whole (14% in 4th quarter, although this has been much higher in the past). This suggests that the supply of mechanical engineers will be adequate to meet demand.

[112] Note: This is very close to the historical average growth between 2005 and 2009 of 8.87
[113] This assumption assumes permanent emigration, which is not necessarily the case. Temporary emigration to obtain workplace experience is – contrary to permanent emigration – beneficial for the economy.

Approximately **201 new electrical engineers** will be demanded in the metals and related sector between 2011 and 2015. Approximately 13,337 electrical engineers are forecasted to graduate between 2011 and 2015 (based on 8.5% growth). Of this 12,763 graduates will stay in South Africa. This meets the demand of 201 electrical engineers for the metals and related sectors, forming 1.6% new graduates. This is lower that the percentage of electrical engineers currently in the metals and related sectors versus the economy as a whole (8% in 4th quarter). This could indicate an oversupply of electrical engineers.

There are three important factors in the above interpretation to keep in mind:

1. If there is already a shortage in engineers (i.e. the number of engineers that are currently in the system does not meet demand) then the demand for engineers may be greater than what is calculated here. Stakeholder consultations with industry seem to indicate that this might be the case.
2. The gap analysis as performed above ignores experience level. The demand created by mortality, retirement and migration is generally for an individual with strong experience, rather than a graduate. The implicit assumption in the model is that individuals already at the company will all move up an employment level if a high level post is left vacant, creating demand for graduate at a junior level. However, if there is already a shortage of engineers to fill the middle and upper level positions, then the system explained here (albeit a simplified version) might not function.
3. The rate for calculating growth of graduates is high, and is not likely to be sustainable throughout the period as universities are already struggling in terms of capacity.

The combination of these factors will likely result in higher demand and lower supply of engineers between 2011 and 2015.

5.1.3 Artisans and technicians

Table 18: Total new artisans and technicians required per scenario, 2011 – 2015

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	61,676	51,137	31,636
Scenario 2	37,414	31,522	20,413
Scenario 3	14,965	13,137	9,624
Scenario 4	4,388	4,388	4,388
Scenario 5	-5,775	-4,076	-745

It is in the employment category of artisans and technicians where the impact of the different sector growth rates really becomes visible. A 3% growth rate (labour elasticity of 0.8) versus a growth rate of 1% (labour elasticity of 0.8) produces demand for an extra 18,385 artisans and technicians. However, the impact of labour elasticity is also very clearly demonstrated – growth at 3% per annum, but with labour elasticity of 0.5 results in approximately 11,109 less jobs. This shows the value of continued pressure and incentives to be as labour intensive as possible.

Technicians

Technicians form a relatively small part of this category, comprising only 2,899 of the 31,522 new employees required under growth scenario 2 and labour scenario b. In 2009, 4,348 technicians graduated, substantially more than the 3,024 graduates in 2005 (compound annual growth rate of

9.5%). If this growth continues, 31,519 technicians will graduate between 2011 and 2015, which should adequately meet demand. Again the simple linear growth applied ignores any capacity issues of continually increasing the intake of students by such a large amount.

The forecasted demand for **electrical engineering technicians is 547**. Approximately 1,519 electrical engineering technicians graduated in 2009 and grew at a compound annual rate of 7% per annum. Assuming this growth rate continues 9,224 students will graduate between 2011 and 2015. Metals and related sector demand therefore only forms 6% of total forecasted supply, which indicates that there might be an oversupply of electrical engineering technicians in the South African economy over the medium term.

Approximately **445 new electronics and telecommunications engineering technicians** will be required between 2011 and 2015. Data received from Department of Higher Education and Training did not include a specific category for electronics and telecommunications technicians, thus it is not possible to directly compare demand and supply.

An estimated **1,907 new mechanical engineering technicians** will be required between 2011 and 2015. In 2009 649 technicians graduated, growing at a compound annual rate of 13% since 2005. If this fast growing trend continues 4,763 mechanical technicians will graduate between 2011 and 2015. Although this meets the demand for the metals and related sectors, it is not likely to be able to meet the demands of the rest of the economy. The metals and related sector technicians is set to take up 40% of the new supply, but formed less than 5% of employment in the 4th quarter 2010.

Artisans

The number of new artisans required under growth scenario 2 and labour scenario b is 31,522. This forms a substantial part (63%) of the New Growth Plan goal of 50,000 artisans (requiring a growth rate of graduates of 27% annually). Given these circumstances there may be a shortage in artisans for the economy as a whole. If a New Growth Plan level of economic growth is achieved (modelled as growth scenario 1: 5%), then the number of artisans will not be enough to meet even the metals and related sector alone.

In analysing the detailed occupational level data (see table below), several issues should be taken into account.

1. The rate for calculating growth of graduates from trade testing is extremely high (27% per year). This is based on the overall number of successful trade tests taken between 2007 and 2010. This growth rate may not be sustainable throughout the period, meaning that the supply figures are likely upward biased.
2. The match between the StatsSA South African Standard Classification of Occupations and the merSETA trade tests are not compatible for most occupations. For some occupations there is more than one applicable trade test, and for others none.
3. Using the StatSA data at such a level of disaggregation leads to high variability in the results.

Table 19: Artisan supply and demand by occupation

Occupation (from StatsSA)	Total new demand 2011 - 2015	Artisan training (from merSETA)	Total graduates 2011 - 2015	Deficit/ (Surplus)
Welders and flame-cutters (including apprentices/trainees)	**9,904**	**Welder**	**3,045**	**6,859**
		Machine Tool Setter	43	
		Boilermaker	5,093	
Mechanical machinery assemblers	**5,678**		**5,137**	**541**
Sheet-metal workers (including apprentices/trainees)	**2,664**	**Sheet Metal Worker**	**76**	**2,588**
Safety; health and quality inspectors; Inspectors; safety and health	2,529		-	2,529
		Fitter	7,434	
		Pipe Fitter	22	
		Fitter and Turner	3,034	
		Turner	1,290	
Agricultural or industrial machinery mechanics and fitters (including apprentices/trainees)	2,353		11,779	(9,426)
Tool-makers and related workers (including apprentices/trainees)	**1,921**	**Tool Jig & Die Maker**	**1,225**	**696**
		Motor Mechanic	6,274	
		Automotive Machinist	325	
		Automotive Engine Fitter	98	
Motor vehicle mechanics and fitters (including apprentices/trainees)	905		6,697	(5,792)
Building and related electricians (including apprentices/trainees)	786	Electrician	7,997	(7,211)
Varnishers and related painters (including apprentices/trainees)	527	Spray-painter	607	(79)
Metal wheel-grinders; polishers and tool sharpeners (including apprentices/trainees)	521		-	521
		Millwright (Electromechanician)	4,345	
		Electrician (Engineering)	184	
		Electronics Equipment Mechanician	33	
Electronics mechanics and servicers (including apprentices/trainees)	286		4,562	(4,277)
Machine-tool setters and setter-operators (including apprentices/trainees)	201		-	201
Structural-metal preparers and erectors (including apprentices/trainees)	170		-	170
		Moulder	163	
		Plastics Mould Maker	11	
Metal moulders and coremakers (including apprentices/trainees)	105		174	(68)
Electrical mechanics and fitters (including apprentices/trainees)	73		-	73

The table above shows that there is not a good match between the current demand and supply of artisan skills. Many trades are forecasted to have an over- or undersupply, with comparatively few

trades having equal supply and demand. The largest forecasted shortfall is in welders and flame-cutters, which has the biggest demand, but a relatively small supply. It is important to reiterate that if a skills gap exists already, then this model will not take it into account. A lack of artisans was consistently mentioned by companies as the biggest skills gap. Thus occupations which are highlighted above as meeting new demand, might not meet the total demand. Furthermore, the skills shortfall may be even larger than estimated for occupations which have a forecasted skills gap. For example, there is evidence that there is already a shortfall in welders in South Africa (Eskom has brought in Thai welders for its Medupi power stations to meet demand[114]).

Sheet-metal workers also have particularly small expected supply, and thus a large shortfall is expected. Tool-makers and mechanical machinery assemblers also have a predicted shortfall. Although the shortfall of tool-makers (estimated to be 696) is small in absolute terms, it is large in relative terms as it implies approximately a third of the demand will not be met.

5.1.4 Clerical workers

Table 20: Total new clerical workers required per scenario, 2011 – 2015

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	24,473	21,260	15,316
Scenario 2	17,077	15,281	11,895
Scenario 3	10,234	9,677	8,606
Scenario 4	7,010	7,010	7,010
Scenario 5	3,912	4,430	5,445

Clerical workers such as bookkeepers are mobile across the whole economy as they are mainly involved in the business aspects rather than production aspects of the company. No clerical occupations were mentioned as having skills shortages, and any demand for these positions are generally met. No attempt is made to calculate the supply of clerical workers.

5.1.5 Operators

Table 21: Total new operators required per scenario, 2011 - 2015

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	36,155	30,242	19,300
Scenario 2	22,542	19,236	13,004
Scenario 3	9,947	8,921	6,950
Scenario 4	4,012	4,012	4,012
Scenario 5	-1,690	-736	1,133

The supply of operators, who often have minimal education, generally meets demand and in many cases there is an oversupply of workers in these occupations (increasing towards the lower skilled operator jobs). Some companies require a NSC or NC(V) certificate, but others require only a grade 9 certificate.

[114] http://www.pmg.org.za/report/20110622-eskom-labour-related-issues-kusile-medupi-power-stations

In 2010, 3,597 learners graduated from NC(V) Level 4. A further 16,697 graduated with an N3 (also comparable to a NSC), and 124,749 obtained their NSC with maths as a subject, along with a further 241,576 who passed with maths literacy.

The table below shows the top 5 occupations based on forecasted demand (based on scenario 2b):

Table 22: Highest new occupational demands for operators, 2011 - 2015

Occupation	Total employment 4th quarter 2010	Total new demand 2011 - 2015
Machine-tool operators	61,782	9,216
Heavy truck and lorry drivers	9,013	3,000
Crane; hoist and related plant operators	7,358	1,668
Lifting-truck operators	10,877	1,467
Car; taxi and van drivers	6,105	1,025

Approximately 9,000 new machine-tool operators are forecasted to be demanded between 2011 and 2015. These operators are likely to have required some training, as well as requiring some pre-existing knowledge regarding machinery and production. However, with over 20,000 students enrolled in NC(V) engineering and design courses in 2010, and an additional 634 enrolled in mechatronics, demand for machine-tool operators should be met. Crane and other lifting-truck operators are likely to require some on-the-job training, but do not necessarily require a specific education. Heavy truck, lorry, car, and van drivers are all constrained by the need for a valid South African driver's licence, rather than a particular education.

5.1.6 Elementary workers

Table 23: Total new elementary workers required per scenario, 2011 – 2015

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	30,833	25,632	16,010
Scenario 2	18,861	15,954	10,473
Scenario 3	7,784	6,882	5,149
Scenario 4	2,565	2,565	2,565
Scenario 5	-2,449	-1,611	33

Strong sectoral growth and high labour intensity could have a potentially large impact on employing unskilled workers in the metals fabrication, capital equipment and transport equipment sectors. Assuming 3% sectoral growth and a labour elasticity of 0.8 a demand for 15,954 elementary workers would be created. The demand for elementary workers is however closely linked with higher skilled occupations, particularly artisans and technicians. In a recent study Behar found that skilled and unskilled labour are compliments in South African manufacturing, with an increase in skill supply leading to an increase in demand for unskilled labour.[115] A skills gap in artisans, technicians and engineers would therefore constrain the demand for unskilled labour such as elementary workers and operators.

[115] Behar, Alberto. 2008. Does training benefit those who do not get any? Elasticities of complementarity and factor price in South Africa. Available: www.economics.ox.ac.uk/members/alberto.behar

Comments on the impact of technological shifts on demand and supply of skills

The forecasting method used above does not take into account the impact of technological shifts on the supply and demand of skills. Industry identified two main shifts in production, namely increased mechanisation and use of electronics; and increased focus on green production. The increased mechanisation and use of electronics (e.g. robotics in automobile manufacturing, Computer Numerical Control – CNC) requires some systems, electronics, and IT knowledge. This generally requires higher skilled individuals, and may replace some unskilled workers. Some companies have already mentioned experiencing difficulties in finding CNC operators. It also creates a demand for programmers and electronic engineers who are responsible for the design and maintenance of the electronic machines and systems. The focus on greener production takes on many different aspects including waste management, reduction in use of energy, and reduction in Green House Gasses emissions. In some instances changing to greener production methods requires new equipment, but generally companies are able to gradually shift to greener methods through in-house training and raising awareness of green issues.

There is unlikely to be a major technological shift in the production methods of the metals and related sectors over between 2011 and 2015. In the current economic environment of volatility and low demand many companies may not be willing or able to undergo major production overhauls or capital outlays. Several companies have noted that they have not yet experienced a recovery from the recession and are still operating in distress. For example, some companies have placed a moratorium on any new hiring until demand picks up again. Furthermore, South African companies generally have low levels of R&D, and uptake of new technology is often slow. Thus drastic changes over the next 5 years are unlikely; rather a gradual shift to demanding more electronics-literate staff.

Both the FET and HET curriculums are subject to review every 3 to 5 years, which provides the mechanism to update the curriculum to include any new technologies. For FET curriculum, DHET leads the review but hosts workshops with industry and academic institutions in order to identify gaps in the curriculum, as well as to introduce newer technologies. One such example is the replacement of the studying of carburettors in automotive courses with the studying of fuel injectors – a newer technology. HET institutions have more discretion in terms of curriculum, but generally review the curriculum offered annually or biennially, with an ECSA accreditation review every 4 or 5 years. HET curriculum therefore tends to have minor changes for several years, followed by a complete update and introduction of new courses.

5.2 Major constraints to closing the skills gap

Concerns regarding the **quality of students** were consistently raised by educational institutions and industry. In educational institutions, the lack of basic literacy and mathematic skills results in students who are unable to complete their diploma/ certificates/ degrees in the minimum time, and get stuck in the system. Some institutions reported throughput rates of as low as 20%. This puts strain on capacity of the institutions, with some even resorting to lowering intake rates of students. HET institutions have responded to perceived lower quality and grade inflation by introducing their own admissions testing and by including bridging courses (although the bridging course is designed only for a smaller number of students). The recent findings of Department of Basic Education survey – which found the national average performance in grade 3 for literacy was 35% and 28 percentage for numeracy[116] (well below global comparisons) – means that this problem is likely to continue in the long run.

[116] http://www.businessday.co.za/articles/Content.aspx?id=147091

Industry is also wary about the quality of graduates exiting the various education systems. Graduates are seen to have the wrong skills set, and often have poor theoretical and practical knowledge. In response, companies are beginning to place greater emphasis on work experience, resulting in an estimated 300,000 unemployed graduates in South Africa.[117] Graduates from FETs in engineering and science in particular have trouble in finding work after graduation. A study in 2006 by the Development Policy Research Unit found that tertiary qualified individuals made less than three percent of the unemployed, but this is still a substantial number (200,000).[118] Of the tertiary qualified unemployed, 82 percent of hold diplomas. This may reflect industries wariness of the quality of education received when completing a diploma. Within the tertiary qualified unemployed, those in manufacturing, engineering and technology have relatively low rates (11.6% of total tertiary unemployment in 2005). [119]

Similarly, students have difficulty **obtaining workplace experience** through vacation work or internships. There is also anecdotal evidence that a few companies have begun to abuse the situation through unpaid internships, or in one instance charging the student a fee to work at the company. This finding mirrors the **low emphasis on in-house training** by industry. Despite skills shortages in certain occupations, many companies still do not place much focus on in-house training. This is a short-sighted response, especially with an aging skilled labour force.

Changes to the education system in the past ten years may have exacerbated the decline in quality of graduates passing through the system. The shift from apprenticeships to learnerships for artisan training has largely been unsuccessful, and new programmes are generally shifting back towards the apprenticeship model. The introduction of the NC(V) levels and scrapping of the N courses have also caused some problems and confusion. A Steel and Engineering Industries Federation of South Africa document states that: "It seems problematic that at a time when shortages of skilled artisans present a key constraint to growth, the DoE is introducing new and unpiloted one year vocational programmes at colleges without proper transitional arrangements for companies indenturing apprentices."[120] These changes also impact on industry, which due to confusion or disillusionment may choose to ignore students with certain certificates or diplomas.

FET and HET institutions are currently struggling in terms of **capacity**. FET colleges find it difficult to attract and retain appropriate staff. Lecturers in the engineering field often only have engineering training and no teaching training (e.g. one FET college has lecturers who have only completed N6). HETs are also struggling to obtain the skilled lecturers, for example a recent lecturer advert by a university of technology solicited zero applications. Education institutions are under pressure to increase the intake of students, but facilities and number of staff has not increased in line with the increase of students over the past 5 years. These pressures on lecturing capacity are exacerbated by the low throughput of students.

Trade testing centres and the **curriculum** of artisans is also a major constraint. According to industry the quality of artisan knowledge is often low, despite having passed a trade test. The decentralised model has resulted in various levels of quality being enforced, as well as varying curriculum. For example, there are several different tests to become an electrician, depending on the industry. These tests are not always of the same quality and industry is often not aware of the different in the curriculum (and may thus hire someone with the wrong skills set). However, some of these issues are currently being addressed by the National Artisan Moderating Body. Flaws and shortcomings in the curriculum are also being dealt with through targeted programmes such as the National Tooling Initiative and the National Foundry Technology Network – both of which designed and introduced new syllabus.

[117] http://www.engineeringnews.co.za/article/lack-of-work-experience-leave-graduates-unemployed-2011-05-20
[118] DPRU. 2006. Graduate unemployment in Post-Apartheid South Africa: Nature and possible policy responses.
[119] DPRU. 2006. Graduate unemployment in Post-Apartheid South Africa: Nature and possible policy responses.
[120] merSETA. 2008. Impact Assessment Study of Learnerships & Apprenticeships

5.3 Comparison to merSETA Sector Skills Plan

The merSETA Sector Skills Plan[121] focuses on 4 subsectors, namely: automotive, new tyre, plastics, and metals (of which only automotive and metals are relevant to this study). The study applies several simplifying assumptions to the forecasting model:

- 5% growth rate is assumed for each of the sectors
- Elasticity of labour demand is assumed to be equal to one for all sectors, thus a 1% growth in the sector creates a 1% growth in demand for labour
- For metals and automobile sector the replacement demand appears to be assumed equal to growth demand (5% per annum)
- The occupational profile of each subsector is based on the sector-wide profile which was derived from the Workplace Skills Plan (WSP) and Annual Training Report in 2006-2007 and is assumed to remain constant throughout the forecasting period
- Scarce skills calculations seem to be completely dependent on Workplace Skills Plan and Annual Training Report
  - Does not appear to be connected to the calculations of occupational demand per subsector

Based on these assumptions the demand for skills is forecasted for the period 2010 – 2015. A comparison of the results is provided in the table below. Note that the final column represents the findings of this study for growth scenario 1 (5% sector growth per annum) and labour elasticity scenario 1 (unit labour elasticity, 1:1 growth). Although these scenarios are both seen as unlikely (and the combination even more so), it is the most comparable based on merSETA assumptions.

Table 24: Comparison of merSETA findings

Occupation	merSETA calculation: Total new demand 2010 - 2015	Skills outlook study: Total new demand 2011 – 2015 (3% growth, labour elasticity 1: 0.8)	Skills outlook study: Total new demand 2011 – 2015 (5% growth, labour elasticity 1:1)
Senior officials	13,517	12,789	18,762
Professionals	7,091	1,279	2,434
Technicians	6,813	31,522	61,676
Clerks	45,650	15,281	24,473
Sales	14,182	--	--
Agriculture	7,756	--	--
Operators	76,230	19,236	36,155
Labourers	39,224	15,954	30,833
Total	**221,600**	**96,061**	**174,333**

The merSETA findings differ significantly to the results of this document. This could be for several reasons:

- A major difference in the numbers is that the merSETA model applies simple growth to the sector, whereas the model used in this document applies compound growth
  - A growth of 3% in 2012 takes into account that the sector has already grown by 3% in 2011
- Varying focus of the studies
  - merSETA model forecasts only automobile and metal sectors
  - Calculations above include capital equipment and wider transport sector
- Different data sources

[121] merSETA. 2010. Sector skills plan: 2010/11-2015/6

  - merSETA baseline employment and replacement demand data based on WSP, rather than StatsSA Quarterly Labour Force Survey used in this document
  - Both data sets have severe flaws
- merSETA groups occupations into categories based on WSP categories rather than OFO categories
  - Results are therefore not always directly comparable

5.4 Comparison to New Growth Plan and other employment strategies

As mentioned in Chapter 2 it is not possible to accurately model the impact of government and SOE strategies to grow the sector. Many strategies and policies do not focus directly on the metals sector, rather focussing on wider industry. The extent to which a programme will benefit the sector or influence employment level is also not clear. Estimates of the impact of development programmes are therefore implicitly included in the scenario model, rather than explicitly modelled. However, it may still be useful to compare the model results against some of the employment creation targets.

Table 25: Comparison of employment strategies and policies

Occupation	Engineers	Artisans	Total
merSETA calculation: Total new demand 2010 – 2015	7,091	6,813	**221,600**
Skills outlook study: Total new demand 2011 – 2015 (3% growth, labour elasticity 1: 0.8)	1,279	31,522	**96,061**
Skills outlook study: Total new demand 2011 – 2015 (5% growth, labour elasticity 1: 0.8)[122]	2,030	51,137	**146,975**
New Growth Plan	--	--	**350,000** in manufacturing by 2020 (based on IPAP2)
IPAP2	--	54,000	**350,000** in manufacturing (160,000 in automotive, components and medium and heavy commercial vehicles)
Eskom	--	--	**40,000** direct jobs by 2015[123]
Transnet	--	--	**5,000** direct jobs by 2016[124]
IDC Jobs Scheme	--	--	**40,000 to 50,000** employment opportunities (across several industries)

The table above highlights the issue of direct comparison, since employment data from the strategies and policies is often not available at a detailed enough level. If the revised IPAP and New Growth Plan are successful in increasing growth in the metals and related sectors to 5% then it will likely meet the target of 350,000 additional employees by 2020 (metals and related sectors contributing nearly half of the target). Eskom and Transnet are estimated to account for 45,000 of additional employees in the sector. Their capital expansion projects are likely to be one of the main drivers in the sector over the next 5 years.

5.5 Spatial overview

The spatial distribution of the educational institutions potentially plays an important role in meeting the demands of industry. While university and university of technology graduates are likely to be mobile in terms of applying to and working where the demand is located, lower skilled graduates

[122] Note: These numbers are different to those in Table 20 (comparison to merSETA) since the labour elasticity assumption has been changed to a more realistic 0.8 (rather than 1 used to directly compare merSETA findings)
[123] http://www.pmg.org.za/files/docs/110622eskom-edit.pdf
[124] http://www.skillsportal.co.za/page/human-resource/industrial-relations/777170-Transnet-to-create-over-5-000-jobs

from FETs may not be particularly mobile. The table below shows the distribution of education institutions offering relevant courses.

Table 26: Education institutions offering relevant courses by province[125]

Province	Further Education Training Colleges	University of Technologies	Universities	% share of total population
Eastern Cape	7	1	1	13.5%
Free State	4	1	--	5.7%
Gauteng	8	2	3	22.4%
KwaZulu-Natal	9	2	1	21.3%
Limpopo	3	**--**	--	10.9%
Mpumalanga	2	--	--	7.2%
Northern Cape	2	--	--	2.2%
North West	3	--	1	6.4%
Western Cape	8	1	2	10.4%
Total	**46**	**7**	**8**	**--**

Gauteng, KwaZulu-Natal and Western Cape have the highest share of population, and also the highest number of educational institutes. The Western Cape, which has approximately the same population as Limpopo, has substantially more educational institutes. Poorer provinces such as Limpopo, Mpumalanga, Northern Cape and the North West generally do not have HETs and only a few FETs.

The number of education institutes does not mirror industry employment from a spatial perspective. This is mainly due to 51% of all metals fabrication and related sector employment occurring in Gauteng. KwaZulu-Natal, with a relatively high proportion of educational institutes only absorbs 15% of labour, whilst Western Cape only absorbs 11%.

Table 27: Provincial distribution of labour in metals fabrication and related sectors, 4th quarter 2010[126]

Province	Manufacture of basic metals; fabricated metal products machinery and equipment	Manufacture of electrical machinery and apparatus n.e.c.	Manufacture of transport equipment	Total
Eastern Cape	4%	13%	26%	10%
Free State	2%	0%	1%	2%
Gauteng	56%	57%	36%	51%
KwaZulu-Natal	13%	0%	21%	15%
Limpopo	3%	0%	0%	2%
Mpumalanga	6%	16%	0%	4%
Northern Cape	6%	0%	3%	5%
North West	0%	0%	0%	0%
Western Cape	10%	14%	14%	11%

[125] Source: FETs offering relevant based on merSETA (http://ww2.merseta.org.za/OrgIndex.asp?page=sites); relevant courses offered by universities and universities of technologies based on ECSA accredited programmes (www.ecsa.co.za)
[126] Source: StatsSA Quaterly Labour Force Survey 4th Quarter 2010

The plight of the poorer provinces is highlighted in the above two tables. Mpumalanga, Northern Cape, North West and Limpopo have low number of educational institutes, and only have marginal employment in this sector. This is an important finding, as it means that efforts to grow the industry is likely to have a spatial dimension, with growth occurring in Gauteng, KwaZulu-Natal, Western Cape or Eastern Cape (if related to automobiles). Poorer provinces, unless directly targeted by initiatives, are unlikely to benefit from high-level initiatives to grow the sector. Similarly, efforts to boost training and educational levels related to the metals fabrication sector in these provinces are likely to lead the relocation of these students to other provinces upon graduation.

Similar to the educational institutes, there is also a lack of trade test centres in poorer areas. From the available data source, Eastern Cape only has 2 trade testing centres, despite the large automobile manufacturing presence. Mpumalanga and Limpopo only have 4 trade test centres combined.

Table 28: Distribution of trade test centres by province

Province	Number of testing facilities[127]
Eastern Cape	2
Free State/ Northern Cape	4
Gauteng/ North West	11
KwaZulu-Natal	11
Limpopo/ Mpumalanga	4
Western Cape	7

The type of tests offered by each trade test centre is also important to note. Each trade test centre offers several different trade tests, with Gauteng trade testing centres offering the highest number of test per centre. More common trades, such as electricians and fitters are offered across the country at several centres. However, there are also several trades which only have one or two testing centres (mainly in Gauteng).

Table 29: Distribution of trade test centres by type of test and province[128]

Trade	Eastern Cape	Free State/ Northern Cape	Gauteng / North West	KwaZulu -Natal	Western Cape	Grand Total
Electrician	1		5	5	2	**13**
Fitter			5	6	1	**12**
Motor Mechanic	2	2	3	2	2	**11**
Fitter and Turner	1		5	2	2	**10**
Boilermaker		2	5	2		**9**
Millwright			4	4	1	**9**
Turner		1	5	2	1	**9**
Welder	1	1	4	2	1	**9**
Diesel Mechanic	1	1	2	1	2	**7**
Automotive Electrician	1		2		3	**6**
Spray-painter	1	2	1	2		**6**
Automotive Body Repairer	1	2	1	1		**5**
Electronics Equipment Mechanic	1		1	1	2	**5**
Tool Jig & Die Maker			2	3		**5**

[127] Based on Foodbev SETA: www.foodbev.co.za/.../3.3.5.1%20Trade%20test%20centres%202.xls
[128] Based on Foodbev SETA: www.foodbev.co.za/.../3.3.5.1%20Trade%20test%20centres%202.xls

Trade	Eastern Cape	Free State/ Northern Cape	Gauteng / North West	KwaZulu -Natal	Western Cape	Grand Total
Refrigeration Mechanic (Commercial)			1	1	2	**4**
Refrigeration Mechanic (Industrial)			1	1	2	**4**
Diesel Fitter			1	1	1	**3**
Domestic Appliance Mechanic			1	1	1	**3**
Earth Moving Equipment Mechanic			3			**3**
Electrician (Engineering)			1	2		**3**
Instrument Mechanic			1	2		**3**
Automotive Engine Fitter			1		1	**2**
Automotive Machinist			1		1	**2**
Automotive Trimmer	1				1	**2**
Diesel Fuel Injection Mechanic			1		1	**2**
Forklift Mechanic			1		1	**2**
Rigger			2			**2**
Scale Fitter			2			**2**
Sheet Metal Worker			1	1		**2**
Turner Machinist				2		**2**
Vehicle Body Builder			1	1		**2**
Armature Winder			1			**1**
Domestic Radio & TV Mechanic					1	**1**
Lift Mechanic			1			**1**
Machine Tool Setter				1		**1**
Motorcycle and Scooter Mechanic			1			**1**
Plastics Mould Maker			1			**1**
Refractory Mason			1			**1**
Tractor Mechanic			1			**1**
Grand Total	**11**	**11**	**70**	**46**	**29**	**167**

6 Benchmarking

In order to best understand possible interventions in the South African metals sector, it is important to examine other countries with programmes in place to address critical skills gaps. In this benchmarking study, Turkey, Egypt and South Korea have been chosen for examination because of their recent efforts to transform and /or update their Vocational Education and Training (VET) systems across sectors and for their sector-specific human capital research, such as Egypt's efforts in the ICT sector. These efforts can offer helpful lessons for South Africa as it addresses gaps in its metals sector.

6.1 South Korea[129]

6.1.1 Economic and skills development policies

South Korea has implemented highly successful growth policies since 1960, based on two-fold support strategies: The government selected core industries to be developed (e.g. initially light industry and later on heavy chemical industry) and then supported training initiatives to supply the correctly skilled workforce. This was done by assessing the existing training capacity of employers, and if this was found to be lacking the government intervened directly to train the workforce. The Korean economy grew at an annual rate of approximately 7% during the 1970s and parts of the1980s, and around 6 percent in the 1990s. Part of this remarkable growth is due to the design, support and responsiveness of the VET system. The table below tracks the development of government's impact on skills development between 1960 and 1980.

Table 30: Historical demand for skilled work force and strategy response, 1960 - 1980[130]

	1960s	1970s
Per capita GDP (US$)	$80	$254 - $1,676
Economic Development Stage	1st & 2nd Five Year Economic Development Plan(FYEDP) ▸ Import substitution ▸ Focus on manufacturing (e.g. cement, oil refinement, and fertiliser)	3rd & 4th FYEDP: ▸ Focus on light and heavy chemical industries ▸ High growth period (7-8% growth) ▸ Unemployment falls from 8% to 4%
Demand and supply for skilled workforce	▸ Transition in demand from agricultural skills (low skilled) to industrial (higher skilled) demand ▸ Supply of skilled workers manly through formal education system	▸ Shift into higher skilled industrial sector led to shortage of skilled workforce in some industries (e.g. heavy-chemical – Demand for skilled labour force 493,000, requiring an influx of 165,000 additional skilled workers ▸ Unlimited supply of unskilled workforce migrating from rural areas
Market failure	▸ Market failure of skills supply (frequent scouting and poaching)	▸ Lack of highly skilled individuals being trained

[129] Ra, Young-Sun and Shim, Kyung Woo. 2009. The Korean Case Study: Past Experience and New Trends in Training Policies.
[130] Ra, Young-Sun and Shim, Kyung Woo. 2009. The Korean Case Study: Past Experience and New Trends in Training Policies.

	1960s	1970s
Responding skills development strategy	▶ Prescribing a minimum number of engineers to be hired by each company ▶ Formulated a plan to train 6,000 new workers – Increasing the number of technical high school graduates – Improving facilities and curricula – Providing evening vocational classes at all technical high schools	▶ Enacted Vocational Training Act leading to a tripling in trainees between 1967 and 1970 ▶ Supply of skilled workers came from: – Newly established public vocational centres and technical schools – Use military facilities to train unskilled youth – Obligatory enterprise training (supplemented with direct subsidies for in-plant training programs) - Number of companies providing in-house training increase from 15 to 81 ▶ In 1974 obligated large enterprises employing in key industries to conduct in-plant training programs ▶ In 1979, over 90,000 employees trained through in-plant enterprise training program

Following this period of rapid industrialised growth the South Korean economy slowed downed in early 1980s (due to the second oil shock in 1979 and a slowdown in global demand). The government's response to the changing structure of the economy, as well as the increased affects of globalisation is shown in the table below.

Table 31: Historical demand for skilled work force and strategy response, 1980 - 2000[131]

	1980s	1990s	2000s
Per capita GDP (US$)	$1,645 - $5,418	$6,417 - $9,438	$10,841 - $20,000
Economic Development Stage	5th & 6th FYEDP: ▶ Stabilisation and Open Economy Policy	7th or New Economy Plan ▶ Boost international competitiveness ▶ Promote welfare state	▶ Global Economy and Slow Economic Growth
Demand and supply for skilled workforce	▶ Declining demand for skilled and technical manpower (due to economic slowdown) ▶ Decline of in-house training	▶ Near full employment ▶ Increasing demand for upgrade training for incumbents and mass training provision for the unemployed	▶ Low demand in wake of East-Asia crisis ▶ Supply of highly skilled workforce
Responding skills development strategy	▶ Expand public training system to make up for decline in in-house training ▶ Establish Technical Training Colleges ▶ Provide retraining programs for laid-off workers	▶ Shift to levy-grant skills development system ▶ Remove in-house training obligation ▶ Support enterprises to provide life-long training (voluntary) ▶ Require training levy as part of employment insurance premium (reimbursed if training occurs) ▶ Rapid increase in training numbers	▶ Implement skills development account – Voucher for unemployed to select suitable training courses ▶ Correct undue strain of levy on SME ▶ Continued lifelong skills development

[131] Ra, Young-Sun and Shim, Kyung Woo. 2009. The Korean Case Study: Past Experience and New Trends in Training Policies.

6.1.2 Structure of educational councils

Initially the public vocational institutes – funded through foreign aid – were run as independent legal entities. As the number of institutes increased, so did the administrative burden on the Ministry of Labor to coordinate the courses, curricula, and operational methods. The independent nature meant that the bureaucracy could not meet the changing demands for skills in a flexible and fast enough manner.

In response to these issues the Vocational Training Management Corporation was established in 1982 (and eventually became the Human Resources Development Service of Korea in 1991). The Corporation unified the qualification function of the Ministry of Science and Technology with the vocational management functions of the Ministry of Labour, thus eliminating the duplication of function and allowing greater flexibility to respond to changes in demand.

6.1.3 Measuring demand for skills

Although the government measured demand for certain skills as early as the 1960s, it was often done at a high level. Since 2005 the government has conducted a human resources and training demand surveys. The survey consists of an establishment survey, training demand survey of the unemployed, and a training supply capability survey. The survey is classified into two types of surveys: one targeting workers who will be trained in-house, and the other focuses on individuals trained through external training. The survey therefore covers additional workers demanded, but also the types of training which they should receive.

The survey of the vocational training institutions allows the government to analyse the supply capability of the training institute. The survey is conducted on 703 institutions throughout the country.

Based on the survey results the most effective method for skills development is determined. Strategies for training the unemployed and employed are created based on the industrial changes in the region and the type of employment required.

6.1.4 Challenges

Recently, VET has been marginalised by the increasing importance of higher education and general education – a trend that poses a significant challenge for VET in all developed countries. Even in less developed regional economies, where VET may play a more important role than in well-developed areas, the diffusion of the knowledge-based economy makes higher education more important today than it was for the least-developed regions of the past. In Korea, by 2009, vocational high school education was no longer associated with better labour market outcomes than general high school education. [132]

The structural changes since the early 2000s have also made the training and supply of skills more difficult. The overall skill level required has risen, and the life span of technologies has been cut in half. This has made it difficult for a worker to maintain the occupational competence for their whole working career, requiring further training to keep up with technology. Curricula are also required to be much more responsive than was necessary in the past.

[132] Chae, ChangKyun and Chung, Jaeho. 2009. Pre-Employment Vocational Education and Training in Korea

Lessons for South Africa

The Korean model shows the importance of deciding which occupational fields to target for a training system, and having this closely aligned with growth initiatives. South African education institutions currently focus on offering a broad educational base which can easily adapt into any sector or company. For example the level of specialisation in a particular engineering degree is often low versus some developed countries. This means that although new workers may have the tools to deal with work issues, they often still require some training – which, due to low levels of in-house training – makes industry reluctant to take on an individual with no experience. The strong focus on in-house training in all the policies was a strong contributor to the success of the policies. The shift in the wider focus of BBBEE to all 7 pillars (including skills development) should lead to higher levels of in-house training.

The shift to **independent vocational training management organisations** allowed the Korean government more flexibility in its training response and operation of programmes. The establishment of the three education councils in South Africa follows this rational.

One of the success factors of the South Korean educational system was the **quality of both formal and non-formal vocational education and training**. This in turn was based on the quality and reach of primary education (near universal primary school education was obtained in the 1950s). Although there is a current need for training skilled individuals in South Africa, the long term view should focus on the levels of basic, primary education, and building on this into high school and vocational training.

The South Korean example shows the importance of **constant labour market surveys and training programs evaluation** in order to support uninterrupted skills development. The human resources and training demand surveys done by the Ministry of Labour is similar to the Workplace Skills Plans (WSP) conducted and managed by the SETAs. To date these have had low uptake in industry (merSETA return rate is 15%) and is often of low quality. The WSPs, if functional, can be of great use for calculating the change demand for skills.

Since 1997 the Korean government has placed increasing focus on **skills development for poverty reduction**. In response they have set up training programmes target the unemployed (especially high school dropouts), employees of SMEs, and poor female workers. Again, South Africa has clear policies and strategies in place to use education as a poverty reduction tool and does focus on marginalised individuals or groups.

Overall, South Africa already has in place many of the key factors which lead to the Korean successful growth strategies. The issue is then rather with the functioning of the institutions, the coordination among the relevant role players, and the actual implementation of the policies and strategies.

6.2 Egypt[133][134]

Technical and vocational education and training (TVET) in Egypt was achieved through a variety of means. Basic TVET is provided through secondary education and post-secondary education in training institutions. Training through industry attachments, such as apprenticeships, in-service training, and re-training of both employed and unemployed members of the labour force are other forms of TVET outside of formal education. The Supreme Council on Human Resources Development (SCHRD) is responsible for coordinating the independent government agencies that

[133] El-Gabaly, Moustafa and Majidi Mehdi. 2003. ICT Penetration and Skills Gap Analysis
[134] Abrahart, Alan. 2003. Review of Technical and Vocational Education and Training

administer the public TVET system and bringing cohesion to TVET policies. In 2002, the SCHRD defined Egypt's strategic TVET objectives as:

- A qualifications framework that would foster lifelong learning
- A system that would be responsive to the demands of the economy
- A new legal and institutional basis for governing TVET institutions
- Enhanced labour mobility

The priorities that emerged from these objectives were:

- Developing tripartite management of training in individual industries
- Establishing an integrated framework TVET including its links to employment
- Creating a qualifications framework for TVET
- Reviewing relevant donor-supported initiatives with a view to preparing options for continuing worthwhile initiatives
- Reforming the administration of government training centres by monitoring their performance and providing them with greater financial responsibility and accountability for their operations
- Developing a substantive non-government training market
- Developing a broader-based, sustainable mechanism for financing training

The establishment of the SCHRD provides an instrument for creating changes in TVET, though implementing these changes may be difficult. A 2003 World Bank paper advises both institutional and financial reform to mitigate the risk of making ineffectual changes to the TVET system. Institutionally, the paper recommends elevating the SCHRD to a National Training Authority and giving it control of the Training Finance Fund or "fostering willingness among SCHRD members." Either approach is meant to ensure that relevant ministries working with the SCHRD "cooperate in bringing about change" mandated by the SCHRD. It also recommends improving cooperation between employer associations, trade unions, international donors / partners and the SCHRD.

Lessons for South Africa

- The Supreme Council on Human Resources Development is similar in scope to the newly established Quality Council For Trades and Occupations (QCTO) – which aims to create a system responsive to the needs of industry
  - Threat that interaction and coordination required with other education councils could make QCTO less responsive
- Integrated frameworks linking all forms of education and linking training to employment has been completed through the OFO framework
  - With the exception of the details of QCTO framework
- A focus on reviewing relevant donor-supported initiatives could be beneficial, including successes in the National Tooling Initiative and National Foundry Technology Network
  - Lessons learnt on adapting and updating the curriculum
  - Lessons learnt on education and workplace coordination

The Partners for a Competitive Egypt (P*f*CE) project is a USAID funded initiative designed to respond to the challenges of global competitiveness and workforce development. P*f*CE aims to "build private sector coalitions, develop global thinking, and promote Egyptian leadership and innovative public/private sector partnerships". In order to achieve its objectives and to support the Ministry of Communications and Information Technology (MCIT) in implementing its development plan, the P*f*CE developed the ICT Penetration and Skills Gap Analysis study. The purpose of this report was to determine the needs for ICT skills in local, regional and global markets. Although, this particular skills gap analysis does not cover the metals sector, it provides a useful reference point for skills gap analysis in South Africa.

The ICT penetration and skills gap analysis (SGA) study highlights that critical gaps may exist at the individual firm level (skills gaps internal to an organisation) or at the sector level (skills gaps

external to an organisation, or endemic to the industry). An example of external skills gaps is the lack of sufficient external consulting support, which could cripple the development and management of a healthy sector. In the internal gaps category, Egypt was not found to have severe skills gaps in technology-based skills, except for in advanced skills. Significant gaps existed in business and personal communication skills and project management skills due to lack of proper university and general education. This was especially true in terms of language education

Lessons for South Africa

- The advanced skills gaps in Egyptian ICT sector were the result of late adoption of advanced technologies in local and regional markets
- South African firms are often seen as slow adaptors of new technology
  - Current economic environment means firms are more likely to stick with current practices rather than risk implementation of costly new processes
  - Low levels of R&D spend by South African companies (across all sectors)[135]

The P*f*CE SGA study makes several recommendations and compiles skills gap best practices which are targeted to the ICT sector. Of these, the education recommendations are applicable outside of the ICT sector. These recommendations are:

- Establish an Education Skills Committee
  - Create a committee that will transfer the knowledge gained from the SGA and use as input to curriculum development

Lessons for South Africa

- The South African education committee structures have already been put in place, the focus should now be on the functioning of these committees

- Establish Educational Best Practices Forum for educational establishments to leverage the best in local and international areas
  - Best practices could include review processes for students and faculty, coursework development strategies, partnership programs, management and research activities
- Include private consulting and training firms to help close skills gaps
  - Firms with access to special knowledge and skills can help close the skills gaps issues should have the opportunity to offer these courses to the participants in the marketplace

Lessons for South Africa

- The development of a non-government training market is an interesting proposition for South Africa
  - Currently there are approximately 120 private FETs focusing a wide variety of skills (e.g. construction, nursing, business, hair and skincare technology)
  - A stronger and more active private sector training market could improve access to education
- Private sector may be able to more aggressively target training provision at metal companies (as they are reliant on generating this kind of income)

- Establish a Research Centre
  - Potential establishment of a research centre that several educational organisations could participate in the development and running of on day-to-day basis
  - Could provide specialised or original research and problem solving for sector firms
- e-Learning and self-paced programs
  - The addition of relevant e-learning programs to universities will increase the number of students that can be reached with timely materials

[135] UNESCO. 2007. Global perspective on R&D

Lessons for South Africa

- e-Learning and self-paced programmes may not be that effective in the metals sector
  - Lack of internet access
  - Skills shortages are in are in areas which require practical work which has to be supervised

- Regular review of university and technical college curriculum for market needs
  - A regular review should be undertaken to upgrade the quality of programs and their relevance to industry needs and resources required to sustain this in the long term. This would constitute an overall improvement plan for all the education establishments, including salary and compensation review for faculty to become competitive with industry levels
- Add "experience" time and effort into each students coursework
  - Internship programs, work time experience needs to be added into almost all programs in the current university curriculums

Lessons for South Africa

- Apprenticeship and learnership programmes already incorporate on the job experience time
- Many engineering degrees require vacation work to gain experience
- The constraint appears to be in obtaining a higher industry uptake of trainees

- Improvement of university standards and courses
  - Improvement could be achieved through accreditation, quality assurance standards for courses and faculty management, greater investment to make it easier for courses to be brought to market and changed more easily, and quality systems to measure current staff performance and ability to upgrade accordingly
- Add flexibility into educational system
  - Create a positive initiative to help universities deal with creation of more flexible coursework and career paths
  - Not only will this benefit students by giving them alternatives during their undergraduate years, but will also benefit industry if changes can be included to meet industry and market demands

6.3 Turkey

Economic environment and policies[136]

The location of the Republic of Turkey gives it a key advantage, as it is positioned at the intersection of Europe, Central Asia and the Middle East and is surrounded by four seas. Since 1960 the structure of the Turkish economy has changed drastically, moving from an agrarian society (55% of GDP in 1960) to an economy dominated by manufacturing (26% of GDP 2010) and the tertiary sector (65% of GDP 2010). The iron and steel industry, first established in the 1930s, has played an important part in the industrialisation of the economy.[137] Two major turning points in the Turkish economy (with particular relevance to the iron and steel industry) was the shift of focus from import substation to export promotion strategies in the 1980s[138] and the joining of the European Coal and Steel Community and the EU Customs Union in 1996, eliminating customs duties between Turkey and the EU.

The Turkish economy is currently characterised by cluster development approach. This approach has been relatively successful as 14 of the top 15 clusters have gained in world export share

[136] Abylkassymova, M *et al.* 2011. Turkish Automotive Cluster. Available: http://www.isc.hbs.edu/pdf/Student_Projects/Turkey_Automotive_2011.pdf
[137] http://www.taik.org/Default.aspx?pgID=353&langid=1
[138] Polat, O and Uslu, E. 2010. Impact of international trade on employment in manufacturing industry of Turkey

between 1997 and 2007. The metal mining and manufacturing had an export value of US$13.7 billion in 2007.[139]

The Turkish Automotive cluster was the 18th largest in the world with an export value of US$17.6 billion in 2007. Joining the EU Customs Union in 1996 was a key development for the cluster, which now exports the majority of domestic production to European countries. The automotive cluster is supported by upstream industries such as iron and steel, electronics, rubber, and plastics. Despite strong recent growth the cluster still faces the following challenges:

- Weak intellectual property protection
- Low level of collaboration between government, private sector and education institutions (see recommendations below)
- Weak relationship with educational institutions
- Sustaining productivity
  - Threat of producers moving to China or India if the skill level of employees is not constantly improved upon

Vocational Education and Training[140][141]

The government of Turkey has collaborated with the European Commission on a five year project called “Strengthening the Vocational Education and Training System in Turkey” (SVET), which aims to strengthen Turkey’s current Vocational Education and Training (VET) system rather than impose a new structure. Since an effective VET system must reflect labour dynamics, especially on a local level, the SVET program follows the EU model, where regional labour market and more general economic analyses are used to guide regionally diversified occupational standards.

To date, SVET has developed two labour market reports – the first an interim report in 2005, followed by a final report in 2006. These reports show that at a national level Turkey’s GDP grew steadily from 1990-2000 and robustly from 2002-2004. These periods of growth were interrupted by Turkey’s largest economic contraction since the 1950s in 2001. Economic growth was accompanied by sectoral shifts and regional imbalances in GDP contribution. Over the same period, the overall education level of the population has risen, but the eastern regions have lagged behind the rest of the country, and women have benefitted less from rising educational levels than men.

Currently, Turkish compulsory education consists of eight years of schooling from age seven to fifteen. At this point, learners enter a general high school, vocational and technical high school or apprenticeship training. Apprentices attend vocational training centres one day per week and learn and work in workplaces for the remainder of the week. After two to four years, apprentices may take the journeyman test. After qualifying as a journeyman or graduating from a vocational high school, workers train further honing technical and business skills and may take a mastership test to earn the certificate necessary to open a workshop. Alternately, learners may pursue higher education (post-secondary programmes of at least two years) at a university, vocational college, or open learning institute after passing an entrance exam if they have the correct secondary school background. The SVET labour market report identifies the need for understanding the flows through the educational system to ensure labour market needs are met and learners find positions that match their talents and preference. This could be achieved through a system to track learners during their educational careers or through indicators such as the ratio between learners entered into secondary education in year x to the number of school leavers from primary school in year x-1. Indicators such as this one could be used to track flows from primary school to different types of secondary education institutes.

[139] Abylkassymova, M *et al.* 2011. Turkish Automotive Cluster. Available: http://www.isc.hbs.edu/pdf/Student_Projects/Turkey_Automotive_2011.pdf
[140] European Training Foundation. 2010. Education and Business Cooperation Study
[141] Labour Market Team, SVET Project.2006. Turkey’s Labour Market

Lessons for South Africa

- Currently the Department of Basic Education and Department of Higher Education and Training do track learners during their educational careers (through for example the Annual School Survey)
- Tracking learners after the completion of FET diplomas and degrees – NC(V) and N – will provide good indications of the perceived quality of these diplomas/ degrees in industry (based on the type of jobs received) as well as the effectiveness and impact of training (e.g. what percentage of N level graduates go on to do apprenticeships?)

The European Training Foundation conducted a country specific report on education in Turkey to make education more responsive to the demands of the Turkish economy. Forms and modes of cooperation between the education and economic sectors were a focus of the study. Cooperation between the sectors has had a legislative basis since 1986, mainly expressed through apprenticeship and practical training in enterprises. The business community also participates in the Vocational Education Board, Provincial Employment and Education Boards and the Sectoral Committees of the Vocational Qualification Authority. The Vocational Education Board serves as the primary medium for communication between education and businesses at the central level, while the Provincial Employment and Education Boards play this role at the regional level. Building business skills has been introduced into school curricula at all levels of education and some universities have established technoparks. Despite these positive developments in business-education cooperation which may lead to better alignment of market needs and skills supply, challenges remain.

Among these challenges, the VET system has been perceived as an education option for low achievers and business-school cooperation is still not widespread in higher education. Incentives to build cooperation between the sectors are still at a rudimentary stage of development. Inadequate internships, problems matching VET profiles to regional needs, and difficulties mainstreaming pilot projects and limited scale interventions also pose challenges for improving VET in Turkey.

Turkey's recommendations for cooperation between education and business sectors

- Develop tax incentives scheme (or a fund) to encourage industry and business to provide support to secondary and post-secondary vocational schools and practical training/internship opportunities at companies (with an option to target companies that would face difficulties in providing such internships without support)
- Strengthening the importance of school and business cooperation at local level
  - For example: appoint a person responsible for the cooperation at school level. Vocational School Boards may also play a role involving local business and employers' representatives
- Encourage and support schools to provide training for company employees
- Including higher education vocational students in the quotas set for employers for providing practical training places as well as extending the internship period
- Appoint bodies and create mechanisms for systematic skill needs assessments at national regional and local levels and ensure that the results are used in a timely fashion
- Develop proper data collection, monitoring and evaluation instruments to assess the outcomes of cooperation and performance of institutions and bodies with regard to education and business cooperation
- Organise seminars / events at central / local level where schools and social partners could be invited to present their own experiences and best practice

Lessons for South Africa

- Several of these recommendations are already in place in South Africa
  - Funding incentive schemes are already in place in South Africa, with a focus on practical training
    - The **Skills Development Act** (No. 7 of 1998) established the financing scheme of the SETA's through the skills development levy and the National Skills Fund
    - The **Skills Development Levies Act** (No. 9 of 1999) provides for a national levy grant system based on a one percent tax on payroll
  - SETAs and education councils have improved co-ordination with industry as a priority
- Currently no mechanisms in place for systematic skill needs assessments at national and regional levels
  - Partly due to lack of data
  - Turkey unfortunately does not provide a clearer example on the type of mechanisms necessary

7 Recommendations

This section focuses mainly on recommendations that fall within the mandate of **the dti**. Many critical issues highlighted in Chapters 4 and 5, such as the quality of education, increasing number of engineers and artisans, and capacity at educational institutes do not fall within this mandate, and **the dti** can only promote these issues in its interaction with the relevant departments.

7.1 Dissemination of information

The dti, and in particular the Skills for Economy Unit could play an important role in gathering, analysing and disseminating information on current employment, and possible gaps that might arise in the future. Regularly disseminating to stakeholders (e.g. industry associations, key companies in the sector with which **the dti** interacts, education institutes, SETAs, other national departments) would allow companies to plan better, inform student and career guidance counsellors, and can inform the debate at a strategy and policy level.

It is currently difficult to make any concrete analysis on the current and future demand and supply of skill due to the lack of data. The data come from several different institutions, but could be updated and maintained at the Skills for Economy Unit at **the dti.**

Current employment data
Data is obtained from the Quarterly Labour Force Survey. As mentioned in the above, the data as it is used in this document does not form a representative sample. To make the sample representative at the level of data used here requires a new survey, and it may be difficult to successfully advocate for this with StatsSA given resource limitations.

However, the merSETA Workplace Skills Plans may be easier to adjust in order to gain the needed information. The biggest drawback of the WSP is the low response rate from companies. If this can be improved then data could be made available on current employment levels as well as possible future skills requirements.

Some of the variability of the QFLS data could be mitigated by using moving averages instead of the latest available data. Moving averages were not used in this document for two reasons: the preceding periods were seen as an exception due to the recession and the QLFS only started in 2008, giving few observations.

It may also be possible to add new questions into the QLFS which could address some of the issues raised in this document. For example, a question on previous work experience (in years or months) could shed light on the extent to which graduates with no experience are struggling to find work.

Replacement demand data
There are various data sources for mortality and retirement; however data on migration and mobility are scarce. Migration data does not appear to be a priority of the Department of Home Affairs and as such it will remain difficult getting estimates. Using mirror data may remain the best option, but is an underestimate of the true emigration rates. Data from the 2011 census (for which results have not yet been released) could potentially be used to obtain immigration data. Ideally immigration and emigration data captured should include the same occupation categories as the QLFS.

Supply-side data

Data on enrolled and graduated students for FETs and HETs are available from the Department of Higher Education and Training. However, these data are not always publically available. It should be collected annually by the Skills Unit and combined with artisan test data from SETAs to get an overall picture of supply levels. Once more data are obtained (and over a longer time frame) it may be possible to match the supply and demand more directly than what is presently done in this model.

Data required for a complete model

The table below gives an overview of the type of data ideally required to create a more accurate model.

Table 32: Ideal data availability for forecasting model

	Type of data	Specifics	Agency responsible
Baseline data	Current employment	▶ Data of employment levels by: – Occupational level (using OFO codes) – Industry, sectors, and subsector	▶ StatsSA ▶ merSETA
Economic growth	Forecasts of growth by sector	▶ Industry wide growth (e.g. manufacturing) ▶ Sectoral growth (e.g. manufacture of transport equipment) ▶ Subsectoral growth (e.g. manufacture of motor vehicles)	▶ National Treasury ▶ South African Reserve Bank ▶ Private sector
	Labour productivity	▶ Historical growth rate of: – Industry (GDP or GVA) – Employment levels (by industry, sector and subsector) – Productivity (by industry, sector and subsector)	▶ StatsSA ▶ South African Reserve Bank (productivity)
Replacement demand	Mortality	▶ Mortality rates by: – Industry, sector, subsector – Occupation	▶ StatsSA ▶ Actuarial Society of South Africa
	Migration	▶ Immigration and emigration by: – Industry, sector, subsector – Occupation	▶ Department of Home Affairs ▶ StatsSA (published emigration and immigration data until 2003)
	Retirement	▶ Age by: – Industry, sector, subsector – Occupation	▶ StatsSA
	Mobility	▶ Previous employment by: – Industry, sector, subsector – Occupation	▶ StatsSA
Supply of skills	Enrolment	▶ Enrolment numbers by: – Degree (e.g. NC(V)) – Stream (e.g. Engineering studies) – Education institution	▶ Department of Higher Education and Training
	Graduation	▶ Graduation numbers by: – Degree (e.g. NC(V)) – Stream (e.g. Engineering studies) – Education institution	▶ Department of Higher Education and Training

Classification of data
Much of the data mentioned in the table above and used in this document is not in comparable form. Advocacy for the use of a standardised method of capturing skills and occupation related data will be extremely useful for future quantitative skills assessments. There is still a mismatch between SASCO used by StatsSA and OFO as endorsed by Department of Labour and SETAs. Until a unified standard is used by all parties it is recommended that a concordance is constructed which can map SASCO into OFO classifications. This can be done by the Skills for Economy Unit and disseminated into the public domain.

Focus on wider industry
The focus of this study is relatively narrow. Focussing only on the metals and related sector means that linkages with other manufacturing sectors – as well as the rest of the economy – are ignored. For example, linkages between skills used in automobile manufacturing and its transferability to maintenance and repair of motor vehicles (which falls under the service sector rather than manufacturing) are not included. For this reason international practice (see Appendix A for some examples) is generally to conduct a skills gap analysis for the entire economy. This also deals with the supply side of skills in a more consistent manner; in calculating the supply of engineers or artisans in this document it is unclear exactly the extent to which there may be a shortfall, since the metals and related sector only requires a proportion of the total. Using the QFLS at the economy wide level, rather than for specific industries will also likely provide more accurate results.

Update model regularly
The model used in this document should be updated regularly (in terms of data and assumptions) to be able to identify and address current and potential skill gaps. If the model (and its assumptions) are updated and improved on annually (as is done in South Korea based on the human resources and training demand surveys) it will also provide an indication of the impact of current policies and strategies such as IPAP and the New Growth Plan which could inject more flexibility into the system. Rather than waiting until the target period of the strategy or policy is finished, a regularly updated model could show areas of weakness or success in terms of employment and allow for learning and improvements.

7.2 Promotion of in-house training

BBBEE implementation
Although in-house training does not fall directly in **the dti**'s mandate, it may be possible for the department to impact on in-house training levels through the implementation of BBBEE. The shift to the 7 pillars of BBBEE includes skills development as one of the pillars, in particular skills development spend on learning programmes for black employees as a percentage of leviable amount (based on the skills levy). If industry shows strong uptake of these codes, it could raise in-house training substantially. Furthermore, the code requires that companies are registered with the relevant SETAs, and importantly from a data perspective, develops a Workplace Skills Plan. The extent to which this legislation is implemented will partly determine the level of in-house training provided in the medium term.

One of the constraints highlighted in Section 5 is the quality of testing and capacity at trade test centres. Through its interaction South African National Accreditation System (SANAS), money spent on providing capacity or equipment to trade test centres by companies could also count toward BBBEE spend on skills development (even though it is not necessarily in-house training).

Incentives schemes
Some of **the dti's** existing incentive schemes could be adapted to include skills development in critical areas such as welding. The Manufacturing Investment Programme is an incentive designed to stimulate investment growth in manufacturing. Currently the programme is limited to physical capital costs (e.g. expansion of current production facilities or the establishment of new facilities). It offers an investment grant of up to 30% of the value of qualifying investments. This programme

could be extended to include human capital investments, particularly projects in areas which focus on scarce skills, or which can unlock unskilled and semi-skilled opportunities (i.e. occupations which are complimentary to unskilled jobs such as artisans).

7.3 Promotion and extension of existing sub-sector support programmes

Existing programmes supported by **the dti** such as the National Tooling Initiative and the National Foundry Technology Network have achieved positive results thus far. Both initiatives have updated old curriculum and introduced new training programmes based on international best practice. Both initiatives have been able to successfully engage industry and educational institutions to work towards a solution to skills gaps in these industries. It is recommended that **the dti** should continue providing technical and financial support to these organisations.

Programmes focussing on specific areas are an efficient solution to lagging skill areas and curriculum flaws, as these are industry driven and government supported. Industry involvement and buy-in is critical in these initiatives, as they are effectively the 'end-user'. In terms of curriculum these projects are able to provide more focussed and industry specific training than the more general FET courses. One drawback of these programmes is that the intervention is often only once the situation becomes critical – it is reactive rather than proactive. Continuous dissemination of skills related data (as recommended above) could potentially overcome this since it could provide early warning signs of a gap emerging.

There are indications that a shortfall of welders currently exists in South Africa. This report forecasts a shortfall in new welders between 2011 and 2015 which will further aggravate the problem. Although several private and public institutions already offer training in welding, a targeted programme similar to the NTI could raise the profile and importance of welding. A review of the curriculum currently being taught in South Africa may also be necessary, including a greater focus on quality (the error margin in South African welders was found to be substantially higher than international averages[142]). New technologies such as non-destructive testing (e.g. Time of Flight Diffraction; Phased Array) should also be included in the curriculum. Potential partners to manage such a project is the South African Institute of Welding – a non-profit organisation which currently provides training and testing, but has strong ties with industry and academic institutions.

Industry entities consulted also indicated a skills gap in terms of engineers. As highlighted in Chapter 4, much attention is already being given to increasing the number of engineers graduating. Programmes such as the Engenius which aims to increase the uptake of engineering students by increasing promoting engineering to schools should also be supported. These programmes have a longer term focus and compliment some of the short- to medium term projects that **the dti** already supports. Support to the Engenius programme can be financial, or through advocating participation in the programmes by companies in the metals and related sector.

7.4 Advocacy around skills issues

Many of the skills related issues fall outside the scope of **the dti**. However, through its interaction with various departments, industry and other stakeholders, **the dti** can play an active role in advocating action around skills issues.

Advocacy for industry involvement in curriculum reviews
The review and introduction of FET programmes is supposed to occur every 3 years. This should provide a system for regular interaction with industry and stakeholders, allowing them to highlight

142 http://www.merseta.org.za/Portals/0/Documents2/MERMEDIA/merSETA%20Launches%20welding%20centre%20of%20excellence.pdf

gaps in the curriculum and lobby for the introduction of new technologies into the curriculum. However, this is based on strong interaction between industry, FETs and DHET, which is not always the case. This disconnect means that curriculum may get updated without strong industry input. **The dti** should act as a middleman in this process, encouraging industry participation as well as provide information to companies on timings and requirements. **The dti** should also seek to include wider stakeholders in the process to obtain the best results. This can include industry experts, academics, and other departments such as the Department of Science and Technology (which can provide information on new technology). The inclusion of DST in will help place a greater focus on technological changes – particularly as industry is often conservative in these matters.

Promotion of capacity at educational institutes

A lack of capacity at academic institutions was consistently mentioned in stakeholder interviews. In order to achieve the growth in artisans and engineers necessary to meet the goals of the New Growth Plan academic institutions will have to receive substantial assistance in terms of lecturing capacity, equipment and infrastructure. **The dti** can promote a focus on capacity at educational institutions conducting and publishing annual analyses of the number of enrolments and graduates (to identify changes in growth rates). Furthermore, **the dti** can raise the issue of capacity with industry and industry associates, which may be able to fund expansions as part of their corporate social investment strategies (or in some cases R&D strategies). Finally, **the dti** can be more directly involved by tailoring the Critical Infrastructure Programme – which aims to improve competitiveness of South African industries through a 70/30 cost sharing grant[143] – to include infrastructure expansion at HETs and FETs. This should have a particular focus on engineering and related studies, or identified scarce skills. The Critical Infrastructure Programme already includes a focus on skills development, but it is currently limited to companies.[144]

Promotion of programmes to improve work experience

Stakeholder consultation has highlighted that industry places great value on work experience. Candidates with work place experience need less in-house training and are able to slot into their roles more easily. In order to change this preference for experienced workers incentives should be offered to companies to hire graduates. The National Treasury and National Planning Commission have recently suggested several policy options to address this issue, including youth employment subsidy and a relaxation of labour laws.

A youth employment subsidy reduces relative financial costs of employing an inexperienced individual, while leaving the wage the employee receives unaffected. This should result in an increase in the demand for young, inexperienced workers.[145] This subsidy was formally proposed in the 2011 budget and could already be implemented as early as 1 March 2012.

The dti, in particular the Skills for Economy Unit, should also begin to engage in the inter-departmental debate on labour laws and the impact these have on the economy. Restrictive hiring and firing laws, as well as the bureaucracy and red tape around labour issues should be discussed. **The dti** should focus in particular on promoting an environment that benefits first time workers in the economy. Thus far **the dti** has sided with the Department of Labour, which has not been in favour of relaxing labour laws.[146] Support for some of the suggestions of National Treasury and National Planning Commission could place more pressure on the Department of Labour to consider measures which could ultimately lead to an increased uptake of graduates.

Another possibility to promote work experience is by providing incentives for companies to increase their existing bursary schemes. Bursary schemes are mainly limited to larger companies,

[143] http://www.tradeinvestsa.co.za/incentives/983079.htm
[144] http://www.pmg.org.za/report/20110810-department-trade-and-industry-incentive-schemes
[145] National Treasury. 2011. Confronting youth unemployment: policy options for South Africa
[146] http://www.businessday.co.za/articles/Content.aspx?id=151155

which use these schemes as a core part of the recruitment process or for corporate social investment. The creation of a fund which subsidises additional bursaries (rather than existing ones) could increase the number of bursars at larger firms, but also allow smaller firms to take on one or two students. This allows firms to be directly involved in the student's education, and can provide guidance on subject choice and other academic support. Through the bursary scheme the student is also assured of obtaining vacation or full time work – which is part of the bursary agreement – and thus gains valuable work experience.[147]

Promotion of information gathering

The creation of a database of companies willing to take on learnerships / apprentices or interns could be a useful tool for education institutions and students. Through its regular interaction with companies and industry associations, **the dti** may be able to set up the core of the database, allowing other stakeholders such as Department of Labour and SETAs to add information. A possibility is expanding the UNIDO SPX industry profiling database which it is currently being updated to include such information (**the dti** is one of the stakeholders in this project).

The dti can also play an important role in advocacy and support for the creation of an artisan register. The task of creating the register (which was scrapped in the early 2000s) will fall on the newly created National Artisan Moderation Body (NAMB). Such a register could anchor discussions around skills shortages for artisans and increase the flow of labour market information on available artisanal skills (e.g. by allowing role players to comment on issues such as Eskom bringing Thai welders due to a lack of local welders). Using its links with industry associations and companies, **the dti** can offer support to NAMB in the creation of this list as well as advocating for this to be viewed as a priority.

Finally, **the dti** should support SETA to obtain better workplace information (through WSPs and ATRs). The functioning of the SETAs are key to higher levels of in-house training, the functioning of the skills development pillar of the BBBEEE codes, as well as obtaining higher quality data on the workplace.

[147] DPRU. 2006. Graduate unemployment in Post-Apartheid South Africa: Nature and possible policy responses.

Appendix A: Overview of government initiatives, strategies and regulation

This chapter provides a summary of relevant national and sector strategies as well as legislation impacting on the metals fabrication, capital equipment and transport equipment sector.

I. Economic strategies which impact on the metals, capital and transport equipment sector

The **National Industrial Policy Framework (NIPF)**[148] was adopted in 2007, broadly setting out government's approach to industrialisation. It forms a core part of achieving the goals of the **Accelerated and Shared Growth Initiative of South Africa's (ASGI-SA)** such as GDP growth of 6% by 2010 and halving unemployment and poverty by 2014. The NIPF acts as a policy framework, with the aim to:

- Diversify the economy away from traditional commodities and non-tradable services
- Shift toward a knowledge economy
- Promote a labour absorbing industrialisation path

Within this framework the Industrial Policy Action Plan (IPAP) and **Revised Industrial Policy Action Plan (IPAP2)** were drafted to achieve some of these goals. IPAP2 explicitly lists metal fabrication, capital equipment and transport equipment as new focus areas. Key action programmes include[149]:

- Identification of fleet programmes/ products to make investments in associated supply chains viable and thereby promote local manufacturing
- Competitive financing programme for suppliers into public capex programme
- National Tooling Initiative (see below for further detail)
- National Foundry Technology Network (see below for further detail)
- Facilitate the upgrading of the white goods industry to increase production and grow exports

IPAP2 also highlights challenges faced by the metal fabrication, capital equipment and transport equipment sector, including[150]:

- Current procurement practises by SOEs which do not always favour local procurement
- Inadequate capital investment (which has led to poor quality and old plants, machinery and equipment)
- Import parity pricing of material imports, uncompetitive production and technology
- Low-cost international competition

The constraints highlighted by IPAP2 were also identified in **the dti's Metals Customised Sector Programme**. The programme deals with some of these constraints through action plans. These are[151]:

- Establishing a sector support facility
- Establishing a competitive input price regime in the metals sector
- Maximising local content through backward linkages
- Establishing an import monitoring system
- Upgrading production capabilities in downstream industries

The central idea in the **New Growth Path** is to improve the labour absorption capacity of the economy.[152] One of the aims is to create 5 million new jobs by 2020, and key job creators highlighted are:

- Infrastructure
- Agricultural value chain

[148] the dti. 2007. National Industrial Policy Framework
[149] the dti. 2010. Revised Industrial Policy Action Plan
[150] the dti. 2010. Revised Industrial Policy Action Plan
[151] the dti. 2006. Metals Customised Sector Programme
[152] http://www.southafrica.info/business/economy/policies/employment-240310.htm

- Mining value chain
- Green economy
- Manufacturing sectors highlighted in IPAP2
- Tourism

Metals fabrication, capital equipment and transport equipment sector is potentially impacted by three of these sectors, namely infrastructure upgrades, mining, and manufacturing sector. Infrastructure investments in energy, transport, and communications can create 250,000 jobs per year.[153] The Industrial Development Corporation estimates that mining can add 140,000 additional jobs by 2020 (not including downstream effects).[154]

State owned enterprises (SOE), under the guidance of Department of Public Enterprise, have initiated **Competitive Supplier Development Programmes** (CSDP) which aims to increase local competitiveness, capacity and capability of local suppliers.[155] The focus of the programme is to foster and improve the competitiveness of potential local enterprises to enter the SOE supply chain. From a procurement side it is also a commitment by SOEs to procure locally as much possible. To date only Eskom and Transnet have submitted CSDPs. Eskom's CSDP will focus on plant and equipment, structural and reinforcement steel, coal boiler, coal turbine, and controls and instrumentation. It will spend R131 billion on these focus areas between 2008 and 2013.[156] Transnet have highlighted rolling stock and port equipment as areas for increasing local procurement.[157] These programmes, if successful, could substantially add to the growth of the metals fabrication, capital equipment and transport equipment sectors. There are already some cases where these programmes have been successful, such as the recent US$230 million Transnet order for 32 new locomotives, which requires 50% local content.[158] However, it is difficult to accurately determine the extent of the impact of these programmes. Possible CSDPs by other SOEs could also have an impact on the growth of the sectors.

The **National tooling initiative (NTI)** aims to rehabilitate the South African tool, die and mould packaging industry by strengthening the capacity (through skills upgrade) and competitiveness of the tooling industry.[159] The tooling industry underpins the manufacturing sector and impacts greatly on its competitiveness.

There are several other sector development strategies that impact on the metals fabrication, capital equipment and transport equipment sectors. The **strategy for a sustainable, economical and growing aerospace industry** identifies the role local manufacturers and aerospace's present and potential future position.[160] It recommends the creation of a long-term business climate that is conducive to growing the sector (including through infrastructure upgrades), collective manufacturing and marketing, and active SMME and BEE development.[161] The **Automotive Production and Development Programme** which replaces the Motor Industry Development Programme seeks to provide local industry with support in a market neutral manner.[162] The strategy is in line with the NIPF and IPAP2, with the long term goal of doubling production to 1.2 million vehicles by 2020.[163] The **National Foundry Technology Network** (NFTN) aims to support

[153] Department of Economic Development. 2010. New Growth Path
[154] Department of Economic Development. 2010. New Growth Path
[155] Department of Public Enterprises. Date unknown. Competitive Supplier Development Programme
[156] Eskom. 2008. Competitive Supplier Development Programme
[157] Transnet. 2008. Competitive Supplier Development Programme
[158] http://www.engineeringnews.co.za/article/transnet-orders-another-32-locomotives-for-its-iron-ore-line-2011-03-02
[159] the dti. 2010. Revised Industrial Policy Action Plan
[160] Department of Science and Technology. 2008. A Strategy for a Sustainable, Economical and Growing Aerospace Industry
[161] Department of Science and Technology. 2008. A Strategy for a Sustainable, Economical and Growing Aerospace Industry
[162] http://www.idc.co.za/Access/2008/December/project_update.html
[163] http://www.idc.co.za/Access/2008/December/project_update.html

the industry through skills training, technology transfer, promote SMMEs, and provide technical foundry support for day to day issues.[164]

Implications for skills forecasting

The strategies summarised above will impact on the metals fabrication, capital equipment and transport equipment sectors. If successful, these programmes will increase growth in the sector and therefore fuel further demand for employment within this sector. It is also possible that not all the goals of the strategies are researched, or that programmes are only partly successful in stimulating growth and demand. The impact of these programmes is difficult to account for in a forecasting model, since it is not yet known to what extent these programmes will be successful and how it will translate across to employment demand.

II. Skills development strategies

The **National Skills Development Strategy 2005 – 2010** (NSDSIII) is the medium term strategy for the Department of Labour. It also assigns national priority areas which will be supported through the projected R21 billion in revenues from the skills development levy[165]. The strategy is generally broad in nature, addressing economy wide skills development issues rather than sector specific issues. It provides performance indicators on which the SETA Service Level Agreements are based.

The **Joint Initiative on Priority Skills Acquisition** (JIPSA) was established in 2006 with the aim of addressing the supply of scarce and critical skills in order to meet the objectives of AsgiSA.[166] The role of JIPSA was to improve cooperation amongst the various constituencies, including government departments. The most critical challenge has been to create of common sense of purpose and partnership between key players.[167] JIPSA has succeeded had some success since inception, including gaining a greater priority for skills in within national frameworks, and reprioritising funding for the delivery of skills such as artisans.[168]

The Human Resource Development Strategy for South Africa (HRD-SA) 2010 – 2030[169] was approved in March 2009. It replaces the previous HRD strategy from 2001. The aim of HRD-SA is to increase the aggregate levels of skills in the workforce, in order to benefit individuals and society alike. A set of fifteen priorities were identified to be addressed over a 20 year period, including:

- Eradicating adult illiteracy in the population
- Ensuring education and training for all until the age of 18 years
- Ensuring that new labour market entrants have access to employment-focused education and training opportunities
- Ensuring a balance between immigration and emigration is such that there is a net positive inflow of individuals with priority skills
- Ensuring all adults in the labour market (both unemployed and employed) can obtain education and training in order to attain a minimum qualification at Level 4 of the NQF

[164] http://www.nftn.co.za/
[165] Department of Labour. 2005. National Skills Development Strategy 1 April 2005 – 31 March 2010
[166] Department of Labour. 2008. Professions case study report: artisans/trades
[167] Department of Labour. 2008. Professions case study report: artisans/trades
[168] Department of Labour. 2008. Professions case study report: artisans/trades
[169] Department of Education . 2009. Human Resource Development Strategy for South Africa (HRD-SA) 2010 – 2030

III. Legislation

The aims of the skills development strategies mentioned above are supported by the two key pieces of legislation:

The **Skills Development Act** (No. 7 of 1998) established the National Skills Authority as well as the Sector Education and Training Authorities (SETAs). It also established the financing scheme of the SETA's through the skills development levy and the National Skills Fund.

The **Skills Development Levies Act** (No. 9 of 1999) provides for a national levy grant system based on a one percent tax on payroll. It forms part of the core of the supporting legislation to the NSDS. The Act provides for an 80:20 allocation, with 80% of the total levy revenue (minus administrative costs) is allocated to enterprises utilising SETA training grants. The remaining 20 percent is allocated to the National Skills Fund, which is used for strategic projects and expenditures by the National Skills Authority.

Appendix B: Literature review on skills demand forecasting and skills gaps

This chapter provides an overview of international practices in forecasting skills demand and skills gaps. It also reviews some initiatives to boost the metals and related sectors. Finally, this chapter provides a review of previous attempts to forecast skills demand in South Africa.

Note: the majority of the benchmarking analysis will take place during Step 6 (see Figure 1: Project Plan). The analysis at this stage of the project is limited to high-level secondary research review.

I. International demand forecasting and gap analysis

There are several different international models that deal with identifying employment trends and possible future gaps between supply and demand. The type of model often varies on the data available and on the main purpose and final users of the estimation. The models can be roughly grouped into 4 categories, each of which will be expanded on below:

Quantitative models

Quantitative models rely on historical data to project changes to the demand and supply of labour. These models vary in complexity and detail. Some countries employ economy wide computational general equilibrium model (CGE) which attempts to model all the dynamics and linkages between sectors, employment and growth. **Australia**, for example, uses a CGE model to generate forecasts for 113 industries, 56 regions and up to 341 occupations.[170] The forecasts are annually calculated for the next 5 years.

Simpler, less data intensive models can also be employed. These models use time series data to extrapolate future growth areas. These techniques are useful when only limited information is available. Such models do not always have great detail (again due to lack of data), for example the estimation of future skills need in **Northern Ireland** had 25 occupations for the economy wide exercise.[171]

The **Chinese government**[172] uses data from employment offices (such as job vacancies) to forecast market labour demand. This has the drawback of only addressing current vacancies and does not necessarily plan for future changes in demand. Furthermore the data from rural areas are often unreliable.

Direct surveys to companies are also sometimes used to identify skills gaps. This involves companies answering a number of different questions on current employment, current gaps in employment and future employment needs. The data is the collated and analysed to identify demand for certain skills or occupation. The demand for skills is then measured against the current output from schools and tertiary institutions. Surveys were particularly popular in the **United Kingdom** in the late 1960s and early 1970s, but have since been criticised as having no theoretical foundation, that it's subjective, and that it's based on inconsistent assumptions made by respondents when answering the questions.[173] Since the respondents often focus on current vacancies (which may not be a structural problem) surveys are best employed to provide very

[170] Wilson, R. A, I. Woolard and D. Lee. 2004. Developing a National Skills Forecasting Tool for South Africa. IER/HSRC/Department of Labour.
[171] Oxford Economics. 2009. Forecasting future skill needs in Northern Ireland
[172] European Centre for the Development of Vocational Training. 2009. Cedefop briefing note
[173] Wilson, R. A, I. Woolard and D. Lee (2004). Developing a National Skills Forecasting Tool for South Africa. IER/HSRC/Department of Labour.

short-term often forecasts. Due to these issues, surveys are often designed to take a more qualitative approach rather than obtaining hard quantitative data (or at least a mix of the two).[174]

It should be noted that the majority of these studies focus on forecasting skills for the economy as a whole. This is done to reflect the linkages and spillovers between industries, but is also partly driven by data. Several countries (e.g. UK, Northern Ireland) forecast occupations at a high level (e.g. managers and senior officials; process, plant and machine operatives; and skilled trades). The US and Australia have much more in-depth data available and are therefore able to provide forecasts in more detail (data is available on 530 and 113 occupations respectively).[175]

Quantitative example: Canada

Canada has a rigorous process to estimate employment projections, including the following:[176]

Employment by industry

1. Forecast GDP by industry based on the outlook of provided the Conference Board of Canada's medium-term forecasting model (this data is therefore exogenous to the model)
2. Estimate labour productivity based on historical trend using a Hodrick-Prescott filter (a tool to smooth the time series – reducing the sensitivity to short run shocks)

Forecast of employment by occupation

1. Project share of an occupation within total employment within a particular industry (140 occupations and 33 industries)
2. Estimate using lagged values of the share of total employment (capturing long term trends) and an estimate of the cyclical position of the industry (capturing short-term cyclical effects)

Replacement demand

1. Assume immigration and emigration rates remain constant to the historical average
2. Derive occupational retirements using the Labour Force Survey (LFS). Retirements are estimated as the average annual number of employed workers within five years of the LFS median retirement age
3. Use average mortality rates – updated to take into account increased life expectancy over the period

Labour supply: School leavers

1. Project enrolment into secondary, trade and vocational, community college, and university (consider only full time students)
2. Estimate the number of discontinuants by subtracting the number of graduates from the number the number of students enrolled in the original year of study (e.g. if it is a four year degree then graduates of 2010 will be measured against enrolments of 2006.
3. Filter out those continuing to study after obtaining a degree
4. Match school leavers into occupations:
    a. For individuals with only high school degrees information from the Labour Force Survey is used in order to 'place' them in an occupation
    b. Tertiary graduates are placed in an occupation according to the type of degree and field of study (based on the National Graduate Survey)

Combining the above estimates provides an indication of the future labour demand and supply and possible skills gaps.

[174] Wilson, R. A, I. Woolard and D. Lee (2004). Developing a National Skills Forecasting Tool for South Africa. IER/HSRC/Department of Labour.
[175] New Zealand Department of Labour. 2009. Future demand for skills in New Zealand compared with forecasts for some Western Countries: relative importance of expansion and retirement demand
[176] Human Resources and Skills Development Canada. 2006. Looking-Ahead: A 10-Year Outlook for the Canadian Labour Market (2006-2015)

Qualitative models

Qualitative approaches include Delphi-style methods (an interactive forecasting method which relies on expert opinions), focus groups, case studies, holistic modelling and scenario planning. These models can often by subjective, and as a result may not be consistent over time or across industries. However, the qualitative approach is often used by countries which lack the necessary statistics to do quantitative models. These models are not employed to obtain precise or detailed measurements of skills requirements or skills gap, but are rather used to provide an overview of current and future needs and trends. Few countries rely solely on qualitative forecasts, with most tending to use the qualitative models mentioned here in conjunction with quantitative models.

Scenario planning is increasingly becoming popular as a methodology which is able to compensate for the limitations of forecasting, especially in situations where there is uncertainty around how key drivers such as government initiatives will shape the growth of the sector.[177]

Qualitative example: The Netherlands

A recent study by the Netherlands Taskforce on E-skills developed 5 different scenarios for the ICT sector[178]:

1. Back to normal: Growth rates return to the historical development trajectory (pre-crisis)
2. Investing in the future: Moderate growth and some acceleration of ICT investments and innovation (yielding results after the estimation period of 2015)
3. Turbo knowledge economy: European wide growth – ICT careers become more attractive and growth of demand for e-skills
4. Tradition wins: Export-driven recovery advantages traditional industries – moderate economic growth with low ICT growth. Acceleration of the relocation of the ICT industry outside of Europe
5. Stagnation: Slow recovery and domestic protectionism which discourages innovation investments. Low ICT investments and IT off-shoring reduces demand

For each of the scenarios demand patterns are calculated based on assumed GDP growth and related IT spending per scenario. These are matched against forecast skill supply, calculated by extrapolating historical figures.

Signalling models

Signalling models use various different data sources as leading indicators of developing trends in the labour market. A signal is a discrete piece of information which points towards something significant which may be happening. For example, if wages in a particular occupation start rising rapidly it is usually a signal that there is a shortage in the number of qualified people for the particular occupation.[179] Proponents of signalling argue that it allows industry and policy makers to gain a better understanding of general trends in the marketplace, rather than forecasts which often require assumptions and generalisations.

Germany uses an early recognition system for qualification and training needs based on job advertisements in dominant newspapers. These advertisements are saved and categorised in a

[177] Wilson, R. A, I. Woolard and D. Lee (2004). Developing a National Skills Forecasting Tool for South Africa. IER/HSRC/Department of Labour.
[178] NL Taskforce on E-Skills. 2010. Supply and demand of E-Skills in the Netherlands
[179] merSETA. 2009. A model for sector skills planning

databank from where it is analysed. [180] This provides useful indicators for demand, but is also most useful in a short term framework rather than a long term framework. However, the time series aspect of the data does allow for an analysis of structural shifts in employment.

Finland[181] has on online information service on skill needs, called ENSTI, which was developed to provide rapid data dissemination for the education and labour market. The anticipation-related news and numerical forecasts (job-openings in different professional groups and training needs in sectors) are seen as of particular importance. Descriptions of other reports and projects are also useful to keep users up to date with the latest events. The objective is to close the gap between the users and producers of data. Users include national, regional and local administrations, universities, guidance councillors, and researchers in education and training.

Each Thursday the Employment and Training Administration of the **U.S.** Department of Labour[182] releases data on the number of U.S. workers who have filed an initial claim for unemployment insurance in that week. This data is used by analysts and policy makers to forecast the strength of the labour market as well as wider implications to the economy. However, there is evidence that unemployment claims as a forecast tool for labour demand is only accurate during recessions.[183] During upturns the systematic relationship between unemployment claims and labour demand disappears.

Mixed methodologies

As mentioned above several countries employ a mix between quantitative forecasting and qualitative information. Traditional forecasting results are updated and refined through qualitative techniques such as surveys of employer's opinions and skills audits. In cases where detailed employment and occupation data are not available such methodologies often needed to be verified through qualitative techniques as the forecasts are based on several assumptions (in order to deal with the lack of data) which may provide inaccurate results.

South Korea uses a mix between quantitative forecasts conducted annually, predicting the labour demand for the next two years. Demand for skills and qualifications are determined through sample surveys of enterprises – relating to current employment figures (including amount of new recruits), future demand by occupation, and views on the longer term labour market.

[180] Wilson, R. A, I. Woolard and D. Lee (2004). Developing a National Skills Forecasting Tool for South Africa. IER/HSRC/Department of Labour.
[181] European Centre for the Development of Vocational Training. 2008. Systems for anticipation of skill needs
[182] McConnell, M. 1998. Rethinking the value of initial claims as a forecasting tool.
[183] McConnell, M. 1998. Rethinking the value of initial claims as a forecasting tool.

Mixed methodologies example: The UK[184]

Since the introduction of the UK-wide Sector Skills Development Agency in 2002, a more holistic approach has been taken to skills forecasting rather than the traditional, quantitative forecasting techniques. Quantitative models include extrapolative techniques (similar to the Canadian model) as well as behavioural/ economic models. These results are updated with case studies, focus groups and scenario planning. The sector skills councils also consult with employers to gather opinions on employment trends and requirements.

The anticipation of skills is done on a sectoral basis, which is further broken down regionally. This analysis forms the basis of the skills need assessment which each of the 25 sector skills councils are mandated to develop. It is a sector skills agreement between employers and teaching and training institutions within the sector. This agreement is the main mechanisms through which employers' skills needs in the UK are identified and met.

The strengths of the system are the following:

- Forecasting combines cross sector, comparable sources of information (from national sources structured by the standard industrial classification)
- Forecasts are complemented by employer consultation from employers and sector experts
- Strong procedural guidelines for each sector skills council to follow, thus allowing for easier interaction with employers and greater cross-sector comparability

II. Providing skills guidance and training policies

South Korea's[185] skills development strategy is one of the key driving forces of its rapid economic development. Government intervention in skills development occurred at an early stage in South Korea's industrialisation (the Skills Development System was introduced in 1967). This was necessary for three reasons:

1. Workforce mobility was frequent. Enterprises aimed to recruit from other enterprises rather than provide training themselves
2. The large and unskilled workforce began migrating from the rural to urban areas. This caused wage disparities. To address the inequality, government needed to enhance opportunities and productivity through training
3. Demand for future skilled workers would not have been met if skills development by mechanisms of the free market alone

Part of the success of the skills development system was its flexibility to adapt to the economic cycles of the Korean economy. For example, the focus shifted from supplying skilled workers for export-oriented light industries in the 1960s and early 1970s, to heavy and chemical industries in the late 1970s and 1980s and shifted again to the more advanced and knowledge based industries in the 1990s and 2000s.[186] Overall economic policy (e.g. Five-Year Economic Development) included estimates of supply and demand of the skilled workforce and skills policies were developed based on these estimates.

In 1989 **Malaysia**[187] established the National Vocational Training Council (NVTC) to improve the coordination of training provision in Malaysia. However, the success of the council has been hampered by a lack of legal authority. It has also attempted to alleviate skills shortages by encouraging the development of joint private public sector training initiative. Through this consortia

[184] European Centre for the Development of Vocational Training. 2008. Systems for anticipation of skill needs
[185] Young-Sun Ra and Kyung Woo Shim. 2009. The Korean Case Study: Past Experience and New Trends in Training Policies
[186] Young-Sun Ra and Kyung Woo Shim. 2009. The Korean Case Study: Past Experience and New Trends in Training Policies
[187] Tzannatos, Z and Johnes, G. 1997. Training and Skills Development in the East Asian Newly Industrialised Countries: a comparison and lessons for developing countries. *Journal of Vocational Education and Training,* Vol. 49, No. 3, 1997

of firms have emerged in to provide training in technology and engineering to shop-floor workers (e.g. Penang Skills Development Centre involving more than 50 firms). The Double Deduction Incentive for Training was introduced in 1987, allowing firms to deduct two times their allowable training costs from their income tax. The uptake of the programme (which requires approval by the Malaysian Industrial Development Authority) has been slow (approximately 3,000 trained in the first six years). Most of the uptake was by multinational firms concentrated in the electronics sector, which has a well established training history. Since 1992 eligibility has been restricted to small manufacturing firms, but firms have been reluctant to participate for administrative reasons.

III. South African literature review

Forecasting South African labour demand

There have been some attempts to forecast labour demand in South Africa. These vary in scope and methodology. Some of the key studies are discussed below:

The 1999 HSRC study forecasted market trends between 1998 and 2003 for eight sectors (only excluding agriculture) in the South African economy.[188] It was therefore quite a high level study. Forecasts were made at a sub-sector level with 68 professional and 10 artisanal occupational categories. Data were obtained through a survey of 273 randomly selected companies, and matched with macroeconomic growth forecasts. Replacement demand was calculated by assuming economy wide and constant figures (e.g. mortality rate was assumed to be 6.5 per 1,000 for all occupations).[189]

In 2001 the Bureau of Market Research investigated skills shortages in South Africa and the level of skills development.[190] The study used a mix of qualitative and quantitative methods, e.g. interviews, workshops, and secondary national data. The study concluded that there is will be a lack of IT specialists, electronic engineers and specialist managers.[191] It also noted that the educational system needed to be closer aligned to the needs of employers.

Woolard, Kneebone and Lee updated the HSRC study of 1999 for the period of 2001 to 2006.[192] Data from the Labour Force Surveys (by StatsSA) were used in order to obtain employment by occupation and sector. As with several international studies, the occupations used are broad – 10 in total for the whole economy (e.g. academics, doctors, scientists, engineers). Sectoral growth forecasts were obtained from growth predictions by ABSA which forecasted the performance of 37 sectors of the South African economy. By multiplying the growth forecasts to the employment data and labour elasticity (how much the demand for labour changes for a percentage change in the size of the sector) future employment demand is obtained. The elasticities used were obtained from the HSRC study of 1999, which was heavily reliant on interviews with companies and industry experts.[193] Replacement demand was calculated as follows:

- Retirement: 10% of group that was aged between 50 and 60 in 2001 were assumed to retire annually

[188] Whiteford AC, van Zyl E, Simkins C and Hall, E (1999). Labour market trends and future workforce needs. Pretoria: Human Sciences Research Council.
[189] Wilson, R. A, I. Woolard and D. Lee. 2004. Developing a National Skills Forecasting Tool for South Africa. IER/HSRC/Department of Labour.
[190] Bureau of Market Research, (2001) Key Skills Shortages and the fast Tracking of Skills Development, Bureau of Market Research: University of Southern Africa.
[191] Wilson, R. A, I. Woolard and D. Lee. 2004. Developing a National Skills Forecasting Tool for South Africa. IER/HSRC/Department of Labour.
[192] Woolard, I, Kneebone, P & Lee, D (2003) Forecasting the Demand for Scarce Skills, 2001 – 2006, Human Resources Development Review 2003: Education, Employment and Skills in South Africa, Human Sciences Research Council, Cape Town: HSRC Press.
[193] Woolard, I, Kneebone, P & Lee, D (2003) Forecasting the Demand for Scarce Skills, 2001 – 2006, Human Resources Development Review 2003: Education, Employment and Skills in South Africa, Human Sciences Research Council, Cape Town: HSRC Press.

- Mortality: Used Actuarial Society of South Africa's mortality prediction of death risk for each occupational class
- Emigration: Assumed that 0.2 % of working adult population emigrate annually

In a report commissioned by the Department of Labour, Maree *et al* investigated the industrial structure and skills in the metal beneficiation sector of South Africa.[194] The report provides an overview of the sector and its subsectors, including the value chain and historical performance. Employment data is taken from the Labour Force Surveys (StatsSA) as well as the Standardised Employment Series produced by the Development Bank of Southern Africa. Historical changes in labour demand are tracked between 1996 and 2005, showing a decline in employment within the sector between 1996 and 2001, followed by gradual employment growth to 2005. Demand for the technicians, craft workers and operators rose substantially over between 1999 and 2005, whilst demand for elementary workers declined. Demand for professional engineers also dropped However, as the authors note using these data sources has severe limitations and they dispute the drop in demand for engineers, e.g. it is not possible to compile data on an industry or sector specific level.[195] Educational supply of skills is found to be slow to respond to pressures arising at the demand level. An inadequate supply of skills was found to have inhibited the growth and development of the sector. Poor quality of public schooling is listed as a major constraint to matching the demand for skills in the metals fabrication sector.

In 2009, merSETA initiated a project to develop a model for identifying and reporting on skills needs in the sector. The aim is to use the methods and tools to inform planning and prioritisation of interventions as well as decisions regarding support and resources offered for training in the sector.[196] The research was commissioned in order to be less reliant on workplace skills plans (WSP) and annual training reports (ATR) as only 15% of employers submit these documents, thus only providing a partial picture. Furthermore the submissions are generally from larger firms, thus skewing the results. The final model is based on a mix between qualitative and quantitative information and is summarised below:

- Description of value chain of each sub-sector – based mainly on Leontief input-output models as well as stakeholder consultation
- Calculate expected growth of subsectors
- Calculate expected growth in demand for labour and skills of subsectors (growth of subsector multiplied by current labour and a labour elasticity coefficient)
- Forecast expected growth for individual occupations, based on expected sector wide labour demand and WSP.
- Calculate replacement demand:
  - Retirement (based on WSP data)
  - Mortality (using generic national data against demographic profile of the sector based on WSP data)
  - Inter-occupational data (using generic national data)
  - Migration (using generic national data)
- Validation of results through stakeholder consultation

The above methodology was followed in merSETA's Sector Skill Plan 2010 – 2015.[197] The study focuses on 4 subsectors, namely: automotive, new tyre, plastics, and metals. However, several simplifying assumptions are made. The elasticity of labour demand is assumed to be equal to one for all sectors, thus a 1% growth in the sector creates a 1% growth in demand for labour. Furthermore a 5% growth rate is assumed for each of the sectors. The occupational profile of each subsector is based on the sector-wide profile which was derived from the WSP and ATR in 2006-2007 and is assumed to remain constant throughout the forecasting period. Replacement

[194] Maree, J. Lundall, P and Godfrey, S. 2008. Industrial structure and skills in the metals beneficiation sector of South Africa.
[195] Maree, J. Lundall, P and Godfrey, S. 2008. Industrial structure and skills in the metals beneficiation sector of South Africa.
[196] merSETA. 2009. A Model for Sector Skills Planning.
[197] merSETA. 2009.Sector Skills Plan 2010 - 2015

demand is assumed to be 5% per annum across all subsectors – it is unclear exactly how this figure was determined. Using these simplifying assumptions occupational demand is forecasted over the next 5 years. The final scarce skills calculations seem to be completely dependent on WSP and ATR and does not appear to be connected to the calculations of occupational demand per subsector.

Wider literature around skills in South Africa

Wider studies regarding skills in South Africa often focus on the impact and extent of the skills shortage and on ways to improve the skill level in South Africa.

In 2003 the Nedlac Fund for Research into Industrial Development Growth and Equity (Fridge) published a study aimed to research and analyse the metals and engineering sector in order to recommend strategies for growth and job creation.[198] The results are based on quantitative (based on Metals and Engineering Industry Bargaining Council data) and qualitative (face to face interviews) analysis of the industry. The availability of skills was found to be a constraint to the sector, particularly in the more 'design-intensive' sectors where South Africa has a competitive advantage due to lower engineering costs.

The Department of Labour conducted the National Skills Survey[199] in 2007 to determine the changes in training activities in South Africa that may have been driven by the NSDS. The aim of the study was thus to establish how enterprises are committed and responding to the NSDS, the propensity of enterprises to extend skills development activities and to review the relationship between enterprises and the respective SETAs. Questionnaires were posted to a random selection of 9,500 enterprises based on enterprise size from South African Revenue Services database of levy paying enterprises. Of the 9,500 enterprises 1,557 (16.4%) responded. Of this 144 surveys were from merSETA and 36 from the Mining Qualifications Authority. Key findings of the National Skills Survey include:

- Strong growth in training activity, mainly due to competitive issues such as meeting quality control standards, improving productivity, and technological changes
  - SETA initiatives did not have a major impact on training initiatives, ranked ninth out of fifteen factors in terms of perceived influence
- Concern surrounding employers willingness to continue training operations during an economic downturn
- No shift in SETA performances, overall performance rated as 2.5 out of 5 (excellent).
- Substantial variation in training across enterprise size
  - Training rate of large enterprises (64%) almost double that of small enterprises (34%)

A scarce and critical skills research project surrounding artisans/ trades was undertaken in March 2008, also commissioned by the Department of Labour.[200] The study uses both qualitative and quantitative methods to establish the extent and impact of the artisanal shortage in South Africa. Data were obtained from Labour Force Surveys as well as October Household Surveys. The quality and availability of data again impedes the study, which cautions that the results should be seen as illustrative. The study does not forecast skills, instead taking a historic view of artisan development and issues and making recommendations based on this. It found that there is a severe shortage of artisanal labour in key markets, including metal, machinery and related trades which has the second largest demand for artisans. Recommendations include:[201]

- Finalisation of artisan development regulation
- Finalisation and clarification of the National Qualifications Framework (NQF)

[198] Nedlac. 2003. FRIDGE Metals and Engineering industry study
[199] Department of Labour. 2007. National Skills Survey of 2007
[200] Department of Labour. 2008. Scarce and critical skills research project
[201] Department of Labour. 2008. Scarce and critical skills research project

Appendix C: Forecasting results

The tables below show the total demand (by number of employees) for each major OFO occupation (i.e. the sum of all new demand by occupation between 2011 and 2015). The figures thus represent the total number of *new* employees required in each occupation for the *entire* period. The occupations follow the SASCO classification and are also grouped into the major OFO occupational classification.

I. Managers

Directors and chief executives

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	5,120	4,721	3,984
Scenario 2	4,203	3,980	3,560
Scenario 3	3,354	3,285	3,152
Scenario 4	2,954	2,954	2,954
Scenario 5	2,570	2,634	2,760

Finance and administration managers/department managers

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	5,758	5,031	3,686
Scenario 2	4,085	3,678	2,912
Scenario 3	2,537	2,411	2,168
Scenario 4	1,807	1,807	1,807
Scenario 5	1,106	1,223	1,453

General managers of business services

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	3,497	3,277	2,869
Scenario 2	2,990	2,866	2,634
Scenario 3	2,520	2,482	2,409
Scenario 4	2,299	2,299	2,299
Scenario 5	2,087	2,122	2,192

Other managers/department managers not elsewhere classified

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	165	137	85
Scenario 2	101	85	56
Scenario 3	41	36	27
Scenario 4	13	13	13
Scenario 5	-14	-9	-0

Personnel and industrial relations managers/department managers

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	728	605	377
Scenario 2	445	376	246
Scenario 3	182	161	120
Scenario 4	59	59	59
Scenario 5	-60	-40	-1

Production and operations managers/department managers in business services

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	452	376	234
Scenario 2	276	233	153
Scenario 3	113	100	74
Scenario 4	37	37	37
Scenario 5	-37	-25	-1

Production and operations managers/department managers in manufacturing

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	2,466	2,049	1,277
Scenario 2	1,506	1,273	833
Scenario 3	618	545	406
Scenario 4	199	199	199
Scenario 5	-203	-136	-4

Sales and marketing managers/department managers

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	393	327	204
Scenario 2	240	203	133
Scenario 3	98	87	65
Scenario 4	32	32	32
Scenario 5	-32	-22	-1

II. Professionals

Accountants and related accounting occupations; Accounting occupations not elsewhere classified; Auditors and related occupations and Articled clerks with accountant/auditor

	Labour elasticity		
Sector growth	Scenario a	Scenario b	Scenario c
Scenario 1	248	207	131
Scenario 2	153	130	87
Scenario 3	66	59	45
Scenario 4	24	24	24
Scenario 5	-15	-9	4

Architects; engineers and related professionals not elsewhere classified; Industrial/production engineers; Quantity surveyors; Architects; engineers and related professionals not elsewhere classified

	Labour elasticity		
Sector growth	Scenario a	Scenario b	Scenario c
Scenario 1	106	89	56
Scenario 2	66	56	37
Scenario 3	28	25	19
Scenario 4	10	10	10
Scenario 5	-7	-4	2

Business professionals not elsewhere classified; Consultants

	Labour elasticity		
Sector growth	Scenario a	Scenario b	Scenario c
Scenario 1	183	152	95
Scenario 2	112	95	62
Scenario 3	46	41	30
Scenario 4	15	15	15
Scenario 5	-15	-10	-0

Electrical engineers

	Labour elasticity		
Sector growth	Scenario a	Scenario b	Scenario c
Scenario 1	383	319	202
Scenario 2	237	201	134
Scenario 3	101	90	69
Scenario 4	38	38	38
Scenario 5	-24	-13	7

Mechanical engineers

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	1,514	1,263	798
Scenario 2	936	795	531
Scenario 3	401	357	274
Scenario 4	149	149	149
Scenario 5	-93	-52	27

Personnel and careers professionals; Consultants: management/personnel

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	183	153	97
Scenario 2	113	96	64
Scenario 3	49	43	33
Scenario 4	18	18	18
Scenario 5	-11	-6	3

III. Artisans

Agricultural or industrial machinery mechanics and fitters (including apprentices/trainees)

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	4,890	4,003	2,363
Scenario 2	2,849	2,353	1,419
Scenario 3	961	807	512
Scenario 4	71	71	71
Scenario 5	-784	-641	-360

Building and related electricians (including apprentices/trainees)

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	1,633	1,337	789
Scenario 2	952	786	474
Scenario 3	321	270	171
Scenario 4	24	24	24
Scenario 5	-262	-214	-120

Electrical mechanics and fitters (including apprentices/trainees)

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	151	124	73
Scenario 2	88	73	44
Scenario 3	30	25	16
Scenario 4	2	2	2
Scenario 5	-24	-20	-11

Electronics mechanics and servicers (including apprentices/trainees)

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	594	486	287
Scenario 2	346	286	172
Scenario 3	117	98	62
Scenario 4	9	9	9
Scenario 5	-95	-78	-44

Machine-tool setters and setter-operators (including apprentices/trainees)

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	417	342	202
Scenario 2	243	201	121
Scenario 3	82	69	44
Scenario 4	6	6	6
Scenario 5	-67	-55	-31

Mechanical machinery assemblers

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	11,797	9,658	5,701
Scenario 2	6,874	5,678	3,424
Scenario 3	2,318	1,947	1,234
Scenario 4	172	172	172
Scenario 5	-1,890	-1,546	-870

Metal moulders and coremakers (including apprentices/trainees)

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	218	179	105
Scenario 2	127	105	63
Scenario 3	43	36	23
Scenario 4	3	3	3
Scenario 5	-35	-29	-16

Metal wheel-grinders; polishers and tool sharpeners (including apprentices/trainees)

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	1,083	887	524
Scenario 2	631	521	314
Scenario 3	213	179	113
Scenario 4	16	16	16
Scenario 5	-174	-142	-80

Motor vehicle mechanics and fitters (including apprentices/trainees)

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	1,879	1,539	908
Scenario 2	1,095	905	545
Scenario 3	369	310	197
Scenario 4	27	27	27
Scenario 5	-301	-246	-139

Safety; health and quality inspectors; Inspectors; safety and health

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	4,027	3,503	2,535
Scenario 2	2,822	2,529	1,978
Scenario 3	1,707	1,616	1,442
Scenario 4	1,182	1,182	1,182
Scenario 5	677	762	927

Sheet-metal workers (including apprentices/trainees)

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	4,787	4,045	2,672
Scenario 2	3,079	2,664	1,881
Scenario 3	1,498	1,369	1,121
Scenario 4	753	753	753
Scenario 5	37	157	391

Structural-metal preparers and erectors (including apprentices/trainees)

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	352	289	170
Scenario 2	205	170	102
Scenario 3	69	58	37
Scenario 4	5	5	5
Scenario 5	-56	-46	-26

Tool-makers and related workers (including apprentices/trainees)

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	3,545	2,977	1,927
Scenario 2	2,238	1,921	1,323
Scenario 3	1,029	931	742
Scenario 4	460	460	460
Scenario 5	-88	4	183

Varnishers and related painters (including apprentices/trainees)

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	1,096	897	530
Scenario 2	639	527	318
Scenario 3	215	181	115
Scenario 4	16	16	16
Scenario 5	-176	-144	-81

Welders and flamecutters (including apprentices/trainees)

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	19,183	15,940	9,939
Scenario 2	11,717	9,904	6,486
Scenario 3	4,809	4,247	3,166
Scenario 4	1,555	1,555	1,555
Scenario 5	-1,573	-1,050	-25

IV. Technicians

Electrical engineering technicians; Technicians; engineering; electrical; Assistants; technical; electrical engineering

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	1,137	931	549
Scenario 2	662	547	330
Scenario 3	223	188	119
Scenario 4	17	17	17
Scenario 5	-182	-149	-84

Electronics and telecommunications engineering technicians; Assistants; technical and electronic engineering

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	924	757	447
Scenario 2	539	445	268
Scenario 3	182	153	97
Scenario 4	13	13	13
Scenario 5	-148	-121	-68

Mechanical engineering technicians; Technicians; engineering; mechanical; Assistants; technical and mechanical engineering

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	3,963	3,244	1,915
Scenario 2	2,309	1,907	1,150
Scenario 3	779	654	415
Scenario 4	58	58	58
Scenario 5	-635	-519	-292

V. Clerical workers

Accounting and bookkeeping clerks

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	1,762	1,440	843
Scenario 2	1,020	840	500
Scenario 3	333	277	169
Scenario 4	9	9	9
Scenario 5	-302	-250	-148

Bookkeepers

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	1,244	1,016	595
Scenario 2	720	592	353
Scenario 3	235	195	120
Scenario 4	6	6	6
Scenario 5	-213	-176	-104

Mail carriers and sorting clerks

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	96	79	46
Scenario 2	56	46	27
Scenario 3	18	15	9
Scenario 4	1	1	1
Scenario 5	-17	-14	-8

Other office clerks and clerks not elsewhere classified (except customer services clerks)

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	10,248	9,298	7,540
Scenario 2	8,061	7,530	6,529
Scenario 3	6,038	5,873	5,556
Scenario 4	5,084	5,084	5,084
Scenario 5	4,168	4,321	4,621

Production clerks

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	919	807	599
Scenario 2	661	598	480
Scenario 3	422	402	365
Scenario 4	309	309	309
Scenario 5	201	219	255

Receptionists and information clerks

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	1,286	1,050	615
Scenario 2	744	612	364
Scenario 3	243	202	124
Scenario 4	7	7	7
Scenario 5	-220	-182	-108

Secretaries

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	492	402	236
Scenario 2	285	235	140
Scenario 3	93	77	47
Scenario 4	3	3	3
Scenario 5	-84	-70	-41

Statistical finance clerks

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	2,056	1,680	984
Scenario 2	1,190	979	583
Scenario 3	388	323	198
Scenario 4	11	11	11
Scenario 5	-352	-291	-173

Stock clerks

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	6,369	5,488	3,858
Scenario 2	4,341	3,848	2,920
Scenario 3	2,464	2,311	2,018
Scenario 4	1,580	1,580	1,580
Scenario 5	731	873	1,151

VI. Operators

Car; taxi and van drivers

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	1,913	1,603	1,029
Scenario 2	1,199	1,025	698
Scenario 3	538	484	381
Scenario 4	227	227	227
Scenario 5	-73	-23	75

Crane; hoist and related plant operators

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	2,738	2,364	1,672
Scenario 2	1,877	1,668	1,274
Scenario 3	1,081	1,016	891
Scenario 4	706	706	706
Scenario 5	345	405	523

Crushing; grinding and chemical mixing machinery operators

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	170	139	82
Scenario 2	99	82	49
Scenario 3	33	28	18
Scenario 4	2	2	2
Scenario 5	-27	-22	-13

Heavy truck and lorry drivers

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	4,310	3,852	3,005
Scenario 2	3,256	3,000	2,517
Scenario 3	2,280	2,200	2,048
Scenario 4	1,820	1,820	1,820
Scenario 5	1,378	1,452	1,597

Lifting-truck operators

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	3,049	2,496	1,473
Scenario 2	1,776	1,467	884
Scenario 3	599	503	318
Scenario 4	44	44	44
Scenario 5	-489	-400	-226

Machine-tool operators

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	18,200	15,060	9,250
Scenario 2	10,971	9,216	5,906
Scenario 3	4,283	3,738	2,691
Scenario 4	1,131	1,131	1,131
Scenario 5	-1,897	-1,391	-398

Metal finishing; plating and coating machine operators

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	916	750	443
Scenario 2	534	441	266
Scenario 3	180	151	96
Scenario 4	13	13	13
Scenario 5	-147	-120	-68

Metal heat-treating plant operators

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	1,248	1,021	603
Scenario 2	727	600	362
Scenario 3	245	206	130
Scenario 4	18	18	18
Scenario 5	-200	-164	-92

Metal melters and casters and rolling-mill operators

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	1,654	1,354	799
Scenario 2	964	796	480
Scenario 3	325	273	173
Scenario 4	24	24	24
Scenario 5	-266	-217	-122

Ore and metal furnace operators

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	500	410	242
Scenario 2	291	241	145
Scenario 3	98	82	52
Scenario 4	7	7	7
Scenario 5	-80	-66	-37

Other machine operators and assemblers not elsewhere classified

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	516	422	249
Scenario 2	300	248	150
Scenario 3	101	85	54
Scenario 4	7	7	7
Scenario 5	-83	-68	-38

Plastic products machine operators

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	940	770	454
Scenario 2	548	452	273
Scenario 3	185	155	98
Scenario 4	13	13	13
Scenario 5	-151	-123	-70

VII. Elementary workers

Assembling labourers

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	283	232	138
Scenario 2	166	138	84
Scenario 3	58	49	32
Scenario 4	7	7	7
Scenario 5	-42	-34	-18

Construction and maintenance labourers: roads; dams and similar constructions

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	1,037	851	507
Scenario 2	609	505	309
Scenario 3	212	180	118
Scenario 4	26	26	26
Scenario 5	-154	-124	-65

Electrical equipment assemblers

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	652	535	318
Scenario 2	383	317	194
Scenario 3	133	113	74
Scenario 4	16	16	16
Scenario 5	-97	-78	-41

Freight handlers

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	774	635	378
Scenario 2	454	377	230
Scenario 3	159	134	88
Scenario 4	19	19	19
Scenario 5	-115	-92	-49

Hand-packers and other manufacturing labourers

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	24,202	20,191	12,770
Scenario 2	14,969	12,727	8,500
Scenario 3	6,426	5,731	4,394
Scenario 4	2,401	2,401	2,401
Scenario 5	-1,466	-819	448

Helpers and cleaners in offices; hotels and other establishments

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	2,918	2,394	1,426
Scenario 2	1,713	1,420	868
Scenario 3	598	507	332
Scenario 4	72	72	72
Scenario 5	-433	-348	-183

Metal; rubber and plastic products assemblers

	Labour elasticity		
Sector growth	**Scenario a**	**Scenario b**	**Scenario c**
Scenario 1	968	794	473
Scenario 2	568	471	288
Scenario 3	198	168	110
Scenario 4	24	24	24
Scenario 5	-144	-116	-61

Appendix D: Classification by occupation

The table below shows the classification of occupations by OFO major category as well as the total employment numbers by occupation based on QFLS 4th quarter.

OFO major category	Occupation	Total employment, 4th quarter 2010
Artisans	Agricultural or industrial machinery mechanics and fitters (including apprentices/trainees)	17,440
	Building and related electricians (including apprentices/trainees)	5,825
	Electrical mechanics and fitters (including apprentices/trainees)	539
	Electronics mechanics and servicers (including apprentices/trainees)	2,117
	Machine-tool setters and setter-operators (including apprentices/trainees)	1,489
	Mechanical machinery assemblers	42,078
	Metal moulders and coremakers (including apprentices/trainees)	778
	Metal wheel-grinders; polishers and tool sharpeners (including apprentices/trainees)	3,864
	Motor vehicle mechanics and fitters (including apprentices/trainees)	6,703
	Painters and related workers (including apprentices/trainees)	-
	Safety; health and quality inspectors; Inspectors; safety and health	10,296
	Sheet-metal workers (including apprentices/trainees)	14,603
	Structural-metal preparers and erectors (including apprentices/trainees)	1,257
	Tool-makers and related workers (including apprentices/trainees)	11,166
	Varnishers and related painters (including apprentices/trainees)	3,909
	Welders and flamecutters (including apprentices/trainees)	63,805
Artisans Total		**185,869**
Technician	Electronics and telecommunications engineering technicians; Assistants; technical and electronic engineering	3,297
	Electrical engineering technicians; Technicians; engineering; electrical; Assistants; technical; electrical engineering	4,055
	Mechanical engineering technicians; Technicians; engineering; mechanical; Assistants; technical and mechanical engineering	14,135
Technician Total		**21,487**
Clerical workers	Accounting and bookkeeping clerks	6,346
	Bookkeepers	4,478
	Mail carriers and sorting clerks	347

OFO major category	Occupation	Total employment, 4th quarter 2010
	Other office clerks and clerks not elsewhere classified (except customer services clerks)	18,692
	Production clerks	2,207
	Receptionists and information clerks	4,629
	Secretaries	1,773
	Statistical finance clerks	7,403
	Stock clerks	17,334
	Telephone switchboard operators	-
Clerical workers Total		**63,209**
Elementary workers	Assembling labourers	998
	Construction and maintenance labourers: roads; dams and similar constructions	3,661
	Electrical equipment assemblers	2,301
	Freight handlers	2,733
	Hand-packers and other manufacturing labourers	78,906
	Helpers and cleaners in offices; hotels and other establishments	10,300
	Metal; rubber and plastic products assemblers	3,416
Elementary workers Total		**102,315**
Managers	Business professionals not elsewhere classified; Consultants	610
	Directors and chief executives	7,838
	Finance and administration managers/department managers	14,300
	General managers of business services	4,335
	Other managers/department managers not elsewhere classified	549
	Personnel and industrial relations managers/department managers	2,422
	Production and operations managers/department managers in business services	1,504
	Production and operations managers/department managers in manufacturing	8,204
	Sales and marketing managers/department managers	1,308
Managers Total		**41,070**
Operators	Car; taxi and van drivers	6,105
	Crane; hoist and related plant operators	7,358
	Crushing; grinding and chemical mixing machinery operators	605
	Heavy truck and lorry drivers	9,013
	Lifting-truck operators	10,877
	Machine-tool operators	61,782
	Metal finishing; plating and coating machine operators	3,269
	Metal heat-treating plant operators	4,451

OFO major category	Occupation	Total employment, 4th quarter 2010
	Metal melters and casters and rolling-mill operators	5,902
	Ore and metal furnace operators	1,785
	Other machine operators and assemblers not elsewhere classified	1,840
	Plastic products machine operators	3,354
Operators Total		**116,341**
Professionals	Accountants and related accounting occupations; Accounting occupations not elsewhere classified; Auditors and related occupations and Articled clerks with accountant/auditor	809
	Architects; engineers and related professionals not elsewhere classified; Industrial/production engineers; Quantity surveyors; Architects; engineers and related professionals not elsewhere classified	347
	Electrical engineers	1,249
	Mechanical engineers	4,939
	Personnel and careers professionals; Consultants: management/personnel	598
Professionals Total		**7,942**
Grand Total		**538,233**

Appendix e: List of stakeholders consulted

Education

Academy of Construction Skill, Kelly Carsel

Boland FET, Andrew Joseph

Central University of Technology, Ms Mbeu

College of Production Technology, Chris Glenwood

Department of Higher Education, Chantelle Dwyer

Department of Higher Education, James Mohali

Ekurhuleni FET, Hohny Abreu

Gert Sibande FET College, Priscilla Mhlekoa

Majuba FET, F Maharaj

Nelson Mandela Metropole University, Mr Sarel Schoombie

North West University, Prof. Storm

North West University, Mr Willem van Niekerk

Northern Cape Urban FET, F van Gens

Pretoria Technical College, Lilly Kotze

South African Qualifications Authority, Yvonne Shapiro

South African Institute of Welding, Ettiene Nell

Tshwane University of Technology, Hendrik van Zyl

Tshwane South FET, Samsung Ramafoko

University of KwaZulu-Natal, Mr Michael Brooks

Waterberg FET College, R Hector

Witwatersrand University, Prof. Claudia Polese

Industry

Allers Mescho, Mike Harride

BK Metals, Mr Esterhuizen

Bosal, Daleen van Wyk

CK Manufacturers (Designamite), Graham Edwins

Columbus Stainless Steel, Japien van Heerden

DCD Ringrollers , Herman Heunis

Engineering Council of South Africa, Dr Chicane

Engineering Council of South Africa, Prof. Hu Hanrahan

GN Metals, Mr Mgobani

Howden Holdings, Johan Pretorius

IDC, Bouer van Niekerk

Imcosa, Nicola Raubenheimer

Institute for the National Development of Learnerships Employment Skills and Labour Assessments, Danie Behrens

Manpower, Wesna Toprek

merSETA, Helen Brown

merSETA, Prof. Sakoojee

National Foundry Technology Network, Adri el Mohamadi

National Tooling Initiative, Grant Stevenson

Ramsey Engineering, Sid Moodly

Southern Africa Stainless Steel Development Association (former Skills Development Manager), Chanel Grovet

Steel and Engineering Industries Federation of South Africa, Janet Lopes

Steel and Engineering Industries Federation of South Africa, Mr Njabulo

Southern Africa Stainless Steel Development Association, Leisley Motma

Steelendale Mesh Group, Johan du Plessis

Volkswagen, Derrick Williams

Volkswagen, Dr Lesley Lee

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