FACTS AND FIGURES ON SKILLS IN MANUFACTURING 2019



Department: Trade and Industry REPUBLIC OF SOUTH AFRICA towards full-scale industrialisation and inclusive growth



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Introduction

Government has acknowledged that the manufacturing sector is indispensable if South Africa is to achieve its economic growth targets (**the dti**, Newsflash, 20 June 2018). After growing by 3,1% in the fourth quarter of 2017, the South African economy wobbled in the first quarter of 2018, shrinking by 2,2% quarter-on-quarter (seasonally adjusted and annualised) (Statistics SA, GDP 2018). Agriculture, mining and manufacturing were the main contributors to the slowdown.

Global challenges such as trade wars and increased protectionism necessitate that South Africa and its neighbours trade among themselves (**the dti**, Newsflash, 20 June 2018). According to Statistics SA, the unemployment rate among young South African people aged 15 to 34 was 38,2%, implying that more than one in every three young people in the labour force did not have a job in the first quarter of 2018. Youth unemployment, however, is not unique to South Africa; it is a global phenomenon. According to the International Labour Organisation (ILO), there were about 71-million unemployed youth aged 15 to 24 years globally in 2017, with many of them facing long-term unemployment.

Artisan training and development has been identified as a critical area to address the challenges of economic growth and redress, and provide an avenue to tackle the growing challenge of youth unemployment in South Africa (NSDS III).

This information brief provides an overview of employment trends for artisans, technicians and engineers in the manufacturing sector in South Africa from 2002 to 2017. It examines

the employment and value-added trends and provides detailed technical occupational trends as well as an overview of the skills levels and technical occupations by qualifications and sub-sectors. Finally, it analyses the relationship between enrolments and graduations of engineering students at universities of technology, and enrolments and competent artisans from the Department of Higher Education and Training.

There is much data and information available on manufacturing value-added and employment growth. This document does not try to replicate the good work carried out by researchers, instead it attempts to pool together a few pieces of data and statistics with the intention to inform the private sector and assist policymakers in their attempts to plan for future skills and economic growth.

Highlights

- South Africa was 61 out of 137 countries in the World Economic Forum's (WEF) 2017/18 ranking of the best place to do business.
- Corruption is the most problematic factor of doing business in South Africa (WEF).
- Manufacturing's share of total employment in the country is 11%.
- Domestic demand remains weak, with sales volumes stuck in negative terrain since 2015.
- The share of South Africa's manufacturing is about 13% of gross domestic product (GDP).
- The majority of artisans do not have the required qualifications.

- The basic metals sector is the largest employer of artisans in the manufacturing sector.
- The majority of the technical workforce in the manufacturing sector is artisans.
- Only 24,4% of South African women are in craft and trade positions in the manufacturing sector.
- Women remain a minority in the science, technology, engineering, and mathematics (STEM) fields.
- Women are less likely to enter and more likely to leave STEM careers.
- Only 11% of all engineers globally are female.
- Only 8% of all students in engineering, manufacturing and construction globally are women.
- South Africa has one engineer per 3 166 people, compared to 1:227 in Brazil and 1:543 in Malaysia (ECSA).
- The key challenge to industrial policy is to incentivise investment in plant, technologies and skills.

Manufacturing employment, value-added and gross domestic product

This section considers growth trends in the manufacturing sector, its share of GDP and impact on the trends in employment between 2002 and 2017. The manufacturing sector provides a locus for stimulating the growth of other activities, such as services, and achieving specific outcomes, such as employment creation and economic empowerment (Brand South Africa, June 2017).



Figure 1: Manufacturing share of total employment, 2008-2017

Source: Statistics South Africa, QLFS and own calculations, 2017

Manufacturing accounts for about 11% of the total South African workforce, down from 14% in 2008, as shown in Figure 1. Manufacturing employment share has been stable at about 11% for the past eight years, though the total employment in the economy has been increasing since 2011.

The rise of digital and changes in manufacturing technologies has led to the decline of employment in the sector. There was, however, improvement and strong linkages to the service sectors that sustain jobs in the economy (**the dti**, 2017). Employment prospects in manufacturing remain weak, with only the two subsectors of wood and textiles reporting positive employment growth (BER Survey, 2017Q4).

Consistent improvement in manufacturing capacity and quality requires a "constant watch" of supply side issues such as labour, skills and material costs (Dylan Slater, March 2018). This is due to innovation and technology, which is always improving. Job creation and economic motivation remains government's first target in attracting domestic and foreign investment to the economy. Government needs to make an effort if it is to achieve the economic projections outlined in the National Development Plan (NDP).



Figure 2: Manufacturing value-added and GDP growth rates at constant 2010 prices, 2002-2017

Source: Statistics South Africa, GDP, 2017

South Africa's manufacturing sector is stuck in a rut, with negative growth in 2017, as indicated in Figure 2. According to the BER 2017Q4 survey, domestic demand remains weak, with sales volumes stuck in negative terrain since 2015. Weak consumer demand, persistently falling business investment, policy uncertainty and the prolonged drought weighed heavily on activity (OECD, 2017). This is a worry for South Africans since stagnating local production and sales volumes will have a negative impact on employment and economic growth.

The decrease in production volumes might have been caused by an increase in total cost of production per unit. The acceleration was likely driven by higher purchasing prices of raw materials, which rose to their highest levels since 2016Q2 (BER Survey, 2017Q4).

According to the South African Reserve Bank (SARB), South Africa continues to record steady declines in manufacturing value added, from about 24% of GDP in the 1980s to 13% in 2017. The declining share of manufacturing is not unusual and is a feature of other developing and developed economies, excluding the Asia and Pacific regions. The share of manufacturing in the United States (US), for example, has been declining for more than two decades (Martin NB and Barry PB, 2014).

Competitive rankings: Education and related indicators

The WEF,s Global Competitiveness Report provides an overview of the competitiveness of 138 economies in 2016/17 and 137 in 2017/18, and is considered the most comprehensive assessment of its kind globally. It contains a detailed profile for each of the economies

included in the study, as well as an extensive section of data tables with global rankings covering more than 100 indicators.

Edition	2011 – 12	2012 - 13	2013 - 14	2014 - 15	2015 - 16	2016 – 17	2017 – 18
Rank	50/142	52/144	53/148	56/144	49/140	47/138	61/137
Score (1 - 7)	4,3	4,4	4,4	4,4	4,4	4,5	4,3

Table 1: Global Competitiveness Index (score and ranking for South Africa), 2011–2018

Source: World Economic Forum, Global Competitiveness Report 2017/18

South Africa was ranked 61 out of 137 countries in the WEF 2017/18 Global Competitiveness report, down from 47 out of 138 countries in 2016/17, as shown in Table 1. According to the Global Competitiveness data, South Africa is ranked 100 (less than 50% on average) out of 137 countries when looking at the availability of scientists and engineers in the country, an improvement on its ranking of 112 in 2016. This means that South Africa does not have enough scientists and engineers, which could impact negatively on the country's levels of innovation and competitiveness.

South Africa's education system is poor; at least 60% of youth drop out of school before the matriculation stage (Thomas Neymar, September 2017). Competitiveness remains an important contributor to the broader goal of human-centric economic progress by creating the resources needed for increased well-being, including better education, health, security and higher per capita income.





Source: World Economic Forum, Executive Opinion Survey 2017

Business confidence remained low despite an improvement in underlying business conditions, falling from 27 points in 2017Q3 to 24 points in 2017Q4 (BER Survey, 2017Q4). Political climate, insufficient demand and skilled labour rated as the biggest constraints.

According to the WEF, the most problematic factor of doing business in South Africa is corruption, followed by crime and theft, and government instability, as listed in Figure 3. The high levels of crime in South Africa are deterring potential investors and contributing to poor economic growth (Thomas Neymar, September 2017). Corruption is the enemy of

good governance and destroys public trust in institutions (**the dti**, Newsflash, 28 September 2018); it discourages people from setting up businesses and applying for certain tenders or jobs, particularly in government, as those who have connections get business in corrupt ways. Monitoring, understanding and adapting to the political situation is critical for every business since it can affect decision-making processes and strategic financial decisions, supply chain, sales, distribution and reputation in the global market.

Skills levels and employment by manufacturing subsectors and qualifications

This section provides an analysis of skills levels in manufacturing, employment by subsectors and the percentage shares of employed artisans, technicians and engineers by education. As indicated in Figure 3, South Africa has an inadequately educated workforce and this was identified as one of the most problematic factors of doing business in the country. This section provides the overview of the qualifications of the technical workforce in manufacturing.



Figure 4: Share of employed persons by occupation in manufacturing, 2002-2017

Source: Statistics South Africa, QLFS and own calculations, 2017

The share of low skilled employment was stable over the period, while that of semi-skilled employment declined by 2,5 percentage points to 61,9% in 2017, and skilled employment increased by 3,1% in 2017, as shown in Figure 4. The manufacturing sector faces a low-growth environment, characterised by a poor skills profile and weak competition for goods and services (StatsSA, 2015). The majority of manufacturing employment is semi-skilled (61,9%), followed by skilled (21,8%) and low-skilled occupations (16,4%).

The change in the skills level employment might be due to new technology in the industry, including robots and automation. Manufacturers rely on skilled people to operate advanced technology, which is a basic requirement of the sector. With increasing reliance on

technology, businesses collect, store and analyse massive amounts of data on a daily basis. These advances in computing and automation have resulted in high demand for analytics professionals (Staff Writer, 20 June 2018). Automation provides the opportunity for humans to focus on higher-skilled, higher-quality and higher-paid tasks.

A key constraint to economic growth is the mismatch between the demand and supply of skills. The extent to which workers are qualified in line with the requirements of the job is a key indicator of the skills mismatch. Historically, most artisans had less than Grade 12 (at least Grade 9) and a post-school qualification, NTC 1-3, attained at a TVET college. However, the oversupply of Grade 12s means that recently trained artisans have a minimum of Grade 12 plus a TVET engineering qualification.



Figure 5: Share of employed artisans and technicians by education, 2017

Source: Statistics South Africa, QLFS and own calculations, 2017

Note to Fugure 5: StatsSA does not include the trade test qualification in its survey, which is the only way to determine if an artisan is qualified or not. 'Tertiary' includes post-matric certificate and diploma, post-higher diploma, bachelor's degree, post-graduate diploma, honours degree and higher degree.

The majority of artisans are unqualified, with 43,0% having less than Grade 12 (with no additional qualification) and 34,1% Grade 12. It is painfully evident from these figures that South Africa has a severe shortage of artisans with tertiary qualifications (7,4%), as shown in Figure 5. While those who are unqualified probably have significant experience, it is clear that not enough effort is being made to provide a form of certification through Recognition of Prior Learning (RPL).

The share of employed persons with tertiary qualifications (graduates and other tertiary) was higher among technicians than artisans. In terms of employed technicians, there is a dissonance between the baseline qualification required (National Diploma from a University of Technology) and the actual qualifications attained. This is worrying. Only 42,4% of technicians in the manufacturing sector had tertiary qualifications, implying that the majority did not have the right qualifications. The findings suggest that 57,6% of employed technicians have either a Grade 12 (39,7%) or less (16,7%).

South Africa has set itself the goals of eradicating poverty, reducing inequality, growing the economy by an average of 5,4% and cutting the unemployment rate to 6% by 2030. Education, training and innovation are critical to the attainment of these goals (NDP: 296-7).

Currently about 38% of South Africa's youth are unemployed and this is further increasing societal issues of poverty, inequality and crime.

South Africa's large, well-developed metals industry, with vast natural resources and a supportive infrastructure, represents roughly a third of all South Africa's manufacturing. In 2001, South Africa was ranked the world's 19th-largest steel-producing country, and is the largest steel producer in Africa (almost 60% of Africa's total production) (Brand South Africa, June 2017).

Manufacturing covers a broad range of sub-sectors, each with its own set of unique challenges and opportunities.



Figure 6: Percentage share of technician employment by manufacturing sub-sector, 2017

The food, beverages and tobacco sector remains the largest employer of technicians in the manufacturing industry, followed by petroleum and basic metals, as indicated in Figure 6.



Figure 7: Percentage share of artisan employment by manufacturing sub-sector, 2017

Source: Statistics South Africa, QLFS and own calculations, 2017

The basic metals sector is the largest employer of artisans in the manufacturing industry, followed by textile and clothing, and the food, beverages and tobacco sector, as shown in Figure 7.

Demographic profile of artisan, technician and engineer employment in manufacturing

The overwhelming majority of the technical workforce in the manufacturing sector is represented by artisans (74%) and technicians (23%), while engineers and technologists constitute only 3,0%, as shown in Figure 8. The percentage share of highly skilled individuals is the smallest of the technical workforce in the sector. According to the Manufacturing, Engineering and Related Services Sector Education and Training Authority (MerSETA), the shortage of highly skilled individuals has contributed to the slow adoption of technology, lower productivity and low competitiveness in South Africa.



Figure 8: Percentage share of technical workforce in manufacturing, 2017

Source: Statistics South Africa, QLFS and own calculations, 2017

Over the period 2002 to 2017, total manufacturing employment grew by about 0,4%, as compared to the annual growth of employment in the economy, which was 2,4%. The compounded annual growth rate (CAGR) varied widely in technical occupations in manufacturing, ranging from -7,1% for engineers and technologists to -0,8% for technicians and -0,8% for artisans (2002 to 2017) (Annexure 1). Employment of technical workforce in manufacturing is therefore shrinking



Figure 9: Employment share of artisans and technicians by gender (%), 2002 and 2017

Source: Statistics South Africa, QLFS and own calculations, 2017

In South Africa, women represent about 52% of the population, but only 24,4% are in craft and trade positions in the manufacturing sector, a decrease of 11% from 35,4% in 2002.

The proportion of women employed as technicians increased from 34,0% in 2002 to 37,4% in 2017, a significant step towards closing the gender gap. TVET colleges are reporting an increase in female students in fitting and turning as well as electrical and motor trades. More women are graduating (20% in 2017) in engineering than men (18% in 2017) in universities of technology (DHET, 2017). In 2017, women were far less likely than men to be working as artisans and technicians. A higher proportion of women (37,4%) are more likely to be technicians than artisans (24,4%), as shown in Figure 9.

As many girls as boys are completing high-school-level education, and more women graduate from university worldwide than men, but women remain a minority in the science, technology, engineering and mathematics (STEM) fields (Ana Maria Munoz-Boudet, March 2017). These include engineers, scientists, technicians and artisans.

Surveys in 2017 indicate that only 11% of engineers globally are female (Moosajee N, October 2017). Worryingly, things are not getting better: The proportion of South African women employed as engineers actually fell between 2002 and 2017 (StatsSA, 2017). Women are less likely to enter and more likely to leave STEM careers (Catalyst, Quick Take, 3 January 2018).

Figure 10: Percentage share (%) of artisans and technicians by population group, 2002 and 2017



Source: Statistics South Africa, QLFS and own calculations, 2017

Figure 10 shows employment of artisans and technicians by population group. Black artisans outnumbered those from other racial categories, with about 69% working as artisans in 2002 and 77% in 2017. In 2002, about 47% of employed technicians were white, dropping to 18% in 2017. The number of black technicians increased the most, growing from 31% in 2002 to 59% in 2017. The percentage share of white artisans declined from 15% in 2002 to 10% in 2017.

The share of black artisans (albeit male) is reflective of the economically active population, contradicting the public perception that the average artisan is white and male (usually more than 50 years of age). The data shows that there has been a substantive turnaround in the demographic profile of the employed artisan population, which closely mirrors the economically active population. The proportion of black workers in the labour force has also increased since 2002 (StatsSA, 2017).

Registration of professional engineering technicians with ECSA

According to the Engineering Council of South Africa (ECSA), persons applying for registration as professionals must have demonstrated their competence, as measured against standards determined by the ECSA for the relevant category of registration, and have passed any additional examinations determined by the council.



Figure 11: Registrations (% growth) of professional engineering technicians with ECSA, 2010–2017

Source: ECSA and own calculations, 2018

In the 2016/17 financial year, there were 49 304 registered persons. At the end of the 2017/18 financial year, the numbers were at 52 557, which shows an upward trajectory of 6,6% in the database of registered engineering practitioners. The percentage share of professional engineering technicians was 19,6%, as compared to the share of professional engineers, which was 59,2% for 2017/18. According to ECSA, the positive trajectory is a result of the increased database of trained and appointed volunteers assisting ECSA with the peer-review exercise, which in turn contributes to reduced turnaround times in the processing of registrations.

Figure 11 provides an analysis of the annual growth trends of registered technician professionals. Black Africans represent the overwhelming share registered in 2017/18, with a growth of 7,8% from 2016/17. In 2010, whites represented the overwhelming share of professional engineering technicians, but constituted 39,1% (more than two population groups) of registrations in 2017/18. White registrations showed the slowest growth in 2017/18.





Figure 12 shows the trend in the growth rates of registered engineers by population group in South Africa. Whites have the lowest growth rates as compared to other population groups.

Source: ECSA and own calculations, 2018

Black Africans grew at higher rates than other groups, followed by Indians. Data provided by ECSA shows that South Africa lags behind other developing countries on the international benchmark of average population per engineer. One engineer in South Africa services an estimated 3 166 people, compared to Brazil's 227 and Malaysia's 543 people per engineer (ECSA, 2018). It is evident from these figures that South Africa has a severe shortage of engineering practitioners. Research shows that shortage of skills is a key obstacle to economic growth, job creation and business expansion.

Industrial Policy Action Plan (IPAP) sectoral focus areas

Industrial policy has traditionally placed a strong emphasis on the manufacturing sector, precisely because industrial investment in targeted technologies and sectors spills over to the rest of the economy, and in terms of production disciplines, the mastery of new technologies and ultimately design capabilities (IPAP, 2018). The IPAP, which has been developed and published by **the dti** every year since 2007, analyses the South African economy and identifies key constraints on industrial policy as well as sectoral focus areas in order to increase the economy's ability to produce more value using less resources.

In addition, core to South Africa's industrial policy is the objective of transforming the racially skewed ownership, management and employment profile of the economy (IPAP, 2018).

Over the 10-year IPAP period, imports have doubled, while manufactured exports have grown four-fold, mainly dominated by metals, metal products, machinery and equipment,

including capital equipment and mining machinery (**the dti**, Newsflash, 20 June 2018). Figure 13 shows the IPAP sectoral focus areas for the period 2018/19 to 2020/21.



Figure 13: IPAP sectors

Source: the dti, IPAP 2018/19 - 2020/21

The IPAP Sectoral focus areas 2 include green industries, mineral beneficiation, business process services, aerospace and defence, electro-technical and white goods industries, and marine manufacturing and associated services.

The key challenge to industrial policy is to incentivise investment in plant, technologies and skills that would have medium- to long-term benefits for the economy (IPAP, 2018). Investment in the sectoral focus areas will increase production, employment and infrastructure development in the economy. New technologies and skills will also have a positive impact on South Africa's competitiveness improvement as compared to other economies. Government must work closely with the private sector to secure and support investments in a modernised and competitive manufacturing sector, if it is to grow the economy (**the dti**, Newsflash, 20 June 2018).

Competitiveness remains an important contributor to the broader goal of economic progress by creating the resources needed for increased well-being, including better health and higher per capita income.

Supply of artisans, technicians and engineers

The supply of artisans and technicians in this paper will be analysed using the following data sources:

- Artisan trade test results number of people enrolled and those who passed the artisan trade test as released by Indlela, based on SETA data; and
- Higher Education Management Information System (HEMIS) data this dataset has the number of engineering (including technician) enrolments and graduations from universities of technology.

SETAs have been established to manage the skills development needs in South Africa. Each SETA coordinates skills development in its particular sector. For the purposes of planning and managing the delivery of training, the economy has been divided into 23 sectors, each of which has its own SETA.

	Actual	enrolled le	arners	Actual certificated learners			
Manufacturing SETAs	2016/17	2017/18	Y/Y growth rate	2016/17	2017/18	Y/Y growth rate	
CHIETA	4 263	3 172	-26%	936	957	2%	
FOODBEV	178	167	-6%	13	63	385%	
FP&M	419	290	-31%	124	114	-8%	
MERSETA	8 038	6 755	-16%	9 661	7 938	-18%	
Total Manufacturing	12 898	10 384	-19%	10734	9072	-15%	

Source: DHET, 2018

The NDP aims to ensure that all South Africans attain a decent standard of living by 2030, and states that the country should produce more than 30 000 qualified artisans a year in order to meet labour demand. Table 2 shows that 9 072 manufacturing artisans were certificated in 2017/18, a decrease from 10 734 in 2016/17. Job creation begins with a

skilled workforce, and South Africa needs to increase its effort to achieve the increase in industrialisation projects and employment projections outlined in the NDP.

Enrolment and graduation of engineers, technologists and technicians

The ratio of enrolment to graduation of engineering students provides insight into the profession's skills pipeline. There are three types of universities in South Africa: traditional, comprehensive and technological. The country's 26 public higher education institutions offer a range of study and research options for local and international students.

The data from the Department of Higher Education and Training (DHET) shows that the overwhelming majority of students are at universities of technology (43,1%), followed by traditional (30,3%) and comprehensive universities (26,6%), as shown in Figure 14.

Figure 14: Engineering students (enrolments) by types of universities in South Africa, 2017



Source: DHET, 2018

Figure 15 shows the trends in the enrolments and graduations of engineers who studied at the universities of technology. Engineering technicians generally hold a National Diploma (NDip) from a university of technology. The number of enrolments improved incrementally over the period, after a dip from 2005 to 2007. The same trend was observed in the number of graduates. There is a big gap between the numbers of enrolments and graduates, a situation that has persisted over the past 16 years. South Africa produces and retains too few engineers, with many graduates choosing to work abroad (Staff Writer, 20 June 2018).

The development of trades and engineers (skills required by the economy) should be a priority.



Figure 15: Trends in universities of technology engineering enrolments and graduates (2002-2017)

Source: DHET, 2018

Data from the DHET shows that engineering is one of the areas with the greatest gender imbalance in universities, with only 27% of students being women in 2017. According to the United Nations Educational, Scientific and Cultural Organisation (Unesco) Institute of Statistics, only 8% of all students in engineering, manufacturing and construction globally are women.

Table 3: Gender distribution of engineering enrolments and graduates at all universities (2017)

Gender	Enrolments	Graduates	% share of graduates
Male	63 585 (73%)	10 561 (70%)	17%
Female	23 721 (27%)	4 482 (30%)	19%
Total	87 305 (100%)	15 043 (100%)	17%

Source: DHET, 2018

The proportion of women receiving engineering degrees in South Africa actually fell between 2002 and 2017 and, according to the World Bank research (Ana Maria Munoz-Boudet, March 2017), the picture is similar around the world. The data, however, shows that in 2017 the percentage of women engineering students who graduated from universities (19%) was higher than that of men (17%), as shown in Table 3.

According to Unesco, limited female role models, misconceptions about engineering studies and careers, and gender bias are some of the factors that are keeping girls and women out of engineering studies and careers (Moosajee N, October 2017).

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Annexures

Annexure 1: Comparison of employment trends in artisans, technicians and manufacturing in South Africa (2002-2017)

	Artisans and	Total manufacturing				
Year	Technicians '000	Y/Y % change	Artisans '000	Y/Y % change	employment '000	
2002	153		481		1647	
2003	141	-7.90%	453	-5.80%	1560	
2004	120	-14.60%	464	2.40%	1724	
2005	110	-8.10%	545	17.50%	1742	
2006	120	8.40%	547	0.40%	1757	
2007	109	-9.10%	525	-4.00%	1776	
2008	158	45.10%	546	4.00%	1917	
2009	168	6.50%	458	-16.10%	1771	
2010	163	-2.90%	445	-2.80%	1713	
2011	135	-17.60%	471	5.80%	1737	
2012	143	5.90%	430	-8.70%	1727	
2013	166	16.30%	404	-6.10%	1667	
2014	145	-12.50%	441	9.20%	1741	
2015	137	-5.40%	475	7.70%	1774	
2016	110	-19.70%	455	-4.20%	1683	
2017	136	23.64%	427	-6.15%	1749	
CAGR	-0.8%		-0.8%		0.4%	

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