



FACTS AND FIGURES ON SKILLS IN MANUFACTURING

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towards full-scale **industrialisation** and inclusive **growth**

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Introduction

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 address the growing youth unemployment challenge in South Africa (NSDS III).

The focus of this information brief is to provide an overview of employment trends for artisans and technicians in manufacturing in South Africa for 2002-2015. Employment trends among the technical workforce are analysed by sub-sector and demographic indicators, including highest education completed, population group, age group and gender. This brief summarises longer, technical reports on artisans and technicians in manufacturing.¹ The data source is the September Labour Force Survey (LFS) 2002-2015 of Statistics South Africa.

Manufacturing is a key determinant of future growth and competitiveness in the provision of a skilled technical workforce. Manufacturing has been growing very slowly, although there has been some green shoots, illustrated by the increased growth in the last quarter of 2015 (1,9% quarter-on-quarter). While the economy has still not turned the corner following the global recession of 2009, to date it has managed to avoid a recession. The contribution of manufacturing to this state of affairs is very important.

Technicians and artisans constitute the core of the technical workforce, ensuring innovation

¹ Longer technical reports on artisans and technicians may be made available on request from skillsfortheeconomy@thedti.gov.za

and efficiency of the production process through the optimal use, design and maintenance of materials, equipment, capital and personnel.

Intermediate-level artisans remain crucial to the future because multi-technical systems need maintenance, servicing and repairs (Prof. Hoosen Rasool, 2016).

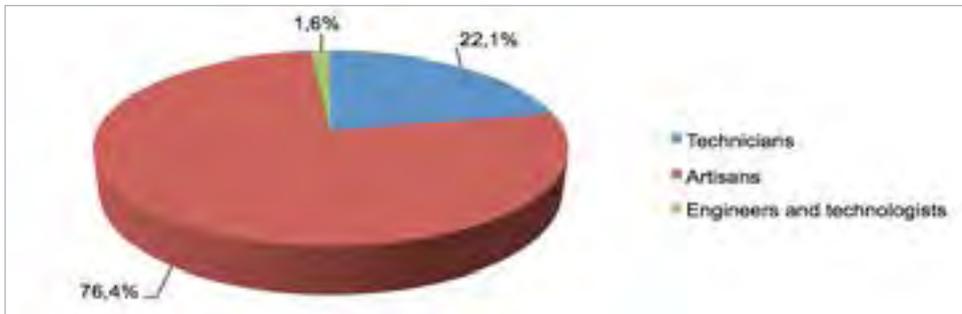
Highlights

- Artisans represent the largest proportion (76%) of the technical occupations, shrinking at 0,1% per annum.
- Engineers and technologists represent the smallest proportion (2%), shrinking at 3,8% per annum.
- Technicians represent 22%, shrinking at 0,8% per annum.
- Most artisans are in the basic metals sector. The food, beverages and tobacco sub-sector is the top employer of technicians. The textile, food, and wood and cork sub-sectors are the second, third and fourth top employers of artisans respectively.
- The share of white technicians declined from 47% to 29%, while black Africans now constitute 44% of all technicians.
- Women constitute just above one-third of employed technicians, but only 24% of artisans, declining from 35% in 2002.
- In 2015, only 16% of engineering students at universities of technology graduated.
- Most artisans are unqualified (57,7%), with nearly one-third having Grade 12.
- Most technicians (57%) are under-qualified, with either Grade 12 (41%) or less than Grade 12 (16%).
- Black engineers and technicians have the lowest share of registration with professional bodies.

Employment of Artisans and Technicians in Manufacturing

Figure 1 shows that artisans represent the overwhelming majority (76%) of the technical workforce, followed by technicians (22%), while engineers and technologists constitute only 2%.

Figure 1: Distribution of engineering professionals and artisans in manufacturing (2015)



Source: Statistics SA, QLFS, 2015 and own calculations

Over the period, total manufacturing employment grew by about 0,6%, just below a quarter of the annual growth of employment in the economy, which was 2,6%. By comparison, the compounded annual growth rate (CAGR) varied widely in technical occupations in manufacturing, ranging from -3,8% for engineers and technologists to -0,1% for artisans and -0,8% for technicians (2002-2015). The employment of technical workforce in manufacturing is therefore shrinking. The demand for artisans, technicians, engineers and technologists is growing below the rate of growth for manufacturing, which is already low (Annexure 2).

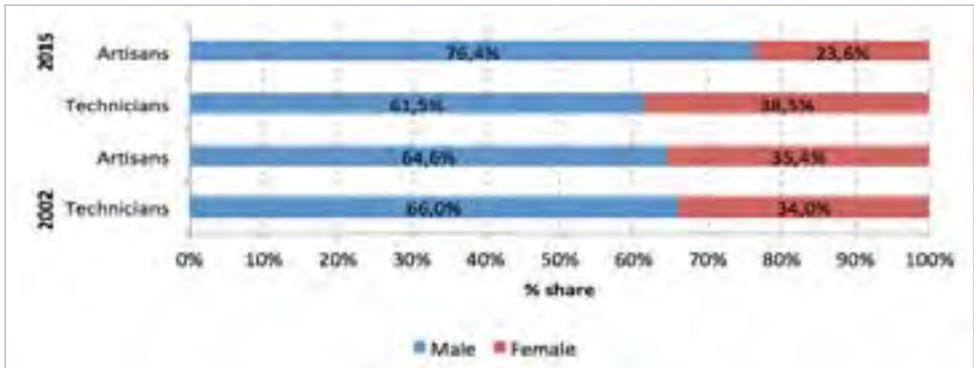
Demographic Profile of Artisans and Technicians

The artisan system continues to bear the historical scars of race and gender discrimination. Employment of artisans and technicians continues to be male-dominated. In fact, the results suggest there has been a significant reversal of gains in the employment of women artisans, with Figure 2 showing a decline of 11,8%, from 35,4% to 23,6%. The results indicate that there has been a secular decline of women artisans. The number of women technicians increased slightly, from 34,0% in 2002 to 38,5% in 2015 (an increase of 4,5% in the share of female technicians). It is clear that there are systemic constraints in the employment of women artisans and technicians. The reasons for the continued marginalisation of women, despite improvements in the enrolment and graduation of women engineers for instance, are not clear. Further, changes to the nature of work, through the use of information and communications technology (ICT), implies that artisan work is no longer that of so-called “grease monkeys” or strictly manual² (HSRC/merSETA, 2013). Legislation has been passed to push for greater employment of women in the workplace, however, the majority of women in South Africa are still not gaining in terms of job placements in the economy. According to the CEO of ATI, it appears that South Africa is lagging when compared to its peers (Fin24, March 2016).

Specialists believe this has to do with wrong perceptions, typically people believe engineering is about building bridges and making better engines for cars (Skillsportal, April 2016).

2 Wildschut et al (2013), Studying artisans in the manufacturing, engineering and related services sector. Client report prepared for the merSETA/HSRC Artisan Identity and Status project: The unfolding South African story. HSRC: Pretoria.

Figure 2: Employment of artisans and technicians by gender (%) 2002 and 2015



Source: Statistics SA, LFS, 2002 to 2015 and own calculations

Figure 3 shows that the decline of white artisans and technicians and the increase of African artisans and technicians have continued apace. Du Toit and Roodt (2008) show that the employment of black African technicians increased from 28,6% (1996-1999) to 41,4% (2000-2005)³, a trend that continued.

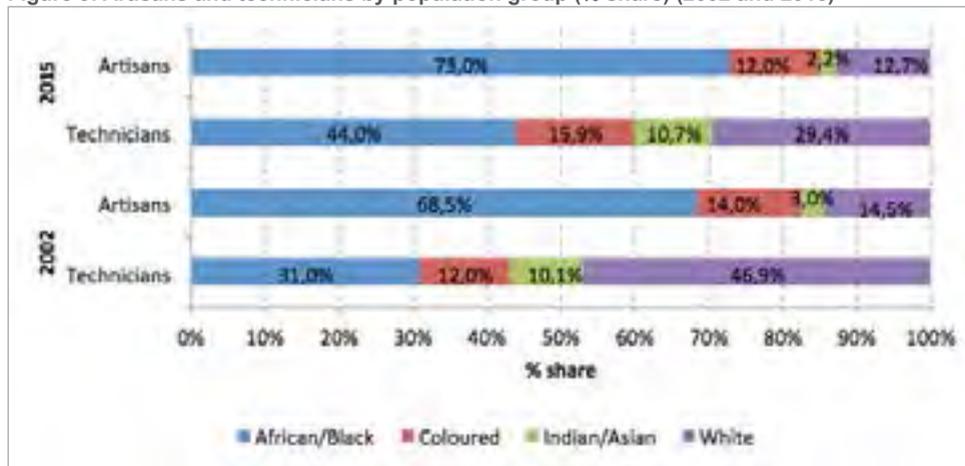
Figure 3 shows that in 2002 about 46,9% of employed technicians were white, dropping to 31,8% in 2008 and 29,4% in 2015. Employment of coloured technicians increased from 12,0% in 2002 to 15,9% in 2015. Black African artisans outnumbered those from other racial categories, as depicted in Figure 3, with their employment increasing from 68,5% to 73,0% over the same period.

³ Renette du Toit and Joan Roodt (2008), Engineering Professionals: Crucial key to development and growth in South Africa, HSRC).



The share of white artisans declined from 14,5% in 2002 to 12,7% in 2015. Over this period there was a secular increase in the share of African artisans. In fact, the share of African artisans (albeit male) is reflective of the share of Africans in the economically active population. This picture contradicts the public perception that the average artisan is white and male (usually more than 50 years of age). The results show that there has been a substantive turnaround in the demographic profile of the employed artisan population, which more closely mirrors the economically active population.

Figure 3: Artisans and technicians by population group (% share) (2002 and 2015)

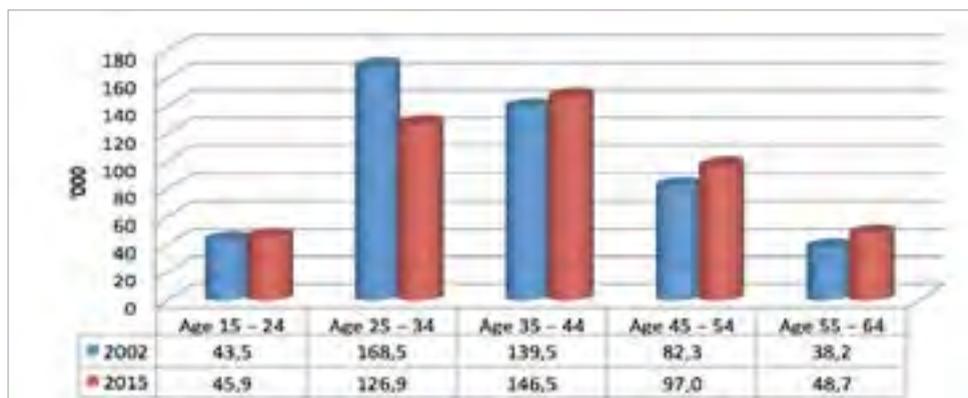


Source: Statistics SA, LFS, 2002 to 2015 and own calculations

The age profile presented in Figure 4 suggests that there is a balanced mix of youth and experienced artisans, with 37% in the age group 15 to 34 years, 32% between the ages of 35 and 44, and 31% who are 45 to 64 years of age. However, the decline in the number of artisans from 168 000 to 127 000 (-2,1% per annum) in their prime productive years (25 to 34 years) is worrying. The number of employed artisans in the age groups 45 to 54 and 55 to 64 increased by 1,3% and 1,9% per annum respectively over the period.

Availability of experience may be suggested by the relatively high share of artisans older than 35 years. Further, the relative growth in the number of artisans older than 45 years bodes well for the sector, as more experienced artisans remain in the system. This may positively affect the transfer of skills from older to younger artisans and the availability of experienced mentors in manufacturing. The increase in the number of entry-level artisans aged 15 to 24 suggests an increase in the skills pipeline. This may suggest that efforts to increase the number of apprentices through the Human Resource Development (HRD) Council and those of the Skills Education Training Authorities (SETAs) are translating into improved employment of young artisans.

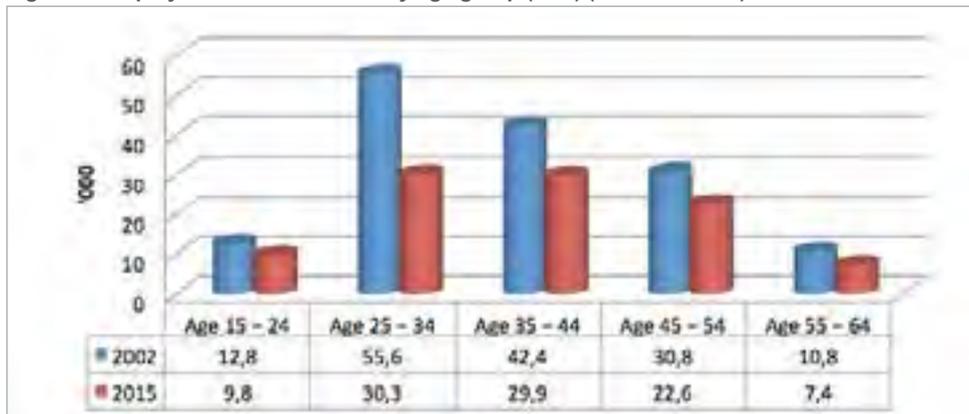
Figure 4: Employment of artisans by age group ('000) (2002 and 2015)



Source: Statistics SA, LFS, 2002 to 2015

There appears to be a more balanced mix of youth and experience among technicians compared to artisans, with 40,1% in the age group 15 to 34 years, 29,9% 35 to 44, and 30,1% 45 to 64. However, the decline in the number of technicians in all age groups is worrying, as shown in Figure 5. The decline in the number of entry-level technicians aged 15 to 24 suggests a slowdown of entry into the skills pipeline. The number of employed technicians in the age group 55 to 64 decreased by -2,9% per annum over the period, as artisans of pensionable age exit the system. Alternatively, they may also enter into business ventures, as research shows that owners of manufacturing enterprises generally have a technical qualification. Availability of experienced technicians older than 35 years may positively affect the transfer of skills from older to younger technicians.

Figure 5: Employment of technicians by age group ('000) (2002 and 2015)



Source: Statistics SA, LFS, 2002 to 2015

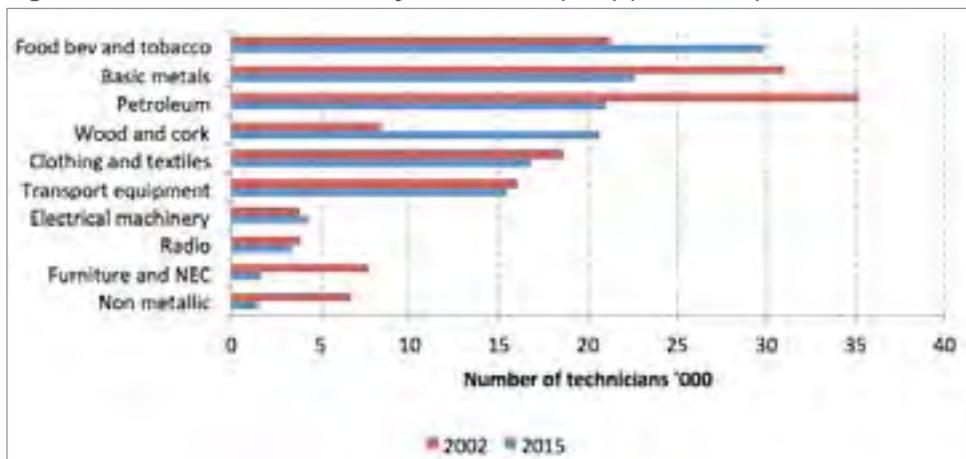
Employment of Artisans and Technicians by Sub-Sector

In 2002, most technicians were employed in the petroleum sector, albeit by a small margin (Figure 6). By 2015, however, there was a significant decrease in employment in the petroleum and basic metals sub-sectors, resulting in the food, beverages and tobacco sub-sector shifting to the top. The basic metals sub-sector has previously been a critical player and employer in the economy, but experienced a decline due to challenges faced in the iron and domestic steel industry that arose primarily from global economic factors such as the oversupply of steel. Local steelmakers are struggling to make ends meet in the current environment of reduced domestic demand, mainly because of a significant increase in

Chinese imports and poor international selling prices (*Financial Mail*, July 2015). There have been a number of interventions, including the imposition of trade tariffs to protect producers of steel as well as an agreement of a developmental price for steel. The latter may improve the relative competitiveness of downstream steel producers. The Department of Trade and Industry (**the dti**) approved a 10% hike in tariffs on 10 primary steel products in 2015, to preserve South Africa's steel-producing capacity against cheap Chinese imports (*Financial Mail*, September 2016).

Employment trends over the period per sub-sector differed significantly. There was a 2,6% increase of technician employment in food and beverages per annum, and a significant decrease in the basic metals (-2,4%) sub-sector, a reflection of factors explored earlier on. The clothing, textiles and leather sub-sector remains a significant employer of technicians, although there was a slight decline over the period as indicated in Figure 6.

Figure 6: Number of technicians by sub-sectors ('000) (2002, 2015)



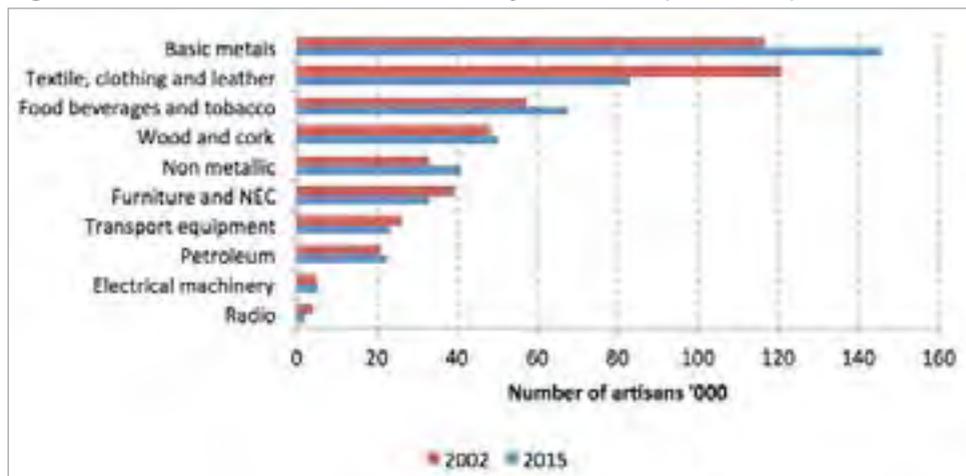
Source: Statistics SA, QLFS (2002-2015)

By 2015, most artisans were employed in the basic metals sub-sector, followed by the food, beverages and tobacco sub-sector, which experienced an increase of 19%, as shown in Figure 7.

Artisan employment increased in the wood, petroleum, and food and beverages sectors. This could be due to economic activity in the manufacturing industry, which reflected positive growth of 6,2% in the third quarter of 2015 because of higher production in the following divisions: petroleum, chemical products, rubber and plastic products; wood and wood products, paper, publishing and printing; and food and beverages (Statistics SA, September

2015, GDP). The ideal ratio for engineers, technologists and technicians has been debated for decades. The Engineering Council of South Africa (ECSA) and Engineering Association of South Africa (EASA) have proposed a ratio of one engineer to one technologist to four technicians to 16 artisans for the South African context (ECSA & EASA, 1995). This ratio might have been the cause for increased artisans and decreased technicians in the petroleum sector in the period 2002 and 2015.

Figure 7: Trends in the number of artisans by sector '000 (2002, 2015)



Source: Statistics SA, QLFS (2002-2015)

Employment of Technicians and Artisans by Education

One of the key constraints to economic growth is the mismatch between the demand and supply of skills. The extent to which workers are appropriately 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, given the oversupply of Grade 12s, recently trained artisans have a minimum of Grade 12, plus a TVET engineering qualification.

Figure 8 shows that the majority of artisans are unqualified, with most (57,7%) having less than Grade 12 (with no additional qualification), 30% having Grade 12 and only 4% the required qualification with less than Grade 12. Interestingly, 7,1% had a post-matric qualification. The latter may be the result of the more recent phenomenon of Grade 12 being the entry requirement. 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).

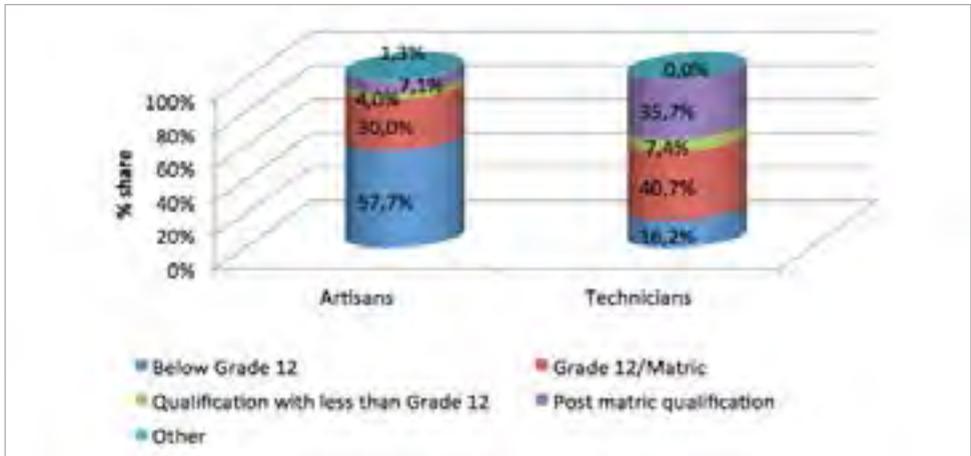
In terms of technicians, there is greater dissonance between the baseline qualification required (National Diploma from a University of Technology) and the actual qualifications attained among employed technicians. This is worrying. As a result, only 35,7% of technicians in the manufacturing sector had post-matric qualifications, implying that the majority was under-qualified. About 7,4% had a post-school qualification with less than Grade 12. The findings suggest that 56,9% of employed technicians have either a Grade 12 (40,7%) or less

(16,2%). These results echo similar findings for the period 1996 to 2005 (Du Toit and Roodt, 2008). The authors argued that the lack of experiential training in the workplace, as required by the National Diploma qualification, may be a contributory factor to the degree of under-qualification. According to the CEO of the Artisan Training Institute (ATI), artisan training has seen a sharp decline over the last 24 months as a result of contractions in the mining, engineering and agricultural sectors due to companies experiencing cash flow and budget constraints (Fin24, March 2016).

This apparent mismatch represents both a challenge and an opportunity in manufacturing. Firstly, technicians may underperform because they do not possess the requisite technical and theoretical knowledge. As assistants to professional engineers they perform an essential function in ensuring the efficiency of the production process. On the other hand, their practical knowledge may compensate (to some extent) for the lack of theoretical and technical knowledge, and needs to be met with efforts for certification through RPL and formal skills upgrading as well as increased work placements for diploma students.



Figure 8: Highest education completed among artisans and technicians (%) (Q3:2015)



Source: Statistics SA, QLFS (2015)

Registration of Professional Engineering Technicians with ECSA⁴

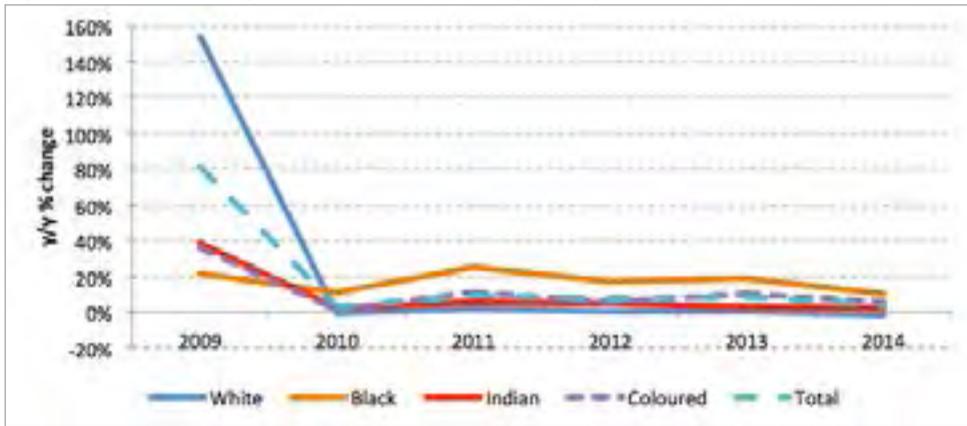
The database of registered engineering professionals increased from 26 566 on 31 March 2014 to 27 342 on 31 March 2015, which represents an increase of 2,9% over the reporting period. The continued growth trajectory in registration numbers can be a result of many factors, including awareness campaigns on the benefits of registration presented to industry and higher education institutions by ECSA (ECSA, 2015).

⁴ The Engineering Council of South Africa (ECSA) is a statutory body established in terms of the Engineering Profession Act, 2000 (Act No. 46 of 2000).

Figure 9 provides an analysis of registration annual growth trends for technician professionals. Whites represented the overwhelming share of all professional engineering technicians registered in 2009 and 2014, with 61,0% and 45,6% respectively, but growth in registration was the slowest compared to black African engineering technicians. Black African technicians constituted 44,6% of registration in 2014. Remarkably, the year-on-year increase in new registration in various categories from 2010 to 2014 is indicative of Government and industry becoming more committed to good quality service provision in the country (ECSA, 2015).

The dip in registration in 2010, particularly for whites, may be ascribed to the large number of cancellations due to non-payment of annual fees as well as the combined effects of the end of World Cup-related engineering projects and the global recession.

Figure 9: Trends in the registration of professional engineering technicians with ECSA (2009 to 2014)



Source: ECSA, 2015

Supply of Artisans and Technicians

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

- Artisans trade test results: The number of people enrolled and those who passed the artisan trade test as released by Indlela, based on SETA data; and
- HEMIS data: This dataset has the number of engineering (including technicians) enrolments and graduations from Universities of Technology. Engineering technicians generally hold a National Diploma (NDip) from a University 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.

Table 1: Number of registered and competent artisan trade test learners in 2014/15 & 2015/16

IPAP Clusters	2014/15		2015/16		Y/Y Growth Rates (%)	
	Registered	Competent	Registered	Competent	Registered	Competent
Plastics, Pharmaceuticals and chemicals	2164	547	3372	743	55.8%	35.8%
Clothing, Textiles, Footwear and Leather	958	30	459	101	-52.1%	236.7%
Green and Energy saving industries	507	360	1378	470	171.8%	30.6%
Agro Processing	70	0	45	0	-35.7%	-
Tourism, Arts & Culture, hospitality, Sports	840	86	514	0	-38.8%	-100.0%

Metal Fabrication, Capital and Transport equipment	7606	6869	8130	8352	6.9%	21.6%
Business processing services	761	348	1127	550	48.1%	58.0%
Non SETA Candidates (INDLELA)	7122	3177	5734	2952	-19.5%	-7.1%
Not in IPAP	8274	2972	7881	2946	-4.7%	-0.9%
Total	28302	14389	28640	16114	1.2%	12.0%

Source: DHET (SETAs), 2016.

Table 1 shows registered and competent artisan learners in Setas and Indlela by IPAP cluster from 2015 to 2016. According to the Department of Higher Education and Training (DHET), there were 28 640 students enrolled in 2015/16 in South Africa, an increase from 28 302 learners in 2014/15. Most of the students in 2015/16 were registered in the metal fabrication, capital and transport equipment cluster (8 130 students), followed by the plastics, pharmaceuticals and chemicals cluster, with 3 372. Indlela had 5 734 registered artisan

learners in 2015/16. The figure further indicates that agro-processing cluster recorded the fewest enrolments (45), followed by clothing, textile, footwear and leather sector with 459.

Table 1 illustrates that the Clothing, Textiles, Footwear and Leather was very successful in the number of competent learners, with growth rates of 237% (for those passing the test), followed by business processing services (58%) and plastics, pharmaceuticals and chemicals sector (36%). Agro Processing cluster fared the worst in registered learners, and so the sector will continue to have problems training artisans given these poor registration and pass trends. Metal, fabrication, capital and transport equipment cluster also performed well, with the number of registered learners growing by 7% while certificated learners grew by 22% over the period. Indlela artisan learners did not perform well, with the number of certificated learners declining by 7% over the period.

Table 2: Artisan enrolments and completion by manufacturing SETAs, 2015 to 2016

Manufacturing SETAs	Actual Enrolled Learners			Actual Certificated Learners		
	2014/15	2015/16	y/y growth rate	2014/15	2015/16	y/y growth rate
CHIETA	2164	3372	55.8%	547	743	36%
FOODBEV	70	45	-35.7%	0	0	-
FP&M SETA	958	459	-52.1%	30	101	237%
MERSETA	7606	8130	6.9%	6869	8352	22%
Total Manufacturing	10798	12006	11.2%	7446	9196	24%

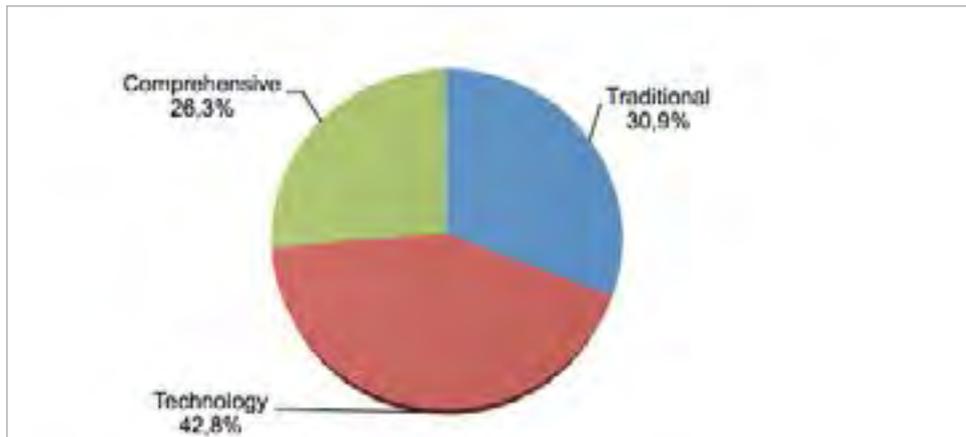
Table 2 shows the number of enrolled and certificated artisan learners by manufacturing SETAs (Chieta, Merseta, Food Bev and FP&M) for the financial years 2014/15 and 2015/16. The number of artisan enrolments in manufacturing SETAs stood at 12 006 in 2015/16, an increase of 11,2% from 10 798. The number of artisans who passed the trade test in manufacturing SETAs also increased by 24% over the period. The actual certificated artisan learners at merSETA increased by 22%, while Chieta rose 36% over the period. This is in support of the National Skills Accord, which highlights the need to increase the numbers of artisans (Economic Development Department, 2011).

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 25 public higher education institutions offer a range of study and research options for local and international students.

Figure 10 shows that the overwhelming majority of students are at universities of technology (42,8%), followed by traditional universities (30,9%) and comprehensive universities (26,3%).

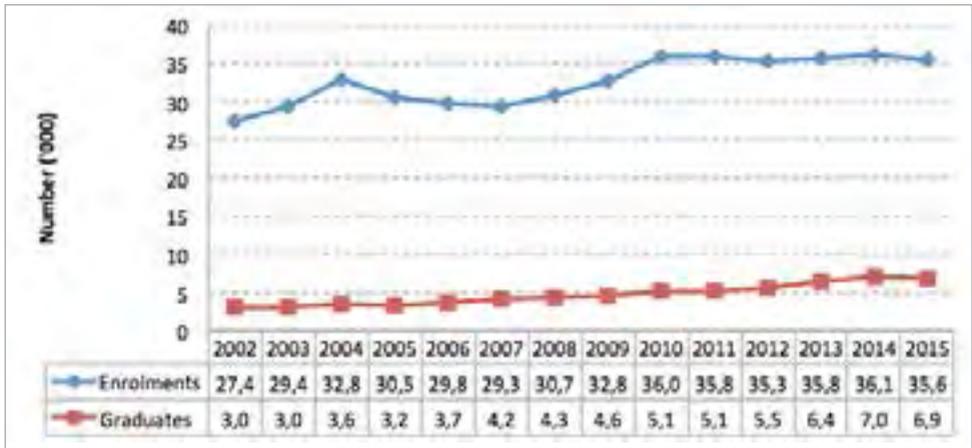
Figure 10: Types of universities in South Africa and their percentage share of engineering students (2015)



Source: DHET, HEMIS (2015)

The number of University of Technology enrolments improved incrementally over the period after a dip in the 2005 to 2007 period. Figure 11 shows that while there was steady growth in university enrolments in 2015, graduation rates remained fairly stable from a low base. There is a big gap between the number of enrolments and number of graduates.

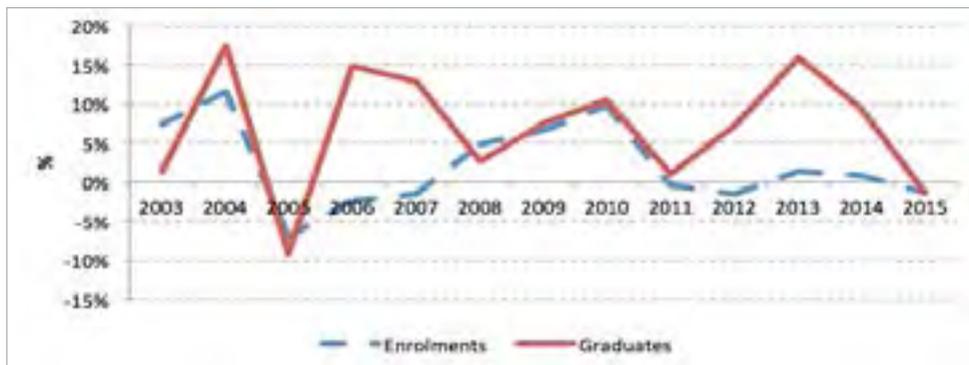
Figure 11: Trends in Universities of Technology engineering enrolments and graduates (2002 – 2015)



Source: DHET, HEMIS (2002 – 2015)

There is a positive relationship between enrolments and graduates at universities of technology. Figure 12 suggests that in 2005 the number of engineering enrolments at these institutions decreased by almost 8% and the number of graduates by 9%. Despite some significant fluctuations over the period, the ratio of enrolments to graduates was almost 1:1 between 2008 and 2011. The number of graduates began to far outweigh the number of enrolments, starting from 2012 to 2014.

Figure 12: Annual growth in the Universities of Technology engineering enrolments and graduates (2003 – 2015)

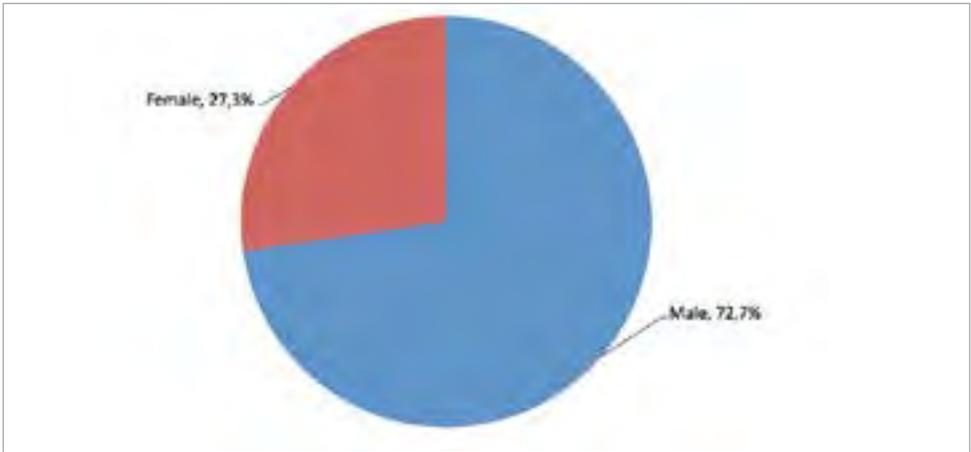


Source: DHET, HEMIS (2002 – 2015)

South Africa began restructuring its higher education system in 2003 to increase access to tertiary education. Smaller universities and technikons (polytechnics) were incorporated into larger institutions to form comprehensive universities.

A comparative analysis suggests there may have been a substitution effect (crossover of students from one kind of institution to the other) at play between the comprehensive, traditional and technology universities in 2005. In 2006, however, the number of graduates at universities of technology increased by 14,8%, but slowly decreased to align with enrolments, then grew at a rate of 10% per year until 2011. In 2015, both enrolments and graduates at these universities declined by the same rate of 1%, as depicted in figure 12.

Figure 13: Gender distribution of engineering enrolments at the universities of technology (2015)



Source: DHET, HEMIS (2015)

According to the DHET-HEMIS data, one of the areas with the greatest gender imbalances in the universities of technology is engineering where only 27,3% of students are women. The engineering enrolments are still dominated by males, with 72,7%, as depicted in figure 13. Government statistics (HEMIS) also show that men are more successful in their engineering studies: in 2015, 70,1% of graduates were men. According to the CEO of the Artisan Training Institute (ATI), more women are graduating as electricians, fitters and turners, and measurement, control and instrumentation technicians (Fin24, March 2016).

Conclusions

Manufacturing is one of the cornerstones of the South African economy and provides consumers with virtually all products that they use in everyday life. In order to produce high-quality products at affordable prices, manufacturers rely on advanced technology and highly trained people. There is a continuous decline in quality and a misalignment of qualifications for artisans and technicians in the manufacturing industry. A shortage of technical skills is one of the key problems undermining the competitiveness of the South African manufacturing sector. The low throughput and pass rates for qualifications are also an issue, which has implications for the manufacturing industry and continued growth in the country. A more nuanced approach is required to increase the capacity, quality and relevance of the development of artisan and technicians in South Africa.

Annexures

Annexure 1: Shortened sector names from the LFS (according to SIC)

Shortened sector name	Industry
Basic metals sector	Basic metals, fabricated metal products machinery and equipment and of office and accounting and computing machinery
Textile, clothing and leather sector	Textile, clothing and leather
Wood and cork sector	Wood and wood products
Food bev and tobacco sector	Food, beverages and tobacco
Non-metallic minerals products sector	Non-metallic mineral products
Furniture and NEC sector	Furniture and manufacturing NEC
Transport equipment sector	Transport equipment
Chemicals and petroleum sector	Petroleum products, chemicals, rubber and plastic
Radio, TV, communication and medical equipment sector	Radio, TV, communication equipment and apparatus and of medical, precision, optical, instruments, watches and locks
Electrical machinery and apparatus sector	Electrical machinery and apparatus

Annexure 2: Comparison of employment trends in artisans, technicians and manufacturing in South Africa (2002 - 2015)

Year	Artisans and technicians employment in manufacturing				Total Manufacturing employment '000
	Technicians '000	Y/Y % change	Artisans '000	Y/Y % change	
2002	153		481		1 647
2003	141	-7,9%	453	-5,8%	1 560
2004	120	-14,6%	464	2,4%	1 724
2005	110	-8,1%	545	17,5%	1 742
2006	120	8,4%	547	0,4%	1 757
2007	109	-9,1%	525	-4,0%	1 776
2008	158	45,1%	546	4,0%	1 917
2009	168	6,5%	458	-16,1%	1 771
2010	163	-2,9%	445	-2,8%	1 713
2011	135	-17,6%	471	5,8%	1 737
2012	143	5,9%	430	-8,7%	1 727
2013	166	16,3%	404	-6,1%	1 667
2014	145	-12,5%	441	9,2%	1 741
2015	137	-5,4%	475	7,7%	1 774

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