Constraints to developing a competitive machinery and equipment industry

4th Annual Competition and Economic Regulation (ACER) week, Southern Africa

Lauralyn Kaziboni and Zavareh Rustomjee

19 & 20 July 2018

Abstract

Over the past twenty-five years, structural transformation in the machinery and equipment value chain remains limited, despite its importance as the heart of the industrial base in South Africa, not to mention its contribution towards employment. Post-apartheid policies appear to have failed to leverage off the inter-sectoral relationships along the metals, machinery and equipment value chain to diversify and develop downstream machinery and equipment. While the upstream industries received substantial subsidisation, there has been limited assistance for the downstream industries. This study has two objectives. Firstly, to assess the status of structural transformation in the machinery and equipment sector. Secondly, the paper aims to understand the factors that have driven the structural transformation outcomes in this industry. Structural transformation relates to changing the sectoral composition of the economy by increasing the proportion of higher productivity activities and high value adding services. Through such changes, industrialised economies have achieved technological advancements and improved productivity, leading to employment creation with higher income and more diverse industries. The paper will draw on firm level information to illustrate the level of concentration and diversification of the machinery and equipment sector. The paper will then go on to compare the performance of the machinery and equipment sector relative to the basic metals and basic non-ferrous industries by looking at export and industry performance data, including investment and output between 1994 and 2017. The paper will conclude by offering policy recommendations that can stimulate the growth and diversification of higher value added products in the machinery and equipment sector.

Key words: structural transformation, metals, machinery and equipment, capabilities

1 Introduction

The trajectory of South Africa's post-war industrial development has centered on the mining, metals and energy value chain, which has historically been characterised by very strong intra-sectoral relationships. The mining and basic metals industries were beneficiaries of favourable electricity tariffs, investment and logistics support aimed at promoting its competitiveness. Subsequently, the post-apartheid state has grappled with how to engage with the main companies (such as ArcelorMittal), including in responding to global developments. At the same time, there have been confusing signals and measures from different departments and public institutions. While the upstream industries received substantial subsidisation, there has been limited assistance for the downstream industries despite the importance of the basic metals' industries in fabrication and machinery and equipment as the heart of the industrial base in South Africa.

This paper's primary research question is to assess the status of structural transformation in the machinery and equipment industry and to understand the challenges that are hampering the diversification and sophistication of the machinery and equipment sector. Structural transformation relates to changing the sectoral composition of the economy by increasing the proportion of higher productivity activities and high value adding services (Nübler, 2014). Through such changes, industrialised economies achieved technological advancements and improved productivity, leading to employment creation with higher income and more diverse industries.

The practice of upgrading entails advancing processes, products and functions. Process upgrading involves improving the production process by re-organising production systems. Product upgrading occurs when firms introduces new technology, thereby moving into higher and more sophisticated product lines. Functional upgrading is the process of moving into higher-skills content functions (Humphrey & Schmitz, 2002). This implies that for the metals, machinery and equipment value chain, structural transformation would take the form of the production of higher value added diverse products along the value chain, through improvements in production processes, incorporating different and new technology, thereby increasing the demand for highly skilled labour.

A comprehensive set of productive capabilities needs to be in place to facilitate the shift from low productivity to higher productive activities within and across sectors. Such capabilities include technology, infrastructure, capital, skills as well as policies that facilitate the transformation (e.g. trade, investment, research and development and exchange rate policies). Research, engineering and design are necessary in not only improving productivity, but also in technological advancements and product development within cluster groupings. More recent studies stress the importance of industrial ecosystems where the product space revolves around productive organisations, public institutions, intermediaries and demand-side actors. These agents work together to diversify the industry and develop innovative strategies aimed at renewing and stimulating industries. Diversification in this instance may be triggered by similarities, complementarities or recombination of capabilities (Andreoni, 2018).

How these capabilities interact is key for structural transformation. For example, as technology and innovation advance, there is increasing demand for more educated and skilled labour, while the demand for less educated and lower skilled labour diminishes. As this occurs, the engagement between industrial policy, skills and tertiary institutions and the industry becomes pertinent to ensure the development of human capital to suit the changing demands (Daniels, 2007). Poor engagement of these policies, lack of complementary capabilities and failure to catch up to emerging technology may thwart structural transformation (Andreoni, 2018).

This paper draws directly from a research project that was conducted by the Centre for Competition, Regulation and Economic Development, at the University of Johannesburg on the same subject. As such, all references to industry knowledge and interviews are based on data and information collected during the broader study. Over the past three decades, the sectors within these value chains have been intensively researched, although the studies have tended to be compartmentalised. The broader study employed detailed empirical analysis of the overall value chain trends with an extensive literature review and selected interviews.

The rest of the paper is structured as followed. Section 2 provides an overview of the machinery and equipment value chain, and the importance of the sector's linkages with the metals and steel sectors. The next section maps out the status of structural transformation. Section 4 then discusses the key challenges to structural transformation. The last section concludes the papers and suggests recommendations.

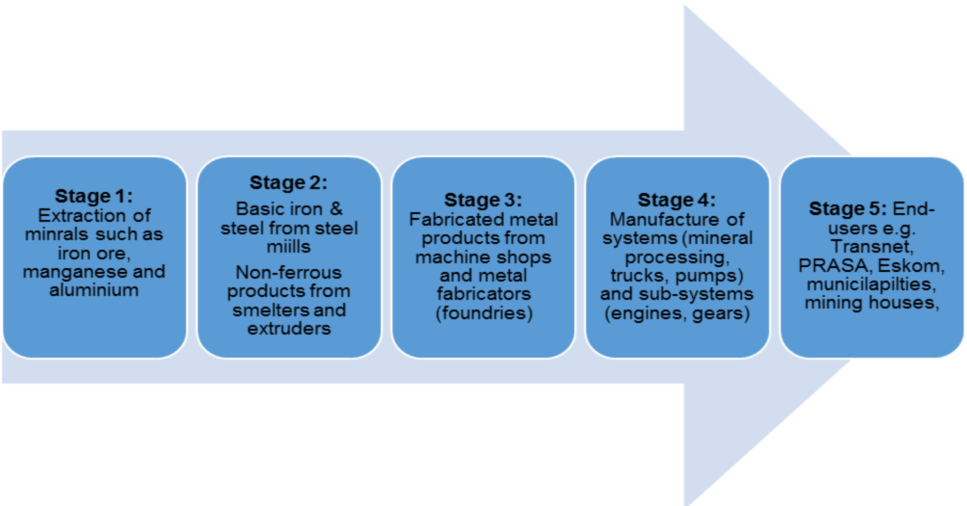
2 The metals, machinery and equipment value chain

The machinery and equipment segment has strong backward linkages with the metals and steel sectors, strong forward linkages with the mining sector, utilities sectors and transport and storage. The sector also has strong internal linkages. These linkages shall be discussed in relation to the value chain (figure 1) on the next page.

The first stage involves the extraction minerals such as iron ore and aluminium that are then processed at stage 2 into basic ferrous and basic non-ferrous steel. Basic ferrous steel is processed into flat and long products. Long products are mainly used in construction while flat products can be used in a number of industries including machinery and equipment. Given this, machinery and equipment sources 21% of its intermediate inputs from basic iron and steel and 3% from non-ferrous metals, which is mainly aluminium (Quantec, 2018).

Basic ferrous products are produced by capital intensive steel mills such as Arcelor Mittal South Africa and Highveld Steel. Mini-mills such as Agni Steels and Unica Iron and Steel also produce steel products, but mainly using scrap steel as feedstock.

Figure 1: Metals, machinery and equipment value chain



Source: Adapted from Rustomjee, Kaziboni and Steuart (2018)

The manufacture of structural, treated and fabricated metal products as well as foundry products occurs at Stage 3. These metal products have undergone cutting, bending, machining, forging and assembling processes. Forging and machining is undertaken by foundries such as Atlantis Foundries, Autocast, Naledi Ihlanganiso and Auto Industrial Group. These foundries mainly use scrap steel for their feedstock, similar to the mini-mills at stage 2. From these, the metal products are supplied to downstream original equipment manufacturers, assemblers, and sub-assemblers at Stage 4. Machinery and equipment draws 6% of its intermediate inputs from this sector. While the backward linkage from machinery and equipment to metal products is quite weak, it may not be well represented in the input-output analysis as this is based on value.

Downstream assembly and original equipment manufacturing activities are depicted at Stage 4 along the value chain. This includes the manufacturers of integrated subsystems and systems and the assemblers and sub-assemblers of subsystem components. These subsystems and systems include a range of machinery and equipment that vary in complexity such as pumps, valves, earthmoving equipment, bearings, engines, and material handling equipment. Importantly, the sector has strong internal linkages, sourcing 23% of intermediate inputs from intra-industry. Leading companies at this stage include Multotec, Weir, Bell Equipment, RGR Technologies, Premier Valves and David Brown Gears.

The forward linkages of machinery and equipment are depicted in stage 5. The machinery and equipment are supplied to end-users that include state-owned companies and local government (pumps and valves), mining companies (mineral processing and material handling equipment), and private companies in the construction, engineering, petrochemical, and aerospace sectors. 20% of the intermediate outputs are used in the mining industry, while 18% are used intra-industry and 13% are used in business and transport and logistics. The other sources of demand are agriculture, forestry and mining, petroleum, chemicals, rubber and plastic; electricity, construction and finance. State procurement of machinery through utility departments and through SOCs like Eskom and Transnet therefore constitutes important sources of demand.

There are also a number of closely-related horizontal linkages with activities/sectors such as electronic components and control systems, sensors and mechatronic solutions which cut across different equipment segments and which are critical to competitiveness, value addition, innovation, upgrading and firm-level capabilities. These linkages while important are not covered in the scope of this paper.

The value chain is prone to import penetration because of the tradability of the products. For example, there is an increase in imports of castings and other inputs for downstream fabricated and engineered metal products at stage 3. Additionally, there has been import penetration of standard systems and subsystems at Stage 3.

3 Structural transformation

Structural transformation occurs when the economy moves from low to high productive and more complex sectors, or through upgrading into high value added activities with in a sector. The former is called sectoral transitioning, while the latter is formed sectoral deepening. In the metals, machinery and equipment, sectoral transitioning can occur when the economy trades more of machinery and equipment relative to iron and steel. Sectoral deepening on the other hand would entail producing more sophisticated machinery and equipment, or higher value added iron and steel. Often, sectoral deepening and sectoral transitioning occur simultaneously, since sophistication at one level may induce demand on another level along the value chain (Bell, Goga, Mondliwa and Roberts, 2018).

Moving to more complex and higher value productive activities involves incorporating the application of design and engineering services (higher productivity services) as part of ongoing product development. In this context, reindustrialisation necessitates the development of key sectors such as transport and logistics, finance, design and technology, which further contribute towards economic growth, employment and value addition (Roy, 2015). In contrast, countries in Africa have seen urbanisation being accompanied by growth of low-skilled services (such as cleaning, security and hair care) that do not have growth-enhancing attributes for increasing productivity and innovation (Tregenna, 2016; Hoekman, 2017), and have weak linkages with the manufacturing sector.

Industrialisation has been measured using different approaches in the literature. McMillan and Rodrik (2011), and Tregenna (2013, 2016), examine sectoral changes, since development entails structural change and shifting capital and labour to sectors and activities with higher productivity, such as shifting from agriculture to manufacturing (McMillan & Headey, 2014). Felipe et al also note that changes in industry value-added and the composition of exports over time further allows us to assess changes in the complexity of production and diversification of exports (Felipe, et al., 2012). With this in mind, this paper looks at the change in structural transformation by looking at analysing changes in employment, value addition, investment and trade patterns in the machinery and equipment segment relative to other segments along the metals, machinery and equipment value chain. The analysis will be focused on the time period between 1994 and the latest national data figures (2016 for industry data and 2017 for trade data).

Employment and value addition

Throughout the period 1994 to 2016, the metal products and machinery and equipment sectors have maintained the largest share of employment, contributing 127,467 and 112,835 respectively out of a total 295 000 in 2016 (Table 1). Furthermore, the machinery and equipment sector has experienced the most positive employment growth during the period under analysis. Post 2008, while the other three sectors declined machinery and equipment grew employment from 110 289 in 2009 to 112 835 in 2016.

Between 1994 and 2001 there were substantial employment losses in the upstream basic iron and steel sub-sector, declining at a compounded annual rate of 2.7% from 64,750 to 35,322 employees. This occurred while output remained stable, only increasing from 2002. This was the result of the twin effects of Iscor's 1990s rationalisation and modernisation of existing plants as well as the huge investment in the modern Saldanha Steel plant.

Table 1: Employment and value addition changes between 1994 and 2016

	Total employment			Value added			Average real wage/employee	Labour productivity index, 2016 (1994=100)
	Share of total		Growth 1994-2016	Share of total		Growth 1994-2016		
	1994	2016		1994	2016			
Basic iron and steel	19%	12%	-2.7%	20%	30%	5%	242 272	489.3
Basic non-ferrous metals	10%	6%	-2.3%	17%	15%	2%	144 890	266.6
Fabricated metal products	43%	43%	-0.5%	36%	29%	2%	110 823	167.2
Machinery & equipment	28%	38%	0.1%	27%	27%	3%	126 259	151.1

Source: Quantec

The proportion of value added in basic iron and steel has increased by 10% between 1994 and 2016, while that of machinery and equipment remains the same. Fabricated metal products' share of value added has also declined from 36% to 29%, despite growing at a rate of 2% per annum (Table 1). Basic iron and steel has shown the strongest growth of 5%, while the other sectors are growing at an average of 2.3% year on year.

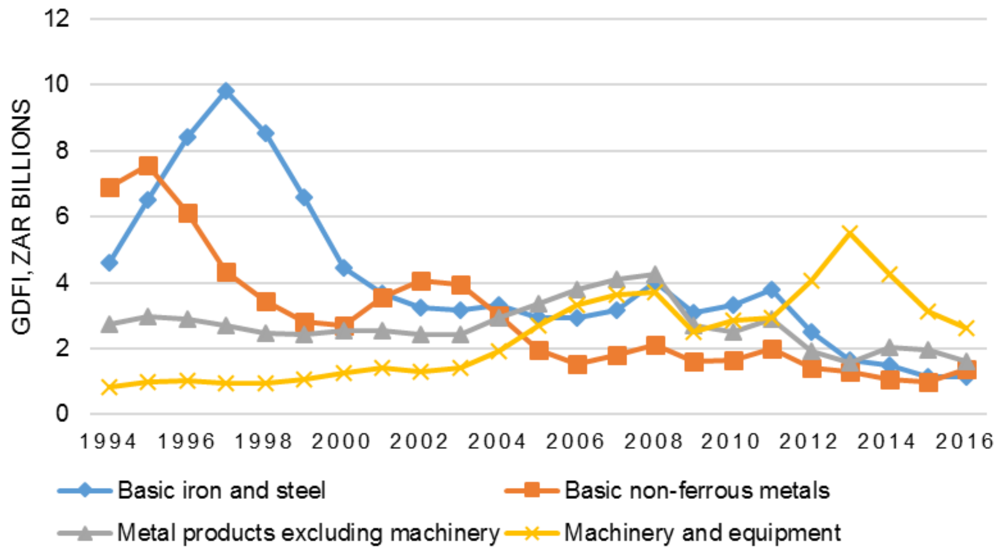
Restructuring in the upstream capital intensive upstream industry led to the decline of low skilled labour, and an increase in productivity (due to increased output due to mechanization). The reduction in low skilled labour, and the associated higher wage rates contrasts with the downstream machinery and equipment segment. The average wage per employee in the basic iron and steel sector is almost double that of machinery and equipment.

Investment patterns

Significant investments were made in the basic iron and steel sector (Saldanha Steel and Columbus Stainless) in the early 1990s and in the non-ferrous metals sector (Alusaf and Hillside smelters in the early 2000s). Investment in the basic non-ferrous metals (aluminium smelters) increased sharply between the early 1990s and 2008, on the back of favourable electricity tariffs. Investments were made into the aluminium smelters in the early 1990s, peaking at R7.6 billion in 1995. However, since the financial crisis, the industry has not been able to recover, with investment levels still lower than 1990s. Investment in the basic iron and steel sectors has also tapered off (Figure 2).

In the mid- and downstream sectors, investment was stable, until early 2000 when there was an increase in investment, likely linked to the commodity boom, until the 2008 global crisis. Investments in mining and development of energy and water sectors in the region (i.e. SADC) have also driven investment by the machinery and equipment sector. However, investment in metal products declined sharply from R4.2 billion in 2008 to R1.6 billion in 2016.

Figure 2: Gross domestic fixed investment 1994-2016, constant 2010-prices



Source: Quantec

Since 2011, investment in all sub-sectors has declined with the exception of machinery and equipment which recorded investment increases in 2012 and 2013, but has since tapered off. It is possible that this coincided with the DTI designation of certain machinery and equipment items while the slowdown in investment post-2014 could be attributed to declining commodity prices, weak business confidence and low levels of profitability (National Treasury, 2017) and (Bosiu, et al., 2017).

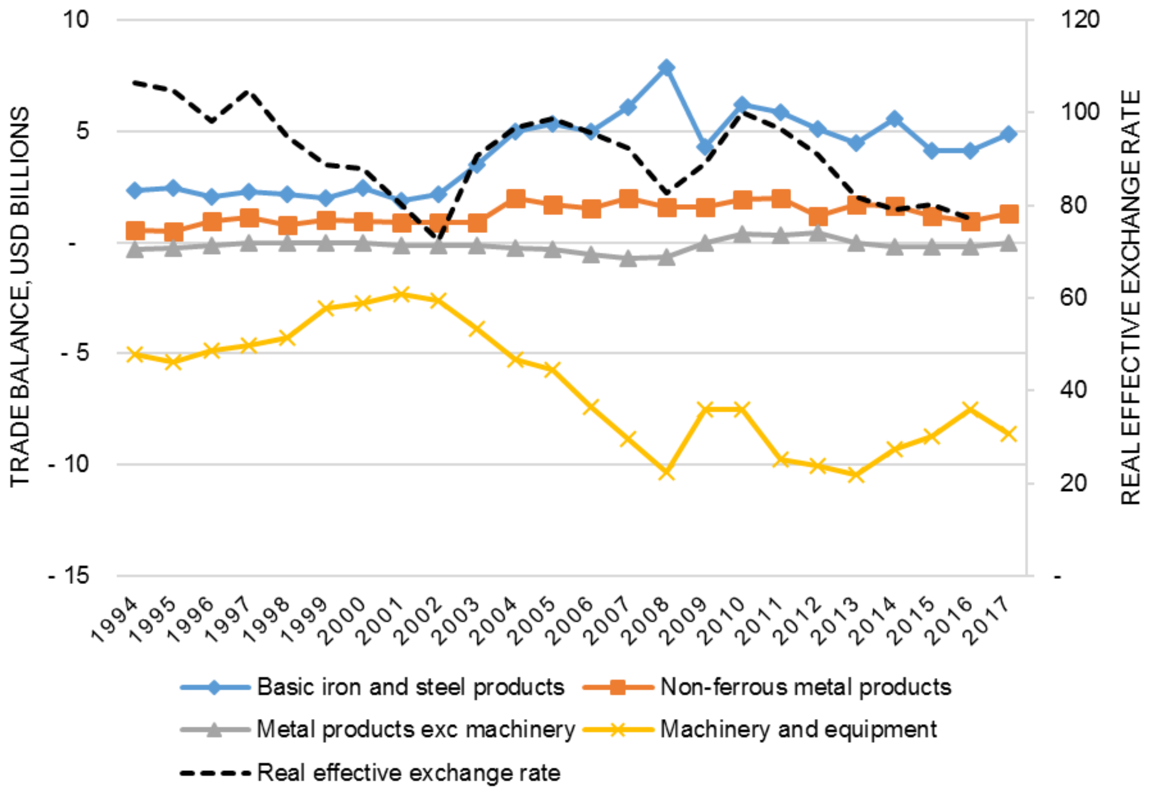
In the early 2000s, significant local and foreign investment was poured into the mining industry, while the rise in income was mainly used to finance consumer spending and less so on productive capacity. This resulted in the erosion of capabilities in the capital equipment sector between 2002 and 2008 hence limiting the scope for structural transformation

Trade performance

The increase in commodities price in the early 2000s had inflationary pressures on general prices in South Africa. To avert inflation, the South African Reserve Bank, in line with inflation targeting, increased the interest rates in an attempt to stabilise inflation. Together with the resource earnings, the portfolio inflows resulted in the appreciation of the rand, thus making exports less competitive in terms of Rand prices versus international currencies. The impact of this is less evident in the basic iron and steel and basic non-ferrous products as the increase in commodity prices had a positive impact on the value of exports. However, the machinery and equipment sector was adversely impacted by the currency appreciation, compounded by the fact that a larger proportion of growing local demand from mining and infrastructure was met by imports (Figure 3).

Basic non-ferrous and basic iron and steel industries have the largest positive trade balance, which accelerated during the commodity boom after 2001. Conversely, the labour absorbing machinery and equipment sector shows an increasing deficit between 2002 and 2008, with the negative balance narrowing since 2013 when the Rand weakened. Between 2002 and 2008, the trade deficit for machinery and equipment went from $2 billion to $10 billion, a loss 28 of $8 billion, which is equivalent to the sectors output in that year, employing close to 100 000.

Figure 3: Trade balances, 1994-2016 in nominal USD millions



Source: Quantec and SARB

The intermediate metal products sub-sector (which covers a very diverse group of products) has demonstrated an overall relative neutral trade balance throughout the period. The response of the machinery and equipment sector's trade balance to changes in the exchange rate is influenced by the fact that machinery and equipment is highly traded. Import penetration and export-output ratio were both in excess of 90% in 2016. These ratios are different from basic iron and steel that had an import penetration of 20% and an export-out ratio of 63% in 2016. The low import penetration may be attributed to the trade protection offered to the upstream sector.

The machinery and equipment sector is a net importer, but closer look at African trade reveals that South Africa is in fact a net exporter in Africa, with the proportion of trade increasing sharply between 2010 and 2014, following which it has been gradually declining. The SADC market is becoming increasingly important, with Namibia, Zambia, Botswana, Zimbabwe and Mozambique commanding a significant proportion of total exports (Figure 8). Products with trade surpluses in the world market i.e. internationally competitive include centrifuges; machinery for sorting, screening, separating and so on; parts suitable for use solely or principally with internal combustion piston engine of heading; spark-ignition reciprocating or rotary internal combustion piston engine and machines for cleaning, sorting or grading seed, grain or dried leguminous vegetables; machinery. Though some products have a negative trade balance in the world market, they have positive trade balances in the regional market. The top exports to SADC mainly include machinery and equipment that is used in the mining industry.

What does this mean in terms of structural transformation?

As mentioned earlier, sectoral transition speaks to moving along the value chain from low value added products to more sophisticated products, while improving productivity within a product grouping in the value chain is referred to as sectoral deepening. From the analysis above, we note that the metals machinery and equipment value chain has undergone both sectoral deepening and to some extent sectoral transitioning. Each product grouping has undergone sectoral deepening with value added growing at an average of 5% per annum, and increasing productivity over the period under review. Sectoral transition appears weak, as most of the value remains at the upstream levels.

The investments which took place in the early 1990s for the basic iron and steel industries, resulted in a more capital-intensive upstream industry which consequently shed many low skilled jobs. At the same time, the labour intensive metals, machinery and equipment sectors have in fact grown employment, even during periods when output was depressed. With regards to investment, machinery and equipment is the only sector that appears to have grown investment between 2011 and 2013, which could be attributed to investments in mining, development of energy and water sectors in SADC.

Trade performance of the metals, machinery and equipment value chain has shown to be very closely linked to the exchange rate movements. The appreciation of the rand in the 2000s, during the commodity boom, rendered South African products less competitive than international products. As a result, the highly tradeable fabricated metals, machinery and equipment were exposed to high import penetration. The excess demand in the local industry was thus met by imports, despite the growth in output and exports between 2002 and 2008. Since 2008, the rand has been depreciating, and this has coincided with the improvement of the fabricated metals, machinery and equipment sectors' trade balances.

The performance of the downstream industry has been suboptimal despite their contribution to employment. The foundry and machinery and equipment sectors are facing declining demand for their products, as demand is being increasingly met through imports. The decline of the downstream industry and increasing import penetration emphasises the need to address the factors that have hampered the growth and development of the downstream

4 Key issues along the value chain

Extensive company and industry-level analyses makes it clear that achieving competitiveness is entails an understanding value chains, and building clusters to address collective challenges at different levels of the chain, in a holistic approach. The main constraints to growth and development are capabilities (low levels of research and development, and lack of skills), policies (focusing on procurement policies) and operating environment (electricity costs). Highlighting the knock-on effects from the upstream industries (steel products and metal cast products) is also important to better understand the structural transformation outcomes.

4.1 Knock-on effects along the value chain

The metals machinery and equipment has strong linkages with the upstream industries (steel and metal products) as indicated earlier in section 2. Such links imply that any changes at the upstream level, will have a direct impact on the competitiveness of the machinery and equipment industry.

Importance of steel pricing to downstream development

The upstream industry is mainly private owned, by foreign based companies. Over the years the leading companies – Arcelor Mittal South Africa, Columbus Steel and Highveld – have shifted their focus to achieve the global companies' objectives of maximising profit and shareholder value, and are not aligned with South Africa's developmental objectives. As at 2017, the main structural change is that the ownership and control of the upstream sector is more concentrated than it has ever been by ArcelorMittal, with the likelihood that this could increase further as Highveld and Scaw are dismembered.

The upstream steel sector has been receiving substantial government support to meet stakeholder profit expectations, and anti-competitive outcomes[1] have thus far been raised in the basic iron and steel industry. Such behaviour has had the effect of undermining the performance of the downstream industries, given the importance of steel as an input. In the manufacture of general purpose, mining and food machinery, steel products comprising at least 20% of direct inputs and 23% of indirect inputs (Table 2).

Table 2: Proportion of direct and in-direct steel inputs in machinery and equipment (by value)

Sub-sector	% Direct inputs	% Direct + indirect inputs
General machinery	19.3%	24.9%
Mining machinery	18.8%	24.4%
Food machinery	18.4%	23.4%

Source: DTI, 2010

A study by the dti in 2010 estimated that a reduction of steel prices would likely increase output and/or increase employment (Table 3). The study was carried out, following the commodity and construction booms, when demand for machinery and equipment were high. Nonetheless, these estimates, which can be adjusted down, stand to reason that lower steel prices will have a positive effect on the downstream industry.

Table 3: Effects on employment and output of lower steel prices

% reduction in the domestic price of steel	% of firms that would increase output by > 10%	% of firms that would increase employment by >10%
10% lower steel prices	43.5%	21.8%
20% lower steel prices	67.7%	44.9%
30% lower steel prices	80.9%	56.7%

Source, DTI 2010

The protection of the upstream industry further increases the cost of accessing key inputs for the machinery and equipment sector, especially for products that are not manufactured locally. For example. Bell Equipment is unable to secure high grade steel for the articulated dump trick tip and resorts to imports. For these imports, Bell Equipment pays a duty of 20% on

[1] In August 2016, an agreement was reached with AMSA under which all pending Competition Commission cases were settled. These cases include the long steel cartel, scrap metal cartel, flat steel cartel, and excessive pricing. (http://www.compcom.co.za/wp-content/uploads/2016/01/Press-release-ArcelorMittal-final-2.pdf)

imports and this has the effect of increasing the cost of inputs and undermining competitiveness.

Consequences of protecting the upstream industry

A danger is emerging that the collective 22% impact of upstream tariff (10%) and safeguard duty (12%[2]) will be cost raising to downstream users. ArcelorMittal is the main beneficiary of this support which effectively (through tariff protection) increases the cost of downstream steel inputs by up to 22%.[3]

In 2015, the cold-rolling firms Duferco and Safal vigorously opposed the imposition of a 10% duty on hot-rolled coil which constituted around 75% of their input costs, although they had earlier supported the imposition of a 10% duty on coated galvanised steel sheets, aluminium zinc coated steel sheets and painted and plastic coated steel sheets (Creamer, 2015).

As at October 2017, the move to impose safeguard duties on hot-rolled coil is not supported by downstream steel users. The South African Institute of Steel Construction (SAISC) argue that excessive protection on upstream could make domestically manufactured finished steel products uncompetitive, resulting in increased downstream imports, triggering a call for further protection of downstream sectors (Moolan, 2017).

Deteriorating capabilities in the foundry industry

Between 2008 and 2016, there has been a 38% fall in the number of foundries – from 265 in 2007 to 165 in 2016. Some of the latest foundries to close their doors include foundries that have made significant investments in capital equipment and accreditation such as Steloy Castings.

The output in the industry has also declined, along with a reduction in the number of foundries by type. Today, roughly half of all foundries in South Africa are exclusively ferrous foundries. The number of non-ferrous sand, gravity and low pressure foundries have declined by 52% since 2003. The number of ferrous foundries and high pressure foundries have both declined by 28% since 2003. The changing composition of the foundries results in machinery and equipment companies having to import castings that are no longer manufactured locally.

Machinery and equipment companies in the industry are struggling to secure competitively priced castings locally, with firms resorting to imports. Additionally, there appears to be a perception that the quality of local castings is deteriorating. While larger, more complex castings are increasingly difficult to obtain locally, imports are not necessarily of better quality and the lead time is a challenge. This affects the competitiveness of firms that use cast components thus affecting their efficiency.

4.2 High and disproportional energy costs

[2] The tariff will be in place for three years from 2019 and is proposed to fall from 12% in the first year, to 10% in the second year and 8% in the third. Available here: http://www.engineeringnews.co.za/article/bell-laments-import-duties-on-steel-tyres-kamaz-assembly-could-start-in-2019-2018-04-19/rep_id:4136

[3] Currently there is an import duty (10%) on steel imports. Steel and Engineering Industries Federation of Southern Africa (SEIFSA) is advocating for safeguard duty (12%) in order to protect the local companies against dumping, which is still to be approved by the International Trade Administration Commission (ITAC).

Between 1990 and 2006, South Africa enjoyed competitively priced electricity arising from excess generation capacity. Since then, electricity prices have been rising rapidly. Although still relatively low in global terms, electricity-intensive manufacturing sectors including steel foundries and energy-intensive machinery and equipment companies have been adversely impacted, with many unable to adjust to the changing cost structure. Over the next decade the supply structure will inevitably shift from low cost electricity from amortised generation plant to higher cost reflective tariffs from new generation capacity.

A further impediment relates to the structure of electricity distribution and pricing to end users with both Eskom and municipalities supplying industrial customers. There is a structural bias in cost and supply structure of electricity between high voltage customers (upstream steel sector supplied directly by Eskom) and low voltage customers (mainly downstream users supplied by municipalities).

Municipal customers are disadvantaged firstly because municipal electricity prices are not set on the basis of cost of supply but are used as a source of revenue intertwined with the system of local government financing. Secondly, structural underinvestment in electricity distribution infrastructure (approximately R80b in 2017), largely in the municipalities, has resulted in increasingly unreliable electricity supply mainly to downstream sectors.

A hypothetical study was carried out to quantify the costs of accessing electricity from a municipality, versus accessing it directly from Eskom. The study was carried out on foundries located in Ekurhuleni and will be discussed next.

Case study on foundries[4]

Over 80% of the 165 foundries operating in South Africa today obtain electricity from their respective municipality. Of these, more than half are located in the Ekurhuleni Metropolitan Municipality. The Ekurhuleni tariff is therefore a good comparator to use to understand the impact of differentiated electricity pricing between municipalities and Eskom. Tariff structures differ between municipalities, and between municipalities and Eskom. An analysis3 was undertaken to calculate the electricity costs for hypothetical different sized foundries using comparable municipal versus Eskom tariffs (Ekurhuleni Tariff D and the Eskom NIGHTSAVE tariff) (see Annexure 2 for further detail).

The analysis shows that a typical medium to large-sized foundry that receives its electricity from its municipality can pay up to 30% more for its electricity per kilogram of output sold than if it obtained its electricity directly from Eskom. This represents roughly 4% of the foundry's total annual turnover. For a small-sized foundry, the difference in total electricity costs between Eskom and Ekurhuleni is 19% or 2% of total annual turnover. Foundries obtaining their electricity from municipalities rather than Eskom are therefore disadvantaged, impacting on competitiveness. While foundries can make savings on their electricity bills by, for example, smoothing their electricity demand profile regardless of their supplier, the fundamental point

[4] Foundry Concepts, a private consulting company focusing on improving the competitiveness of the foundry industry, with assistance from the University of Johannesburg's Process, Energy and Environment Technology Station, supported this study in calculating the total electricity costs per kilogram sold for a hypothetical medium-to-large sized foundry for a given energy consumption for both the Ekurhuleni Tariff D and the Eskom NIGHTSAVE tariff. More detailed calculations can be accessed https://www.competition.org.za/s/IDTT-MME-Final-Project-Report.pdf.

of our analysis is that, by charging more for electricity, municipal suppliers are raising costs for high energy downstream industries that are central to industrial diversification.

4.3 Poor implementation and monitoring of local content: lessons from valves

Local content policy has in many countries been used as an industrial policy instrument, with the objectives of achieving local industrial development, socio-economic transformation and the empowerment of small business enterprises, cooperatives, and rural and township enterprises.

The dti has consistently sought to leverage state procurement as an instrument of industrial policy through the National Industrial Participation Program (NIPP) in the 1990s to the more direct designation of certain products in the recent period. The NIPP instrument was blunted by the Public Enterprises Department around 2006 when it adopted the Competitive Supplier Development Program (CSDP) which, according to recent analyses, has not been very effective. The Preferential Procurement Policy Framework Act (PPPFA) allows the dti to designate a minimum local content threshold for products that can be manufactured locally. The PPPFA Regulation works in tandem with the CSDP, for products that are designated.

Currently, there appears to be little, if any, support from the state-owned companies (SOCs) and municipalities with regards to leveraging public procurement to build local capabilities. While SOCs do have contracts with local firms, poor levels of institutional coordination have not consolidated procurement so that scale economies can be achieved (Crompton, et al., 2016). The efficacy of the policy instrument is also weak, as illustrated by the local content calculation, exemption process, and verification.

(Mis)Calculating the minimum local content threshold

When a government entity procures, the minimum local content threshold should be stipulated on the bidding documents, and is calculated as:

$Local\ Content = \left(1 - \frac{x}{y}\right) x\ 100$, *where:* x *= imported content (by value) and* y *= tender price*.

Imported content refers to any parts or materials that were procured outside South Africa, regardless of the products stage on the value chain. Transportation and duty related costs are also included in the import content calculation. The remaining content is considered to be local content. This encompasses products that were locally manufactured or assembled and services provided locally. Simply put, local content is calculated as the selling price less the imported content value (customs declaration value). The procuring entity should award the tender based on the supplier committing to meeting the designation i.e. the minimum local content requirements.

The valves industry for example was designated in 2014 at a minimum threshold level of 70% by the dti and the circulars (previously instruction note) lists the different types of valves and actuators designated.[5] The circular for valves and actuators in 2014 instruction note was ambiguous and not explicit on how to achieve local content, and this created inconsistencies in how bidders (mainly importers) calculated local content. According to the SABS classification, local manufacturing also encompassed assembly and packaging. As a result,

[5] National Treasury: 2014. Valves Instruction Notes
http://www.treasury.gov.za/divisions/ocpo/sc/PracticeNotes/Instruction%20-%20Valve%20Products%20and%20Actuators.pdf

this created an incentive to import valves, assemble, or package locally, and inflate the tender price to achieve the requisite minimum local content, despite the little local value addition.

Under such circumstances the valves industry alluded to the fact that some importers submit fraudulent bid documents to win tenders. After submitting false information, the company then imports the valves required and supply the OEM, after having added a mark-up. The valves industry engaged with the dti to revise the instruction note to include the use of locally sourced materials and elaborating that value addition encompasses local drilling, machining, coating, assembly and testing. The dti has since made changes to the designation of valves to ensure that local manufacturers benefit from the designation.

Exemptions

Section 4.1.2 in the 2017 revised PPPFA states that exemption can be granted from minimum local content thresholds for various reasons. Exemptions may be granted on the basis that: (i) it is not economically viable to manufacture the product locally given the required volumes; (ii) there is insufficient capacity in the industry at the time of procurement to deliver the product; (iii) for technical specification or (iv) tight delivery schedules.

Evidence appears to suggest that SOCs have repeatedly been granted exemptions, approved by the dti, on these bases. For example, Eskom has been granted exemption on the basis of lead time. Transnet has also received exemptions on the back of technical specifications. While lack of capacity and technical specifications are “plausible” reasons to be granted exemptions, time-based exemptions should not be granted since SOCs have budget plans and should be able to anticipate demand. Limiting time-based exemptions for one will allow SOCs to plan such that the industry will have enough lead time.

Granting exemptions on specifications has been identified as a contentious issue. Interviews with the industry indicated that SOC procurement officers continuously purchase from the suppliers they have a relationship with as opposed to considering local manufacturers. SOCs have put forward technical arguments or quasi-technical arguments to rationalise importing. For example, the engineering department can say that it has designed its system around a particular (imported) valve, such that it would be costly to switch the valve as this may affect the operating system. Furthermore, in terms of repair and services, the procuring entity will also import parts and services from a specific OEM further disadvantaging the local industry. The local industry has tried without success to engage with municipalities and SOCs to design similar products and replace imports.

Verification

In 2012, the dti nominated The South African Bureau of Standards (SABS) as the verification agency, which was approved by the National Treasury. Presentations by the SABS indicated that in July 2013, the local content verification office was established and capacitated following which the first verification certificate was issued in November 2014 (SABS, 2016). The verification process is an intricate 14-stage process that requires access to adequate resources (Figure 4).However, interviews with key stakeholders suggest that SABS is outsourcing verification to financial auditors at an exorbitant fee.

Verification is conducted on a case-by-case basis, and it is unclear who pays for the verification as this process is not funded by the fiscus and the PPPFA. This is evidenced in the 1 064 locomotive procurement by Transnet, where it is not clear whether SABS or Transnet (or OEMs) should pay for the verification of the R50 billion procurement, and as a result, no verification had been conducted to the end of 2016 (Crompton, et al., 2016).

According to the Valves and Actuators Manufacturing Companies of South Africa (VAMCOSA), in addition to the ambiguity with regards to who pays for local content, it appears as though SABS is not well-equipped to manage the verification flow. Once the public entity awards the tender and the scope of work is submitted to SABS, SABS tends to struggle to provide a quotation before the tender deadline. In some cases, the cost of verification is more than the value of the order (e.g. of order value of R300 000, SABS would quote R500 000 for verification, a cost that the supplier has to borne).

Figure 4: Local content verification process flow

Source: SABS, 2016

What is apparent is that when drafting policies of this nature, there needs to be buy-in from procurement officers and procurement managers at SOCs, municipalities and any other relevant government entities. Furthermore, while it is difficult for suppliers to support localisation requirements and remain competitive, the companies that support localisation programmes and manage to meet the targets and remain competitive are not getting the support that they should from government and state-owned entities.

Import penetration

At the downstream level, import penetration occurred via local companies (both manufacturers and distributors) that are increasingly importing standard products and components. This is also occurring at the high-end level, where companies are importing special machinery and equipment. A case in point would be the high import penetration that is occurring the in pumps and valves and rail rolling stock industries, despite the localisation strategies discussed earlier.

If private companies are importing more of certain products and components, it effectively means that demand for local cast components is declining and substantial benefits to be gained from the manufacturing benefits (value addition, employment creation, etc.) are foregone.

Another explanation for the surge in imports has to do with the loophole in tariff codes. The tariff codes under section 84.81 lists the different types of valves and the duty they would attract if imported as well as the rate of duty by region. Since there is an influx of imports from China, these would be under the general region tariff code. Under the general region, the average duty for valves is 15%, which means should a company or individual import a pressure-reducing valve, check valve, safety or relief valve or ball valves, this would attract a duty of 15%. However, there are duty lines called “other” (8484.10.90, 8481.40.90, 8481.80.90 and 8481.90.90) where imports from the general region would not attract a duty, and this is where the challenge arises.

What the industry has reported to be occurring is that because the South African Revenue Services (SARS) officials are not well versed with the different types of valves, often importers will misclassify a valve and import it under other. Due to the scale of production in India and China, the production of valves is cheaper, such that if an individual is able to import under other this may imply that an already cheaper butterfly valve will land in South Africa 15% cheaper than it ought to be. To address this, VAMCOSA is working with SARS and will be training officials on how to differentiate between different types of valves and linking them with HS code, from November 2017. VAMCOSA is also offering their services to SARS in instances where the officials are not sure if the type of valve is designated or not (refer to next section for the list of designated valves).

In an attempt to increase production machinery and equipment firms are exploring the export markets. SADC is the main region firms are targeting, but even here South African companies are losing market share due to decline in competitiveness, and lack of access to export finance. Export-finance is vital for supporting and facilitating trade, especially when competing with other foreign companies that have access to this facility.

4.4 Deteriorating R&D in machinery and equipment

For local small businesses in the machinery and equipment sector, the low levels of innovation have been compounded by the lack of sufficient capital and limited platforms for small businesses to present business cases to secure funding. While government is addressing the access of small businesses to capital (through the Department of Small Business Development), there is need to integrate research and development across academic institutions, private companies, government departments, and any other agency that can propel the development of technology. This will also assist in address the shortage of skilled labour, particularly in highly skilled sectors such as ICT and engineering (The World Bank, 2017).

The mining industry had a strong national system of innovation that intertwined the mining houses, suppliers, universities, research centres and technical schools, where the Chamber of Mines Research Organisation (COMRO) drove the innovation efforts in the 1990s to early 2000s (Fessehaie, 2015). However, in 2007, COMRO’s research capacity was drastically reduced, which minimised their ability to undertake long-term ground breaking technology and rather focused on short-term development (Kaplan, 2011).

To resuscitate innovation in the mining industry, the Chamber of Mines Research Organisation (COMRO) is being reopened under the Council for Scientific and Industrial Research (CSIR) as the Mandela Mining Precinct. The Department of Science and Technology contributed seed funding valued at R17million towards the initial research to develop business cases for localisation (Creamer, 2016). Even though the primary focus is on mining operations rather than mineral processing, the Mining Precinct will assist in the development of upstream capital goods for the mining industry. In the short-term, the Mining Precinct is focused on improving underground machinery for narrow-reef and hard-rock applications. In the medium-term this would align with the development of machinery and techniques for deep-level mines that operate all the time (Slater, 2016).

The South African Mineral Processing Equipment Cluster (SAMPEC) is the only industry body focused on resuscitating capabilities in the mineral processing industry. It was only established in 2016 and relies on industry subscription fees, which fall short of the requirements. At the moment, SAMPEC does not have any concrete plans to reinvigorate R&D in the sector yet but they are engaging in the post Mining Phakisa[6] supply development preparation process, which does look at investment and technological development within the industry. SAMPEC is also housed at the Mining Precinct along with the Mining Equipment Manufacturers South Africa (MEMSA). MEMSA is working with the mining research and development (R&D) hub and local mining companies to evaluate the stock of current equipment versus future order quantities to develop a better understanding of the possibilities related to future mining equipment (Slater, 2016). MEMSA programmes include marketing, networking & information, localisation, transformation, skills development and manufacturing excellence.[7]

Despite the decline in government and industry led and/or funded research, at a company level there are multi-national corporations in South Africa leading research, development and innovation in the industry. Multotech, an original equipment manufacturer focusing on mineral processing equipment (screening media, samplers, spirals and cyclones), is a large firm, with a workforce of approximately 1800 employees and a turnover in excess of R2 billion per annum. 20% of its revenue is invested in skills development as well as research and development to improve products, processes and equipment. Multotech has many R&D centres and has also established connections with universities including University of Pretoria, University of Johannesburg, Stellenbosch University and the University of Cape Town. The company’s technology is advanced as it uses latest technologies, including 3D printers. While Multotech has embarked on technology and innovation alone, the lack of a collaborative effort (national system of innovation) has resulted in the reduction of R&D and innovation activities across the sector.

Consequently, South Africa is lagging behind rival countries such as India, which are becoming more competitive than South Africa. In the last ten years, South Africa has decreased its market share in mineral processing equipment in Zambia from approximately 60% to 30%. This is decline is further explained by other issues such as lack of export finance and slowness to adopt to local content policies in Zambia.

---

6 The Mining Phakisa was a South African government initiative led by the Presidency based on a “*quick, fast results*” methodology developed initially in Malaysia that brings together all stakeholders in the industry into a “lab” with the aim of identifying constraints and developing a shared vision and growth strategy for the long-term development and transformation of the sector.

7 https://memsa.org.za/

4.5 Training and skills

The government established Skills Education Training Authorities (SETAs) and Technical Vocational Education and Training (TVET) colleges to meet the skills constraint in the country. SETAs are through the revenue collected from the Skills Development Levy. TVET colleges are split between public and private. Public TVET Colleges are established and operated under the authority of the Continuing Education and Training Act 16 of 2006, resort under the Department of Higher Education and Training and are subsidised by the state with approximately R8 billion per year.[8]

Since the establishment of Skills Education Training Authorities (SETAs) by the Department of Labour in 2001, their outputs, outcomes and impact have been found wanting by almost every independent piece of research on the subject. The SETAs are funded by the skills development levy (SDL). The SDL is applicable to employers whose total salaries exceed R500 000 per annum. The employer pays a levy of 1% of the total amount paid in salaries (including overtime payments, leave pay, bonuses, commissions and lump sum payments).[9]

In March 2011 of a Ministerial Task Team was established to investigate and appraise SETA performance. Its final report, published a year later, found numerous challenges with the programme (DHET, 2012). The SETAs' mandate was too broad, not clearly defined, and constantly shifting. Even so, many SETAs engaged in activities outside their mandate. Planning was based on inadequate information and was therefore unreliable; most SETAs had little planning capacity. The quality of most programmes was dubious and most SETAs had concentrated on inappropriate or useless training (e.g. at too low a level or of too short a duration), especially for employed persons. Governance and accountability systems were weak and there was evidence of gross negligence and weak financial accountability and oversight in many SETAs. Administrative systems were unnecessarily complicated and bureaucratic. Since then, it appears as though these bottlenecks have not been addressed, and persist.

Since apprenticeship programmes must be registered by a SETA, the issues outlined around SETA performance have constrained the growth and expansion of apprenticeships. Despite these challenges, collaborative initiatives between government and industry to address the dearth of skilled apprentices appears to be on the rise.

The overwhelming majority of students at public Technical Vocational Education and Training (TVET) colleges are in programmes that require no workplace experience and do not lead to a specific occupational qualification. This has been a serious and constant obstacle to quality in South Africa's public TVET system, and to the employability of its graduates. Public TVET colleges are not dependent in any way upon industry for their income and have, therefore, generally become unresponsive to offers from industry to collaborate on work-based learning (a notable exception to this is the Gauteng Foundry Training Centre).

Industry led initiatives in machinery and equipment

The disconnection between the training provided by TVET and SETA programmes, and the industry requirements has resulted in some industry participants (VAMCOSA, SAMPEC, and SWH-MANCOSA) deferring to SACEEC to lead the training, with their support and guidance.

[8] http://www.tvetcolleges.co.za/Site_Public.aspx
[9] http://www.sars.gov.za/TaxTypes/SDL/Pages/default.aspx

SACEEC recently established a “School of Excellence” (the School) in collaboration with the National Tooling Initiative Program (NTIP) to increase the number of artisans entering the industry and to prepare them for the challenges and opportunities associated with the introduction of new technologies and increasing automation in the workplace. The School offers a 3-year modular programme for trainee apprentices entering the industry. The minimum entry requirement is 60% in English, Maths, Science and Technical Drawing. Every learner is fully supported and provided with accommodation, meals, and guaranteed employment at the end of the course. The programme provides a blend of technical and business-oriented courses. Once qualified, the graduate can then proceed to become a Master Artisan. The programme is currently being accredited by MERSETA and SACEEC is looking to roll out the programme nationally.

To help boost the grades of learners to meet the minimum entry requirements into the School and to increase learner interest in careers as artisans in the capital equipment manufacturing sector, SACEEC has partnered with the Gauteng Growth and Development Agency (GGDA) to implement the SACEEC Schools Programme (SSP) at four technical high schools in Ekurhuleni.[10] In addition, SACEEC has designed a one-year bridging programme for learners who have already matriculated and who neither meet the School’s entry requirements nor received the benefit of the SSP while at school.

The main weakness with the SETA and the TVET colleges is the bridge from theory to practical application of skills in the work-place, which is the gap that the industry-led initiatives have aimed to fill. Without work-based learning, it is difficult for qualified technicians and artisans from SETAs or TVET colleges to be assimilated into the work place. There is an opportunity here for government to leverage off and maximise the impact from industry led initiatives.

5 Conclusions

This paper analysed the evolution of South Africa’s machinery and equipment industry over since 1994 to date, showing the strengths and weaknesses of its internal linkages and the chain’s strong relationship with other sectors (Section 2). It has further considered the level of transformation in the sector (Section 3), and sought to understand outcomes through an analysis of key issues along the value chain (Section 4).

In performance terms (Section 3), the upstream sectors have retained their globally competitive capabilities through substantial investment, access to cheap energy and retrenchments. In contrast, the performance of the downstream foundry and machinery sectors has declined, reflected by increased import penetration and a loss of production capabilities over the past three decades. However, the strong growth in machinery exports into the SADC region suggests considerable future growth potential.

The single biggest development challenge is growing the diversified machinery and equipment sector. Growth in this sector creates employment, including in related services such as in engineering and design. There has been rationalisation of the machinery and equipment sector over the past two decades and a loss of some capabilities. However, there are core capabilities and export competitiveness in the mining capital equipment and mineral

[10] Rhodesfield Technical High School in Kempton Park, Hans Moore High School in Benoni, Springs Technical High School, and Fumana Comprehensive School in Katlehong.

processing equipment sub-sectors. The sector has thus developed islands of capabilities rather than clustering of capabilities in the sector.

While procurement policies are aimed at driving localisation, poor implementation and weak monitoring and evaluation processes have resulted in local firms losing orders, requisite for achieving economies of scale. This is partly attributed to the lack of support from state owned companies and municipalities – the largest procurers and demand drivers. Evidence shows that government entities are employing different tactics to avoid procuring locally (through exemptions), and are resorting to imports. The weak implementation of the policy is exacerbated by the fact that the appointed verification agency does not have funds to undertake verification. Loopholes in the calculation of local content have also undermined the intended consequences of local procurement. However, there seems to be drive at the dti to improve the implementation of the policy.

The impact of low order volumes is also evident in the machinery and equipment sector, where there is high import penetration of components and standard parts. Local procurement, particularly public procurement is not stimulating demand in the local industry thereby undermining the competitiveness of local manufacturers. There are companies that have capabilities among certain products and are advocating for the designation of these products. Designation is dependent on the level of local capabilities. The export market is becoming more important for the industry, and government support is required to improve the competitiveness of these companies to meet international standards.

The upstream industries benefited from access to investment, which allowed them to adopt advanced technologies. For the downstream industries, the narrative is more varied. Though certain foundries have been able to adopt new technologies to improve competitiveness, a bulk of the industries are still employing old obsolete technologies. There is need to work within the existing institutions to localise and improve technology and develop the processes and for foundries to industrialise products.[11]

Access to highly trained skills remains a struggle, despite government's efforts via the TVET and SETAs. In the foundry and machinery and equipment industries there is strong will by the industry to address the failure, evidenced by the different initiatives.

In order to develop and grow industry capabilities, there is need for public and private sector partnerships. While some (if not most) firms have a short term horizon, there is need for government to develop systems of innovation to coordinate skills and technology requirements at present and in the future. Even within government, it is important for different departments – DST, DHET, IDC and the dti – to collectively address building productive capabilities.

[11] https://www.thedti.gov.za/parliament/2015/NFTN.pdf

References

Anderson, A., 2012. Towards a new approach to natural resources and development: The role of learning, innovation and linkage dynamics. International Journal of Technological Learning, Innovation and Development, 5(3), pp. 291-324.

Andreoni, A., 2018. The architecture and dynamics of industrial ecosystems: Diversification and Innovative Industrial Renewal in Mature Economies. Cambridge Journal of Economics, Issue Forthcoming.

Bekker, D., 2017. Manufacture of general purpose machinery, s.l.: Who Owns Whom.

Bell, J. et al., 2017. Research Project on Large Firms and System for Regular Tracking of these Strategies and Decisions: Metals, Machinery and Equipment Sector Assessment, Johannesburg: CCRED Working Paper 18/2017.

Bell, J., Goga, S., Mondliwa, P. and Roberts S. (2018). Structural Transformation in South Africa: moving towards a smart, open economy for all. Available from https://www.competition.org.za/s/IDTT-Structural-Transformation-in-South-Africa-Moving-towards-a-smart-open-economy-for-all.pdf.

Bhorat, H. & Tseng, D., 2014. Brookings Edu. [Online]. Available at: https://www.brookings.edu/blog/africa-in-focus/2014/04/02/south-africas-strike-data-revisited/. [Accessed 20 October 2017].

Body, K., 2005. Research report on Manufacture of machinery for mining, quarrying and construction., s.l.: Who Owns Whom.

Bosiu, T. et al., 2017. Research Project on Large Firms and System for Regular Tracking of their Strategies and Decisions: Top 50 firms on the Johannesburg Stock Exchange (JSE), Johannesburg: Centre for Competition, Regulation and Economic Development, University of Johannesburg.

Creamer, M., 2016. Big boost for South African mining as old COMRO reopens. [Online]. Available at: http://www.miningweekly.com/article/big-boost-for-south-african-mining-as-old-comro-reopens-2016-06-13/rep_id:3650. [Accessed 11 October 2017].

Creamer, T., 2015. Two leading steel re-rollers to oppose application for 10% duty on hot-rolled coil. [Online]. Available at: http://www.engineeringnews.co.za/article/two-leading-steel-re-rollers-to-oppose-application-for-10-duty-on-hot-rolled-coil-2015-11-12. [Accessed 13 October 2017].

Crompton, R., Fessehaie, J., Kaziboni, L. & Zengeni, T., 2016. Railway Locomotives and Transnet: A Case Study, Johannesburg: The Center for Competition, Regulation and Economic Development.

Daniels, R., 2007. Skills shortages in South Africa: A literature review, Cape Town: Development Policy Research Unit.

DHET. 2012d. Report of the Ministerial Task Team on SETA Performance. Pretoria: DHET

Duncan, Ken. 2017. Apprenticeships for Youth Employment. Paper prepared for the Centre for Development and Enterprise's Youth Unemployment Project.

Fessehaie, J., 2014. Case Study on the Mining Capital Equipment Value Chain in South Africa and Zambia, Johannesburg: Centre for Competition, Regulation and Economic Development, University of Johannesburg.

Fessehaie, J., 2015. South Africa's upstream industries to mining: import substitution opportunities and impact of regulatory frameworks, s.l.: Background paper for the Mining Phakisa.

Fessehaie, J., Rustomjee, Z. & and Kaziboni, L., 2016. Can mining promote industrialisation? A comparative analysis of policy frameworks in three Southern African countries. UNU WIDER Working Paper.

Henderson, G., 2008. Research Report on Manufacture of machinery for mining, quarrying and construction, s.l.: Who Owns Whom.

Herbest, S., 2012. Electricity costs remain a concern despite lower 2012/13 tariff increase, Johannesburg: Engineering News.

Humphrey, J. & Schmitz, H., 2002. How does insertion in global value chains affect upgrading in industrial clusters?. Regional Studies, 36(9), pp. 1017-1027.

Kaplan, D., 2011. South African mining equipment and related services: Growth, constraints and policy. Making the Most of Commodities Programme (MMCP), Volume MMCP Discussion Paper 5.

Machaka, J. & Roberts, S., 2006. Addressing the apartheid industrial legacy: local economic development and industrial policy in South Africa – the case of Ekurhuleni. Sustainable Manufacturing.

Moolan, V., 2017. Upstream and downstream industry has to work together. [Online]. Available at: http://www.engineeringnews.co.za/article/upstream-and-downstream-industry-has-to-work-together-2017-08-18. [Accessed 12 September 2017].

Mukora, J. 2008. A history of Recognition of Prior Learning (RPL) in South Africa. s.I Proceedings of the Colloquium on RPL for the upgrading and up-skilling of teachers in South Africa. Pretoria: South African Qualifications Authority (SAQA).

National Treasury, 2017. Budget Review 2017, Pretoria: National Treasury.

Nübler, I., 2014. A theory of capabilities for productive transformation: Learning to catch up. In: Transforming Economies: Making industrial policy work for growth, jobs and development. s.l.:United Nations (UNCTAD) and International Labour Organization, pp. 113-149.

Phele, T., Roberts, S. & Steuart, I., 2004. Industrial Strategy and Local Economic Development: Manufacturing Policy and Technology Capabilities in Ekurhuleni. African Development and Poverty Reduction: the Macro-Micro Linkage, Forum Paper (2004), pp. 1-24.

Porter, M., 2000. Location, Competition and Economic Development: Local Clusters in a Global Economy. Economic Development Quarterly, 14/15(1), pp. 15-34.

Rankin, N., 2016. Labour productivity, factor intensity and labour costs in South African manufacturing. REDI3X3, Working Paper (21), pp. 1-32.

Roberts, S. & Rustomjee, Z., 2009. Industrial policy under democracy: Apartheid's grown up infant industries? Iscor and Sasol. Transformation, Volume 71, pp. 50-75.

SABS, 2016. Presentation to the Portfolio Committee on Trade and Industry: Colloquium on Local Public Procurement. [Online]. Available at: https://www.thedti.gov.za/parliament/2016/SABS_Colloquium_local_public_procurement.pdf. [Accessed 5 December 2017].

SACEEC. (2017). Membership. [Online]. Available at http://www.saceec.com/membership.]Accessed 22 November 2017

Sher, Y. & Subban, V., 2016. Bowmans Law. [Online]. Available at: http://www.bowmanslaw.com/insights/preferential-pricing-system-scrap-metal-industry-working/. [Accessed 22 November 2017].

Slater, D., 2016. Mining Weekly. [Online]. Available at: http://www.miningweekly.com/article/new-initiative-aims-to-take-south-african-mining-into-a-modernised-future-2016-10-07. [Accessed 11 October 2017].

Southall, R., 2007. Ten Propositions about Black Economic Empowerment in South Africa. Review of African Political Economy, Volume 111, pp. 67-84.

The Department of Trade and Industry, 2007. The Industrial Policy Action, s.l.: s.n.

The World Bank, 2017. South Africa Economic Update: Innovation for productivity and inclusiveness, Washington: The World Bank.

Zalk, N. 2017. The Things We Lost in the Fire: The Political Economy of Post-Apartheid Restructuring of the South African Steel and Engineering Sectors. Thesis submitted for the degree of PhD, *Department of Economics, SOAS, University of London*.