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Growth and development policy

New data, new approaches, and new evidence

Part II: Southern Africa

Contents

Figures

Tables

1 Introduction

In contrast to South Africa, most of the other economies in the southern Africa region have grown reasonably rapidly over the past two decades. Recent experience has, however, highlighted the vulnerability of these economies to shocks, sometimes external and sometimes of their own making. For example, for two decades, Mozambique posted one of the fastest economic growth rates in the world. In 2016, a combination of governance failures, political instability (not unrelated to the governance failures), and lower commodity prices for coal and natural gas has generated an ongoing macroeconomic crisis. Per capita GDP growth in Mozambique is expected to be close to zero in 2016.

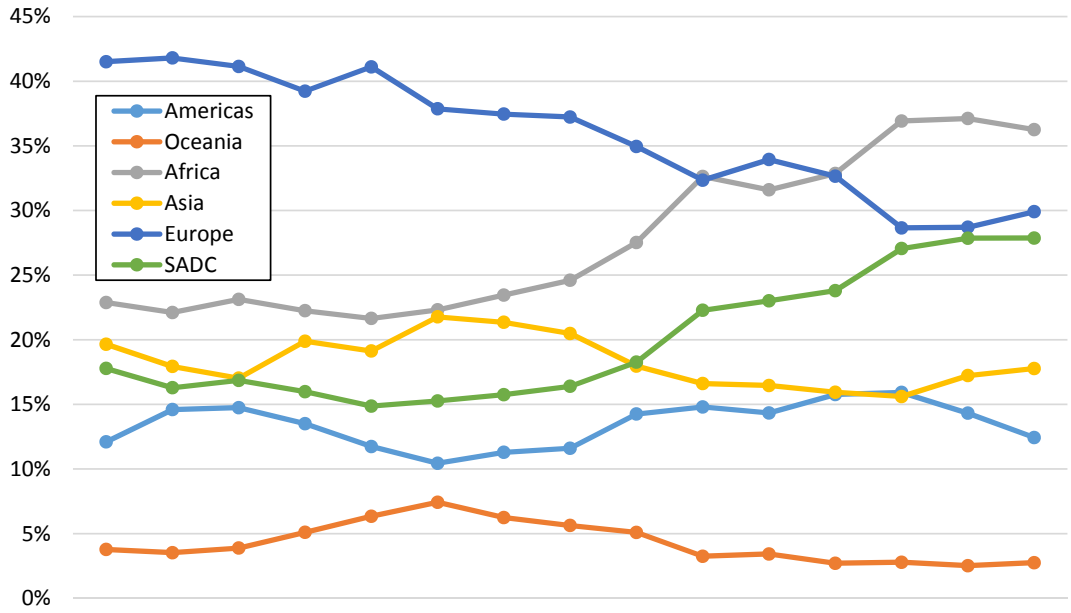
This note is part II of a series. Part I considered South Africa taking the rest of the world as given. Part II considers southern Africa as a whole. It takes stock of the experience of the past two decades and seeks to chart realistic paths forward from a regional growth and development perspectives. It is structured as follows. Section 2 provides background and motivation including a discussion of the philosophy of the research programme undertaken within the framework of this project. Section 3 considers six specific areas where a regional growth and development perspective may have particular promise. These areas are: the spread of regional supermarket chains; the poultry value chain; trucking; mining equipment and related services; energy including bioenergy; and confronting climate change. A final section summarizes and concludes.

2 Background and motivation

Improved growth dynamics in Africa in general and the Southern African Development Community (SADC) in particular combined with an improved political and economic environment within the region has led to rapid growth in trade in the region. Beginning from very small volumes in the immediate post-apartheid period, regional trade has grown rapidly and has now reached levels that imply considerable macroeconomic significance. For example, Figure 1 shows that Africa, driven principally by SADC, has become the largest destination for diversified manufactured exports from South Africa, surpassing the European Union in 2011.

This growth in trade is consistent with the objectives of the SADC free trade area (FTA) and the success that member states have realized in the implementation of the tariff phase downs agreed to within the framework of the FTA (Hartzenberg and Kalenga 2015). As noted in Part I of this series of notes, the growth in trade in goods has been accompanied by rapid growth in trade in services alongside very significant foreign direct investment in Africa in general and SADC in particular (notably by South African firms) in sectors such as retail, banking, insurance, transport, and business support services.

Figure 1: Shares of South Africa's diversified manufacturing exports (excluding basic metals and chemicals) by destination



Source: calculated from Quantec data.

Despite this growth, a series of concerns emerge with respect to the regional integration agenda. Within this context, the following observations are relevant.

1 Similar to many other regions of the world, the momentum for broad-based policy steps to enhance regional integration has slowed considerably or even ceased entirely. For example, the establishment of a SADC customs union was initially targeted for 2010. This integration milestone appears to have effectively disappeared reflecting a greatly reduced appetite for implementation of across-the-board policy steps to enhance trade and regional integration in southern Africa.

2 Frequent incoherence between national policies and the regional integration agenda. For example, the collapse of progress towards a customs union has left in place wide differences in the external tariff rates imposed by SADC member states and a concomitant growth in the profile of rules of origin and other non-tariff barriers (NTBs) to trade. In a broad review, Hartzenberg and Kalenga (2015: 31) conclude that 'most of the NTBs are not merely administrative in nature but are the result of policy and regulatory measures aimed at protecting domestic industries from regional competition'.

3 South Africa has experienced greater success in exporting to the SADC region than other member states have had in exporting to South Africa, particularly if fuels are excluded.[1] This is perhaps not surprising given the range of relatively high value goods available in South Africa and the concentration of export capabilities in a relatively few (often primary) commodities in other member states. The frequency with which trucks leave warehouses in South Africa full of goods destined for sale at (South African) supermarket chains in the region and return empty is emblematic of these imbalances.

4 A somewhat vague sense that substantial regional opportunities to spur growth or confront regional challenges are either not being realized at all or the pace of realization is much slower than it could be.

These four observations underpin the philosophy underlying the research programme that has been pursued for the past two years. There has been, for example, no effort allocated to analyzing the conditions under which a resuscitated effort to form a SADC customs union would yield broad based welfare improvements. Instead, the research programme has sought to focus in on six specific areas in the hopes of identifying "win-win" options for realizing growth potentials and for confronting regional challenges. This focus on specific opportunities allows for the identification of specific regional and national policy reforms that could enhance mutually beneficial trade including flows from the region to South Africa. The research programme also formally assesses the potential scope for broad based gains within the six areas in focus.

We turn now to these six areas.

3 Realizing growth potential and confronting regional challenges

3.1 Supermarkets are shaping routes to market across the region[2]

More than any other African sub-region, southern African countries have experienced strong growth in the number and spread of supermarkets over the past two decades. The two main South African chains (Shoprite and Pick n Pay) have rapidly spread across southern Africa. Together, these chains now account for 366 stores across 16 African countries, all but three of which are SADC countries. With a few exceptions, regional supermarket chains are dominated by South African companies that benefit from first-mover advantages in most countries in terms of establishing distribution centres linked to the roll-out of stores (see Table 1 for selected country information).

While expanding into new countries, supermarkets have also broadened their client base from the traditional high-end affluent consumers in urban areas. They are successfully penetrating new markets in lower income communities in both urban zones and towns supporting rural zones.

The processed and packaged food products sold in supermarket chains located outside of South Africa are largely imported from South Africa and deep-sea suppliers. For example, it is estimated that more than 80% of the products sold in supermarkets in Zambia are imported, mostly from South Africa.

1 See Sandrey (2015) for more detail. South Africa's imports from Africa have increased, but the increase is mainly driven by imports of fuels from Nigeria and Angola.

2 This section draws from Chigumira et al. (2016); das Nair and Chisoro (2015 and 2016); and Ziba and Phiri (2016).

This presents a challenge and an opportunity. For example, food processing has been growing in Zambia and the broader food, beverages and tobacco sector accounts for more than 70% of manufacturing value-added. The spread of supermarkets increases competition from imports. However, if local suppliers meet the standards and terms of the regional supermarket chains, then these chains can potentially open up regional markets to Zambian producers.

Table 1: Number of supermarkets and ownership in each country (main chain stores only)

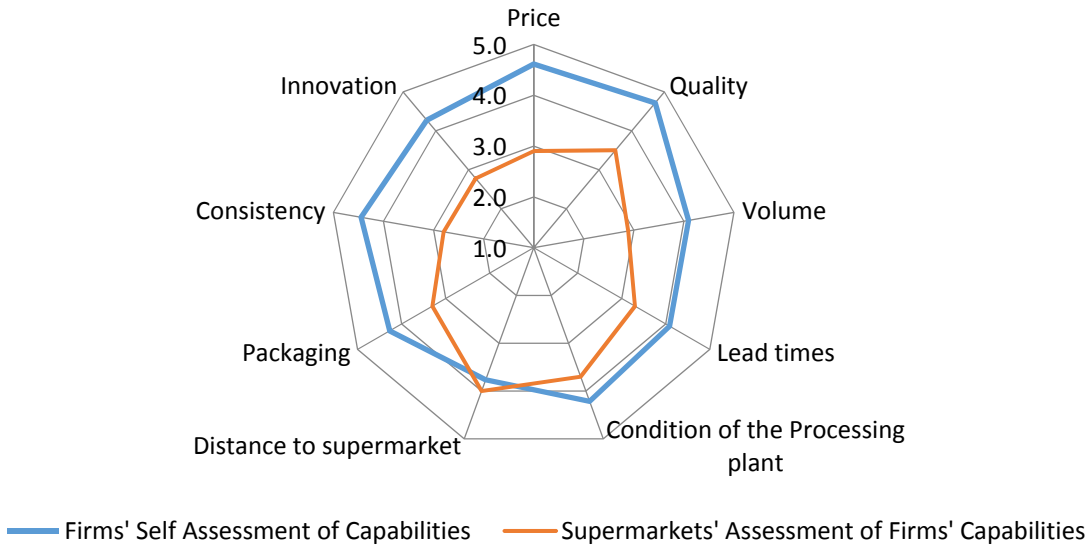
Botswana	South Africa	Zambia	Zimbabwe
Shoprite (11) - SA	Shoprite (1236) - SA	Shoprite (26) - SA	
Pick n Pay (9) -SA	Pick n Pay (1126) - SA	Pick n Pay (12) - SA	TM/Pick n Pay (55) – Zimbabwe/SA
Spar (28) - SA	Spar (821) - SA	Spar (16) - Netherlands	Spar (44) - SA
Food Lovers' Market (1) - SA	Food Lovers' Market (+100) - SA	Food Lovers' Market (2) - SA	Food Lovers' Market (5) - SA
Game/Walmart (2) - USA	Game/Walmart (117) - USA	Game (2) – USA	
Woolworths (22) - SA	Woolworths (166) - SA	Woolworths (2) – SA	
Choppies (73) - Botswana	Choppies (31) - Botswana	Choppies (2) - Botswana	Choppies (20) - Botswana
Shoppers (Sefalana) (23) - Botswana		Melissa (4) - Zambia	OK Zimbabwe (43) - Zimbabwe
Saverite (Trident Eureka/ Walmart) (17) - USA		PoundStretcher (3) – UK	Food World (6) - Zimbabwe

Source: Compilation from various sources, including country reports.

Supplying supermarkets means meeting government regulations on health, food safety and labelling, as well as private standards of supermarket chains and their requirements in terms of costs, quality, packaging, delivery schedules and quantities. These requirements imply significant investments in plant and capabilities.

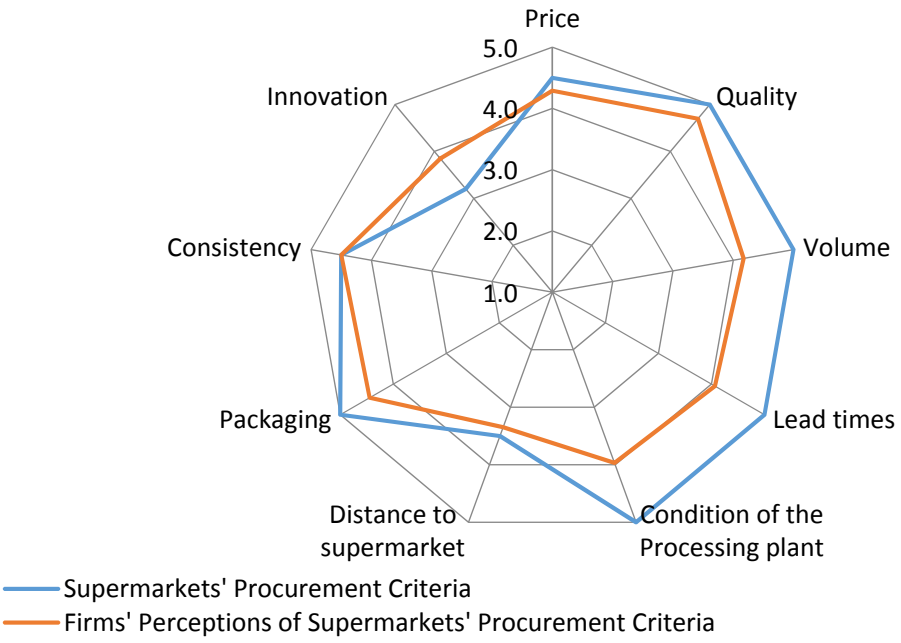
The results of a survey of supermarkets and suppliers in Zambia reveal that the perceptions of local suppliers of their capabilities deviate substantially from that of the supermarkets across the range of price and non-price dimensions (Figure 2). Specifically, Zambian suppliers rate their own capabilities much higher than the supermarkets do. Interestingly, Figure 3 indicates that suppliers and supermarkets are in closer, but certainly not perfect, agreement with respect to the criteria that suppliers must meet. These value chain misalignments matter in terms of supplier development because they imply that buyers and suppliers do not have a common understanding of the capabilities gaps that need to be addressed.

Figure 2: Suppliers and supermarkets assessment of suppliers' capabilities



Source: Ziba and Phiri (2016).

Figure 3: Suppliers' and supermarkets' understanding of key criteria



Source: Ziba and Phiri (2016)

The spread of supermarkets across the region mean they have effectively become key governors of routes to regional market for two reasons. First, on the supply side, they have invested heavily in regional distribution centres and logistics, which confers a high degree of control with respect to regional flows of goods. Second, on the demand side, the main supermarket groups maintain links with property developers in order to secure retail space in desirable locations on an exclusive basis. Local stores are left to occupy less desirable locations.

Hence, supermarkets provide opportunities for suppliers to reach first domestic and then regional markets. At the same time, they require suppliers to upgrade to meet government regulations as well as private standards of supermarkets and to supply large volumes, potentially with short lead times. The totality of these requirements is very often beyond the scope of smaller local producers. Market power is also an issue. Practices of the major chains such as category management, which places the responsibility for organising shelf space in the hands of the main (multinational) producers, also constitute a barrier to entry for local suppliers. This can mean that even where local suppliers are competitive, they are blocked or hampered from reaching consumers in the supermarkets as they are either unable to obtain shelf space or are relegated to the less desirable shelf space within the store.

In principle, supermarkets chains should compete with one another to offer the most desirable products at competitive prices. While this dynamic exists, a key observation is that individual supermarket chains are likely to substantially under-invest in supplier development given that the benefit that the supplier accrues cannot be appropriated by that supermarket. This is an important market failure. For example, if ShopRite works with a Zambian soap supplier such that the supplier attains the capabilities to meet the full set of requirements to supply soap on a regular basis to ShopRite, that same soap supplier will have simultaneously acquired the capability to sell to any other supermarket chain, limiting the ability of ShopRite to earn a return on their investment. In the absence of appropriate interventions, the continued spread of supermarkets may fail to generate the opportunities for regional supply mentioned above or, worse, further skew trade and production to South Africa as well as deep-sea imports.

In order to ensure that suppliers located outside of South Africa gain the capabilities to supply supermarket chains, a policy framework is required to ensure that supermarkets support local suppliers. The framework should facilitate more competitive and promising local suppliers to upgrade their capabilities and to blunt the possible market power that large supermarket chains are likely to have. As usual, the devils are in the details. Provision of effective subsidies to non-competitive, and often well-connected, local suppliers could hamper rather than advance regional growth and development objectives.

Some experience has been gained. In Zambia, soft interventions have induced supermarkets to increase local procurement of dairy, processed grains, edible oil and household products over the last five years. For example, Shoprite has made commitments to local procurement and has signed MoUs to work together with the Zambian Development Agency and private enterprise development programme.

This experience indicates that properly designed measures to increase local procurement and develop capabilities amongst local suppliers can succeed. Policies that encourage supermarkets as a group (addressing the market failure and market power issues discussed above) to engage with promising local suppliers with the goal of generating capabilities that are first nationally and then regionally competitive appear to offer considerable promise on a regional scale.

3.2 Regional food production: animal feed to poultry[3]

Relative to other meats, poultry is remarkably efficient in terms of the amount of feed required to produce one kilogram of animal weight. For efficient operations at an international level, this feed conversion ratio is about 1.7 for poultry meat (broilers) compared with about 3.0 for pork and more than 10 for beef (Tolkamp et al. 2010). This efficiency makes poultry a relatively inexpensive source of animal protein, and this cost advantage has propelled rapid growth in poultry demand globally including in southern Africa. In South Africa, poultry meat consumption increased by nearly 80% between 2000-14, becoming the most important source of protein in the diet of South Africans (Esterhuizen 2015).

Although poultry production has increased substantially on a regional basis, almost all countries in southern Africa remain net importers. For example, South Africa experienced a trade deficit for poultry of US$274 million (or 22% of consumption) in 2015 and an oilcake trade deficit of US$153 million in 2015. Including the soya bean trade deficit of US$49 million in 2015, the total trade deficit related to the poultry industry in South Africa is US$476 million. Nearly all of these imports are sourced from deep-water sources, such as Brazil.

Displacement of these deep-water imports by regional sources constitutes a significant opportunity for countries such as Zambia where there is potential for substantially expanded production of the main components of animal feed (maize and soya). A shift in production patterns for poultry away from South Africa and towards the region constitutes and even greater opportunity in a rapidly growing sector. Low feed cost is a principal source of competitive advantage in poultry production. And, growth in Zambian feed production has been rapid. Indeed, Zambia moved to being a net exporter in 2013/14, mainly to the DRC, Zimbabwe and Malawi.

A remarkable aspect of the feed to poultry regional value chain has been the regionalization of investment flows. Commercial poultry in the region is largely undertaken by businesses which are associated with three main South African based groups, Rainbow (RCL Foods), Astral and Country Bird Holdings (CBH). These groups operate across countries in the region, including through alliances and joint ventures with local businesses in different countries. They typically have some vertical integration into breeding and feed supply. There are other important participants in countries with strong capabilities at one or more levels, such as National Milling Corporation in Zambia with capabilities in milling linked to animal feed, and Zamchick, which is part of the Zambeef group, focused on meat production. Irvine's in Zimbabwe and Hybrid in Zambia are both long established in poultry.

The two main inputs to poultry meat production are feed and breeding stock. These make up 58% and 13% respectively of the cost of a processed chicken. Breeding operations produce parent stock and supply the day-old chicks for broiler production. There are significant scale economies in breeding operations. Feed requires processing facilities for the crushing of soya beans and the milling of maize, together with combining of additional ingredients such as vitamins and supplements. Finally, the chickens have to be slaughtered, processed and supplied to retail outlets and the fast food industry, meaning investments in abattoirs and the cold chain for distribution to these outlets.

A competitive industry thus requires coordination and linked investments in scale operations, where the different components of the supply chain are brought together. At the firm level, this is achieved through significant vertical integration, from feed production (and sometimes even primary maize and soya bean production), downstream into broiler production, processing and distribution. These firms also hold rights to breeding stock, typically on an exclusive basis, from European and North American multinational corporations, with just two breeds, Ross and Cobb, predominant in the region.

While vertical integration can support the large linked capital investments required at different levels of the value chain, the concentration means that there are concerns about market power and anti-competitive conduct. This has been evident in a number of competition cases in South Africa and Zambia involving poultry producers. It also appears to be evident in the pricing of day-old chicks in Zambia. In 2012, day-old chick prices in Zambia were more than twice that in South Africa. Increased investment in production and competition in breeding stock brought a halving of those prices in Zambia from 2012 to 2015.

3 This section draws from Ncube, Roberts, and Zengeni (2016a and 2016b).

Crucially, investment in production capacity and capabilities needs to be achieved at the regional level across southern Africa if it is to compete against the deep-sea imports, which are, as noted, landed in substantial volumes in South Africa. The potential for expanded production of animal feed and its constituent crops exists in countries such as Zambia, Mozambique, and Zimbabwe where there are the appropriate fundamental conditions in terms of land and water.

Zambia has executed a ten-year plan from 2005 which underpinned rapid growth from feed through to poultry. This has almost tripled production of feed over the decade. Animal feed growth outpaced poultry, and has changed the country into a net exporter, to neighbouring countries. The main investments have been made by the largest three regional companies identified above, including through local partnerships.

While the main companies are regional in scope, there is no coordinated regional policy to address obstacles to improved competitiveness and higher levels of growth. In particular, the regional dimensions of production and supply mean that transport and logistics are crucial to the efficiency of the poultry value chain. We turn to transport issues in the next sub-section.

3.3 Intra-regional transport, regional value chains and cost competitiveness[4]

Transport and logistics infrastructure is critical to reducing the costs of trade in goods and services and underlies deepening integration in value chains. It is not simply about costs but about the overall efficiency and dependability of logistics which enable producers to integrate operations across borders in the region and overcome a legacy of fragmented economies. This legacy means that regional suppliers are undermined in competing to meet the demand of the main markets in southern Africa of which the biggest is the Gauteng Province in South Africa. At present, it is cheaper in terms of transport costs for deep-sea importers to supply this market than it is for producers in countries such as Zambia.

Road networks, in particular, are the mode by which a significant majority of goods are transported in the southern African region and understanding efficiencies, cost and price drivers, investments and market dynamics along road networks are therefore critical. Prices charged for overland cross-border freight in southern Africa remain higher than in other regions despite the input costs of road transportation (vehicles, fuel and drivers' wages) apparently being lower than those in Europe and North America.

Benchmarking indicates that transport costs from, for example, Zambia to Gauteng are around twice what they should be. As a result, it is less costly to import products such as animal feed and refined sugar to South Africa from South America than to source both products from Zambia, even though Zambia is very competitive in terms of production costs. With animal feed costs at around US$400/tonne in 2015 and transport costs at above US$100 from Zambia to Gauteng instead of a competitive benchmark of US$40/tonne, transport costs effectively break the regional value chain and favour trade instead deep-sea markets. Reducing transport costs by half would improve the competitiveness of regional producers of commodities, such as animal feed, by more than 10%, supporting stronger regional growth through integration.

The costs are partly due to border delays. Border delays add around US$20/tonne to costs per day of delay for a bulk load and have a larger impact on sensitive goods such as perishable foods. Uncertainties about the time taken for intra-regional freight, however, have a much greater impact than simply the direct cost. Where the products being transported are intermediates in a value chain, the coordination of activities requires being able to plan production. A delay at one level can mean production is stalled with potentially huge knock-on inefficiencies along the chain. As discussed in section 3.1, competitive supply of final goods to retailers also requires on-time delivery as lead times are an important non-price consideration.

In addition, there have been a number of competition concerns about road freight and trading (see also Ncube et al. 2016a and 2016b). Regulatory restrictions can act as barriers to competitive rivalry and protect insider transport groups who can maintain higher prices. These restrictions include rules about who can collect and deliver cargoes in countries as well arrangements where firms have control over critical facilities such as for storage. While such practices can support a local business grouping against bigger regional rivals, the costs are substantial if it undermines a country's exports. Delays and obstacles can also be easily affected through standards and certification which are used by incumbents to block rivals rather than enforced as appropriate.

Improving intra-regional transport and logistics therefore requires joint action across a range of inter-related areas including border controls, standards, control over storage facilities and fostering increased competition and investment. In turn, this depends on appreciating the benefits of two-way trade and not viewing other countries simply as being markets for South African producers. For example, section 3.2 highlights the major opportunities in the poultry value chain, where constraints of water and environment mean that South Africa is a large net importer and likely to remain so. The industrial development of the

4 This section is based on Vilakazi and Paelo (2016a and 2016b).

region as a whole requires appreciating the shared benefits more broadly of expanded production and improved manufacturing capabilities matched by lower transport costs.

The spread of supermarkets across the region provides further opportunities for transport on the backhaul trucking legs. The question is whether a more integrated region can mean growth in regional value chains to meet this demand. Recent developments have instead seen increased protection and trade barriers, particularly non-tariff barriers, being erected.

3.4 Mining as a spur to regional growth and industrial development in southern Africa[5]

Driven by rapid growth in mining and related infrastructure investment, exports of machinery and equipment from South Africa to SADC countries more than quadrupled over 2003-13. More recently, a more subdued commodity price environment has slowed growth and exposed differences in mining capacities, knowledge and demand across southern African countries. Recent analysis also illustrates a lack of coherence and clear policy objectives related to mining and industrial development in the region. Despite lower commodity prices, ample potential for growth remains, particularly from a regional perspective. The creation of a regional system of innovation would help to realize this growth potential

Partnerships are urgently needed between and across countries to build capabilities as well as to leverage existing knowledge and problem-solving skills. Natural resource policies related to mining have tended to focus on the national level, yet existing opportunities are principally regional in nature. At a regional level, southern Africa remains blessed with both substantial endowments of valuable mineral resources and advanced capabilities in resource extraction including manufacture of specialized mining equipment. Yet, the most promising endowments are located outside of South Africa while the strong capability base is located in South Africa.

Partnerships are needed to realize this regional potential. Mining frequently does not lend itself to 'cookie-cutter' solutions. Extraction techniques and related equipment are frequently location- and situation-specific with implications for the equipment employed. A regional system of innovation would solve problems through adaptation and customization, linked to skills and design. Regional institutions in research and training are critical for this to be achieved.

South Africa is currently the hub for mining machinery and services in southern Africa. South Africa accounts for a large share of mining related imports by countries in the region (Table 2). For South African equipment manufacturers and service providers, exports account for a substantial share of output (equivalent to around 75%). Given the ongoing decline of mining in South Africa due essentially to resource exhaustion, the future of the mining equipment and services industries are likely to become even more dependent on export markets. As a consequence, original equipment manufacturers (OEMs) of mining capital equipment in South Africa have taken up regional strategies.

South Africa also has developed a national system of innovation in mining capital equipment and engineering services. As such, it could provide the base for the development of a regional system of innovation to meet the growing needs of local countries and provide the foundation for the lateral growth of capabilities in capital equipment and mining-related services in the region.

South Africa retains three centres for public mining-related research, housed at the Council for Scientific and Industrial Research, MINTEK, and universities, including the South African Minerals to Metals Research Institute – a collaboration between universities and industry.

At the same time, universities in neighbouring countries have weakened over time. This weakening serves nobody's interests. The need is for a vibrant regional system of innovation. The South African national system of innovation, in partnership with industry such as the OEMs mentioned above, could play a critical role in shaping a regional system that capitalizes on existing strengths while expanding opportunities for all.

5 This section draws from Fessehaie, Rustomjee and Kaziboni (2016a and 2016b).

Table 2: Capital equipment imports by selected SADC countries and % from South Africa

	Imports, Rbn Avg (2012-14)	From South Africa, %
Zambia	5.6	37
Namibia	4.7	63
Botswana	4.3	73
Mozambique	4.1	42
DRC	3.5	48
Zimbabwe	3.4	57
Angola	1.0	13
Tanzania	0.9	9
Swaziland	0.8	83
Malawi	0.6	25

Source: Quantec.

To build a regional system of innovation for capital equipment and engineering services for mining, policies must target regional capabilities and industrial development. Institutional collaborations between South African institutions and partners in other countries can rebuild capacity in research institutes and universities to address Science, Technology, Engineering and Maths (STEM) disciplines. In the relatively near term, development finance and support for complementary cluster initiatives could be employed to build a regional hub in Zambia linked to the cluster in South Africa.

3.5 Energy

Global energy markets are currently marked by a high level of flux. The character of future energy systems is perhaps more uncertain than at any time over the past century. There are two principle drivers of change in energy systems.

First, global environmental change linked principally, but not exclusively, to energy use is forcing a reconsideration of energy production and use patterns on a global scale. The discussion over stranded fossil fuel assets is indicative in this regard. IPCC (2014) estimates a carbon budget that would limit global temperature rises to two degrees Centigrade above pre-industrial levels, which amounts to between 1/5th and 1/3rd of the world's proven reserves of oil, gas and coal. As noted by Mark Carney, the Governor of the Bank of England, 'if that estimate is even approximately correct, it would render the vast majority of reserves "stranded" – oil, gas and coal that will be literally unburnable without expensive carbon capture technology, which itself alters fossil fuel economics' (Carney 2015).

In an open letter, Royal Dutch Shell PLC, a major oil and gas company, counters that oil demand will continue to grow with two consequences. First, Shell's oil reserves are not, in fact, stranded (hence, they are valuable); and, second, as a consequence of the emissions from burning these reserves, the two degrees Celsius target is highly likely to be breached by the end of the century (Royal Dutch Shell 2014). Shell projects growth in demand for fossil fuels in general and oil in particular due to a lack of plausible alternatives to fossil fuels, which brings us to the second principle driver of change.

Rates of technical advance in clean energy technologies have been notably rapid, particularly in the last decade. In terms of electricity generation, since 2008, the global solar module price index has fallen by a factor of nearly four, a rate of technical advance vastly more rapid than nearly all predictions (Feldman et al. 2014). Declines in the cost of wind power — while not as dramatic — have been rapid by any standard (Moné et al. 2015). Gains in systems integration are leveraging this rate of advance in renewable technologies by better accommodating the inherent variability of solar and wind power generation, allowing electricity supply to meet demand at lower cost.

In terms of liquid fuels, bioenergy is now well established in Europe, the United States, and Latin America, notably Bazil. Williams (2016) takes stock of ongoing technical advance in bioenergy. Cogeneration of electricity in the production of biofuels and the spread of electric cars, aided by significant advances in battery technology, are blurring the distinction between electricity markets and markets for liquid fuels. Overall, these advances substantially ease the political economy of clean energy transitions (Arent et al. 2016), but they do not guarantee that they will occur.

Viewed from the perspective of southern Africa, the range of choices for future energy systems are very broad. This broad array of choices is, in many respects, a function of endowments. The hydropower potential from the Zambeze and, especially, the Congo River is enormous (Arndt et al. 2016; Swanson 2016). Solar power potential is particularly high, and good sites for generating wind power are available

(Fant 2016). As shown by von Maltitz et al. (2016), fundamental production potential for bioenergy is also very high on a regional basis.

Focusing on renewables, the range of options and their geographical spread creates opportunities in terms of systems integration. Gebretsadik, Fant and Strzepek (2014) show that integrated operation of hydropower on the Zambeze and wind power systems in promising locations have the potential to complement one another. Specifically, dams can effectively serve as batteries by running fewer turbines during periods of high wind power output and running more turbines during periods of low wind power output. The result is up to a 30% increase in wind power generation with the same, or even improved, efficiency for the remainder of the system (mainly coal and hydropower).

On a regional scheme, fossil fuel resources are also abundant, particularly with the large reserves of natural gas and coal that are coming online in Mozambique.

Given the pace of technical advance, notably in renewable generation technologies and systems integration, energy strategies for the southern Africa merit further study. Nevertheless, at least two points are clear. First, institutional models, particularly for the power sector, require reform. In South Africa, institutions in the electricity sector largely hale from an era where one dug coal out of the ground, burned it in a nearby power plant that the state owned, and distributed the resulting electricity around the country on a state-owned grid. This era is rapidly disappearing. Like almost everywhere, energy sector institutions in southern Africa are being subjected to serious winds of change.

Second, a regional perspective on energy offers greater potential than a series of national perspectives. With continued rapid technical advance in renewable systems combined with discovery of new fossil fuel resources and elsewhere, the likelihood is that this observation becomes increasingly relevant over time.

3.6 Climate change impacts and adaptations

Detailed analyses of climate change impacts have been undertaken for the southern Africa region. The case of South Africa is in focus in Cullis et al. (2015). A special issue of *Climatic Change* details impacts for countries that contain the Zambeze river valley including Malalwi, Mozambique, and Zambia (Arndt and Tarp 2015; Arndt et al. 2015). A series of observations emerge.

1 Regardless of the global mitigation regime pursued, countries of the southern Africa region can expect higher temperatures by 2050. Mitigation policies do impact the extent of temperature increase. For example, for South Africa and in the absence of constraints on global emissions, the annual temperature is expected to increase by a minimum of 1.0 or a maximum of about 3.0°C by 2050, with the most likely increase in the range of 1.5 to 2.0°C. Under strict global emissions policies, a smaller increase in temperature is expected ranging from about 0.5 to 2.0°C, with the likely increase being around 1°C.

2 Precipitation outcomes are far more uncertain with the potential impacts ranging from increases to decreases in precipitation for nearly every region of southern Africa though drying is particularly likely in the south-west. Strict mitigation reduces the range of potential changes in precipitation outcomes.

3 In the absence of emissions constraints, implications for economic growth to 2050 are typically negative. By 2050, GDP is typically one to four or five per cent smaller compared with a fictional no climate change scenario, though impacts do vary by country. Mozambique exhibits the greatest range of potential outcomes due principally to high vulnerability to flood events. Impacts for South Africa are smaller and less variable than for the regional economies considered.

4 The more limited vulnerability of South Africa, compared with its neighbours, to climate change impacts is due to a lower concentration of economic activity in climate sensitive sectors and extensive water resource infrastructure. Available infrastructure allows water to be transferred between different regions of the country to meet demand, substantially increasing the robustness of the water-supply system to the vagaries of climate change and reducing the chances of major disruptions in water supplies, particularly for municipal and industrial use.

5 While climate change can be expected to hamper growth and development prospects, climate change appears unlikely to derail development prospects by 2050. For example, if GDP impacts fall in the range of a one to four per cent reduction as mentioned in point 3, then most countries could expect to attain the level of GDP achieved in the absence of climate change with a one year delay, in about 2051. However, climate change impacts tend to become larger with time (i.e., greater impacts in the 2040s than in the 2030s or 2020s) and can be expected to be substantially larger in the latter half of the twenty-first century, especially in the absence of globally-effective mitigation policies.

6 Effective global mitigation policies reduce the range of likely impacts by 2050 and typically shift the distribution of outcomes towards less harmful ranges. The implications of global mitigation for fossil fuel prices over the next 35 years substantially shifts the incidence of mitigation policies between fossil fuel exporters and importers (Arndt et al. 2015). If forward-looking agents conclude that a substantial share of global proven reserves of fossil fuels are likely to be stranded, fossil fuel prices are likely to decline, even in the relatively near term, conferring terms of trade benefits to structural fossil fuel importers such as Malawi, Zambia, and South Africa and terms of trade losses on fossil fuel exporters such as Angola.

7 Regardless of the global mitigation regime pursued, concentrated impacts of climate change can be expected in vulnerable sectors and regions. In other words, while overall impacts may not be particularly large over the next three decades or so, localized impacts on some sectors and/or regions are likely to be intense strongly affecting vulnerable sub-populations.

4 Implications

In sections 3.1, 3.2 and 3.3, this issues note looked at three areas within regional value chains, namely retail (supermarkets), production (with a case study on the animal feed to poultry value chain), and distribution (transport and logistics). One of the most striking findings is the inconsistency between growing regional trade flows and the slow progress in developing integrated value chains. The main supermarket chains operating in the region are South African. The same holds true for investment in the animal feed to poultry industry, which is dominated by three South African integrated producers. Overall, supermarkets have supported increased exports of processed foods from South Africa and imports through South Africa from deep sea sources.

However, supermarkets' domestic sourcing in the region has been limited. Penetration of Zambian, Botswana and Zimbabwean consumer product exports to supermarket outlets across the region has been even more rare. The supermarket-sourcing patterns therefore have not supported two-way intra-regional trade.

While the growth of supermarkets in the region has improved competitive pricing and accessibility to a broader range of products and services in the different countries, it has also imposed challenges on the ability of suppliers (specifically small farmers, food processing and manufacturing firms) to enter the supermarkets' supply chains. The obstacles include meeting supermarkets' standards and packaging, investing in productive capabilities, cost competitiveness in sourcing and processing agricultural produce, and policy barriers to regional value chains.

At the same time, South African poultry companies have made significant investments in domestic production capabilities in the region, but this has not translated into substantially increased intra-regional trade of intermediate and final products. This is particularly problematic in areas where some countries hold an evident potential comparative advantage, such as Zambia's production of soya bean, maize, and animal feed.

There are two main culprits for these bottlenecks. The first one is narrowly-defined policies which protect domestic interests in each country but do not support the development of integrated regional value chains. The second one is high transport and logistics costs.

Supermarkets are integrating the region through their investment in transport and logistics but not necessarily in ways supportive to local producers. The issue is how they can be partners in regional industrial development in order to move the southern African region to being a net exporter of food products.

This requires a combination of: a regional code of conduct for supermarkets; supplier development initiatives with targets for local sourcing; and, agro-processing policies to build industrial capabilities of suppliers, with supermarkets as key routes to market. The code of conduct is necessary to ensure the retail space is open, shelf space is available to smaller brands, and anti-competitive arrangements are not employed to restrict rivalry. The supplier development initiatives combine advice on standards and supply requirements with commitments to stock products. It means that supermarkets (likely in association) take on a critical role in fostering local supplier capabilities in order to meet concrete targets for local and regional sourcing. Without these expectations, individual supermarket chains do not have the incentive to develop suppliers who can also sell to their rivals.

Industrial development policies should also be targeted at the main value chains, such as poultry illustrated here, combining financing of productive capacity with support at different levels of the value chain. Transport and logistics efficiencies are a critical factor in improving the competitiveness of regional value chains as they impact on the delivered cost of agricultural inputs for processing to supply to urban markets.

The constraints of land and rainfall mean that feeding large urban areas requires sourcing agricultural produce from substantial distances away. This challenge is likely to increase with the expected variability in weather under climate change.

A regional scope of analysis of food markets which includes transport and related standards is required if the southern African region is to support investment in expanded output and not become even more dependent on deep-sea imports. There are also important related factors to be considered, such as the regulatory environment for transportation between countries as well as the competitive dynamics between providers of transport services.

Small-scale producers make up a large number of agricultural producers in many African countries where agriculture is the economic pillar, and are key to diversified industrialization and providers of employment. Light manufacturing industries are also typically relatively labour-intensive and have linkages with other sectors of the economy. Meaningful inclusive growth requires opening up opportunities across the region to these producers.

In section 3.4, a different dynamic is in play. After more than a century of intensive activity in extractive industries in South Africa, the resource base, especially with respect to easy to reach deposits of high-value minerals, has been largely exhausted. As discussed in part I of this issue note series, South African mining firms have been forced to work harder to produce less real output, resulting in a measured decline in the productivity of mining in South Africa.

While mineral resources are substantially depleted in South Africa, this is not true in the region. Low commodity prices notwithstanding, solid potential exists for extractive industry growth throughout the sub-region. The bottom line is that the mineral deposits are located outside of South Africa while substantial capabilities for efficient operation of mines, including the manufacture and servicing of specialized mining equipment, reside within South Africa. These capabilities will either be applied outside of South Africa in a manner that benefits the region as a whole or they will wither.

Section 3.5 highlighted the state of flux that characterizes global energy markets due to global environmental concerns and rapid technical advance in many low-emissions energy systems. Because southern Africa is well endowed in hydropower, solar, wind, and bioenergy potential, as well as in traditional fossil fuel resources such as coal and natural gas, the range and potential complexity of choices is notably broad. A regional perspective, including institutional reform, has a high upside. While a great deal has been done, the currently fast moving nature of the energy sector implies that future work is merited to trace the best paths forward.

Section 3.6 underscored the near certainty of substantial temperature rise over the course of the twenty-first century and the very broad uncertainties associated with the implications of that temperature rise. For example, for the large majority of southern Africa, it is not known whether climate change will bring greater or lesser precipitation on average. In response, the value of flexibility is highlighted. In South Africa, for instance, the investments made in water supply infrastructure help substantially to cope with the vagaries of climate change. Maintaining or improving this infrastructure is a clear policy priority.

For the region as a whole, the uncertainties associated with climate change highlight the importance of education and competent institutions. Because the exact impacts of climate change are nearly impossible to predict **a priori** and will unfold over decades, a policy of developing the capability to respond to challenges as they emerge is both good development strategy and a sensible element of the response to climate change.

Finally, the gains from effective global mitigation policies are notable by 2050 and become much more pronounced in the second half of the twenty-first century. The regional as a whole has incentives to see effective global mitigation policy emerge.

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