



**CCRED**  
CENTRE FOR COMPETITION,  
REGULATION AND  
ECONOMIC DEVELOPMENT

# Market development for regional industrialization and sustainability: the case of the soybean to poultry value chain

Grace Nsomba and Olwethu Shedi  
CCRED-IDTT Working Paper 2023/09  
May 2023

The Centre for Competition, Regulation and Economic Development (CCRED) is an academic research centre housed in the School of Economics at the University of Johannesburg's College of Business and Economics. CCRED specialises in research, teaching and advisory services for government and non-governmental organisations on competition policy, industrial development and value chains in Southern and East Africa.

The Industrial Development Think Tank (IDTT) is supported by the Department of Trade, Industry and Competition (the dtic) and is housed at CCRED in partnership with the SARChI Chair in Industrial Development at the University of Johannesburg. CCRED Working Papers contain work in progress by CCRED and IDTT researchers. They may include documentation which is not necessarily published elsewhere. CCRED Working Papers are published under the responsibility of the author(s) alone.

## About the authors

**Grace Nsomba** is a Researcher for the Centre for Competition, Regulation and Economic Development (CCRED) at the University of Johannesburg.

**Olwethu Shedi** is a Researcher for the Centre for Competition, Regulation and Economic Development (CCRED) at the University of Johannesburg.

---

CCRED: Centre for Competition, Regulation and Economic Development

69 Kingsway Ave,  
Auckland Park,  
Johannesburg, 2092

E-mail: [infoccred@uj.ac.za](mailto:infoccred@uj.ac.za) | [www.competition.org.za](http://www.competition.org.za)

CCRED publications can be downloaded free of charge from  
[www.competition.org.za/publications](http://www.competition.org.za/publications)

© CCRED 2023 and the authors



**CCRED**  
CENTRE FOR COMPETITION,  
REGULATION AND  
ECONOMIC DEVELOPMENT



**the dtic**

Department:  
Trade, Industry and Competition  
REPUBLIC OF SOUTH AFRICA



SARChI Chair:  
Industrial Development

## Abstract

Agriculture and food systems are naturally among the most vulnerable to the effects of climate change. Southern Africa is a climate-change hotspot, with greater than average increases in temperature and declining rainfall in the southern parts of the region. However, there is good average rainfall and abundant water for agriculture in the northern parts of the region, such as in the northern parts of Malawi, in Zambia and in south-west Tanzania, which are some of the best areas in the world to sustainably expand agricultural production. This potential has been stymied, however, by the lack of effective regional value chain strategies to link increased agricultural production in some parts of the region with agro-processing activities in other parts so as to foster industrialisation and economic diversification in food production. This paper forms part of the Industrial Development Think Tanks workstream on regional industrialisation that studies selected value chains to understand the role of regional integration in building stronger regional food value chains that are inclusive, sustainable and resilient. We find that the soybean to poultry value chain holds great potential, given the scope to increase the production of the constituents of poultry feed in the northern parts of the region to match poultry production capabilities in countries such as South Africa. However, climate change poses great risk to the competitiveness of the value chain, with climate shocks having significant effects on agricultural production and the competitiveness along the value chain. Our findings point towards the need for a regional approach to climate adaptation to support regional agricultural industrialisation and sustainability, with South Africa at the forefront.

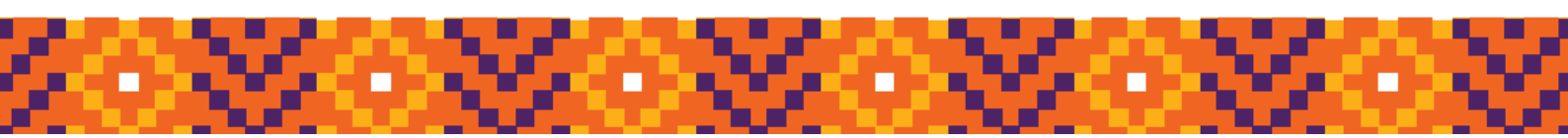
**Keywords:** Agriculture, food systems, transformation, climate change, poultry, value chains, regional integration

**JEL codes:** O13, Q13, Q18, L66, Q54,



## Table of Contents

1. Introduction .....	1
2. Transformative industrialisation in food value chains in the context of climate change..	2
2.1. Implications of climate change on the regional soybean to poultry value chain .....	4
3. Building a competitive regional poultry value chain.....	8
3.1. Key considerations for competitiveness in the poultry value chain.....	9
4. Conclusion and recommendations .....	15
5. References .....	17



## List of figures

Figure 1: Regional maize production .....	5
Figure 2: Regional maize trade balance .....	6
Figure 3: Regional soybean production .....	7
Figure 4: Regional soybean and oilcake trade balance .....	8
Figure 5: The poultry value chain.....	8
Figure 6: Producer price of broilers: fresh and frozen (R/kg) and broiler feed price (R/tonne) .....	10
Figure 7: Zambia exports and South Africa imports of soybean and oilcake .....	11
Figure 8: Broiler production, imports, exports, and consumption .....	13
Figure 9: South African poultry imports (left) and exports (right) .....	14
Figure 10: Malawi and Zambia soybean and oilcake prices against world prices .....	15



## 1. Introduction

Agriculture and food systems are naturally among the most vulnerable to the effects of climate change. Climate projections suggest that effects will include shifting growing conditions for production, increased climate and weather variability, and more uncertainty in predicting weather conditions. Extreme weather events (such as droughts and flooding) and climate patterns directly cause significant production volatility, which can induce secondary transition risks causing food supply chain disruptions.

Southern Africa is a climate-change hotspot, with greater than average increases in temperature and declining rainfall especially in the southern parts of the region. It is increasingly vulnerable to climate change because of its geographical location and socioeconomic development state (Scholes and Engelbrecht, 2021). However, there is good average rainfall and abundant water for agriculture in the northern parts of the region, such as in the northern parts of Malawi, in Zambia and in south-west Tanzania, which are some of the best areas in the world to sustainably expand agricultural production. This potential has been stymied, however, by in part the lack of effective regional value chain strategies to link increased agricultural production in some parts of the region with agro-processing activities in other parts so as to foster industrialisation and economic diversification in food production (Nsomba et al., 2022a; Banga and Balchin, 2023).

Research has further shown that food markets, particularly in the African context, are broken because of factors such as a lack of integration and the inability to address the impacts of climate change (Nsomba et al, 2022b, Roberts and Tshabalala, 2022). One of the outcomes of this has been that food is increasingly expensive, with prices in African cities generally being much higher than in other developing regions in the world (Roberts and Tshabalala, 2022; Allen, 2017; Nakamura et al., 2016).

Increased demand for food including processed foods driven by a growing and urbanising population in the SADC region, is evidence that a regional industrial policy for food value chains is pertinent. The poultry value chain illustrates this need. Chicken meat is one of the main, and cheaper, sources of animal protein and provides for a cost-effective alternative in the diets of the urban population. However, commercial poultry production to meet this demand relies on a competitive poultry feed industry which in turn requires sustainable supply of competitively priced maize and soybean as the main constituents for feed production. Therefore, given the concerning effects of climate change on agricultural production, the region is faced with important choices for climate change adaptation in order to support food systems in the long run. Strengthening regional food value chains, given that there is potential for increased agricultural production in some parts of the region that can meet already existing value addition capabilities in other parts, should form part of regional climate change adaptation measures. This can curb the effects that climate change has on localised food markets.

The SADC Industrialization Strategy and Roadmap, 2015 – 2063 (SADC roadmap) recognises regional value chains as an important tool in driving structural change and industrialisation, which is a good starting point, given that all members of the region stand to gain from structural change and industrialisation. It supports increased participation in regional value chains as a means of expanding production possibilities and enhancing the utilisation of natural and human resources. The key challenge with the SADC roadmap, however, is to identify and prioritise entry points into value chains, where coordination between and leadership amongst governments, policymakers, civil society organisations and the private sector are crucial in achieving the goals envisaged (Paremoer, 2021). As the regions' largest economy with relatively substantial production capabilities, South Africa's leadership in this regard is critical.

In the context of climate change, South Africa has made some progress towards developing response and adaptation strategies. However, the effects of climate change and what this means for agro-processing activities has to a large extent not been evaluated, more so where regional food value chains are concerned (Paremoer, 2021).

This paper forms part of the Industrial Development Think Tanks<sup>1</sup> workstream on regional industrialisation. The workstream studies selected value chains to understand the role of regional integration in building regional food value chains that are inclusive, sustainable and resilient. In this working paper, we consider the soybean to poultry value chain across selected countries in the SADC region to motivate for greater integration in the face of climate change. Central to our analysis is the effect that climate change continues to have on the variability in the production of key inputs, leading to pricing and supply volatility along the value chain with negative impacts in terms of cost competitiveness, participation and high food prices to consumers. This has been found to be the case in a number of countries in the region, including Zambia, Malawi and South Africa (Bosiu and Goga, 2019; Nsomba et al, 2022a; Gondwe, Nsomba and Roberts, 2022; Nsomba and Shedi, 2023).

Adopting regional climate change adaptation measures forms part of strengthening of regional value chains through ensuring that pockets agricultural production efficiently meet areas of agro-processing activities as a way of addressing the unfavourable outcomes that climate change has on food supply chains. We discuss a package of measures that can form part of regional climate adaptation measures where agricultural value chains are concerned, including the critical role to be played by South Africa in leading this agenda. This paper draws on information from the African Market Observatory (AMO), an initiative on the workings of selected food markets in east and southern Africa (ESA), housed at the University of Johannesburg and in partnership with competition authorities across the region.<sup>2</sup>

The paper is structured as follows. Section 2 outlines key considerations for transformative industrialisation in the context of climate change, with key considerations for the South African context. Section 3 details key considerations for building a competitive and sustainable regional poultry value chain, including the role of selected southern African countries as key sources of inputs. Section 4 provides conclusions and recommendations.

## **2. Transformative industrialisation in food value chains in the context of climate change**

The process of economic growth and development has often been referred to as a shift of resources out of low productivity activities into higher productivity manufacturing activities and services with manufacturing being distinct from agriculture (Cramer and Chisoro-Dube, 2021). However, increased agricultural production is the key input into agro-processing activities which subsequently serves as a vehicle for structural transformation and change. This is more so the case in Africa given that the continent's dependence on agriculture has remained unchanged relative to other regions in the world. The contribution of agriculture to GDP in Africa has fluctuated between 30 - 40% over several decades, whereas dependence on agriculture has declined in other emerging regions (Nachum, 2023; Ncube, 2018). Southeast Asia's agricultural share of GDP, for instance, dropped from 30 – 35% in 1970 to 10 – 15% in 2019 (Nachum, 2023).

There have been several successful experiences internationally of sustained economic growth and structural transformation that have been centred on agricultural value chains, such as in India, Mexico, Chile, Brazil and China (Chisoro Dube et al., 2018). However South

<sup>1</sup> <https://www.competition.org.za/idtt>

<sup>2</sup> Funding for the pilot phase from the COMESA Competition Commission is gratefully acknowledged.

Africa, and southern Africa more generally, have not been able to match the growth rates in agricultural exports achieved by these countries. The development of agriculture and agro-processing therefore still holds great opportunities for transformation.

While these opportunities exist, there is need to understand the risks that climate change invariably continues to pose on transformation in the agricultural context. Within the transformation agenda, there is need to address climate adaptation challenges amongst African countries while also moving food systems to a sustainable footing with lower emissions (Roberts and Tshabalala, 2022). These changes all work through market mechanisms, which are poorly understood. In addition, agri-food markets are highly concentrated at important levels from inputs through to trading and processing, which means that market outcomes are largely the result of the decisions of a small number of firms (Roberts and Tshabalala, 2022).

In the following sub-sections, we contextualise these challenges in the case of southern Africa, highlighting why South Africa needs to play a greater role in the transformation of regional food value chains in the face of climate change. Currently, intra-regional trade is low within the southern African region, with estimates suggesting that roughly 90% of total SADC trade remains with countries outside of the region, markedly lower than regions in Europe and Asia (Banga and Balchin, 2023). Majority of South Africa's imports from the region comprise fuels and textiles, and there is an overall low value-added share to these imports (Ncube and Tregenna, 2021). This points towards the limited development of regional value chains, proving that countries in southern Africa do not draw from each other's comparative advantage enough, including in terms of agricultural production and the manufacturing of food.

The southern African region depends on rainfed agriculture, meaning that extreme weather variability such as increased droughts and flooding as a result of climate change has unfavourable effects on the production of agricultural inputs into agro-processing value chains. Variable trends in production and supply are subsequently exacerbated by little investments in water management and irrigation systems. There are also consequences in terms of food security. In 2022 for example, the Horn of Africa experienced one of its most severe droughts in 40 years – following four consecutive poor rain seasons (Relief Web, 2022). Similarly in southern Africa, 2015/16 saw a severe drought while 2019 had southern African countries plagued by tropical storms, cyclones and localised flooding; both impacting the production of commodities such as maize and soybean, with significant price increases over the same periods (Nsomba et al., 2022b).

The El Niño Southern Oscillation (ENSO) is one of the most important weather phenomena which is characterized by three states - "El Niño", "La Niña" or "neutral". El Niño is a warming of the central to eastern tropical Pacific Ocean, with drought in southern Africa whilst inducing heavy rainfall and floods in eastern Africa. The 1982, 1997 and 2015 El Niño were identified as 'super', breaking new average temperature records and triggered catastrophic natural disasters including severe drought in Southern Africa (Rao and Ren, 2017; Roberts and Tshabalala, 2022). These are expected to be more frequent. In 2015/16 it brought the worst drought in 30 years to southern Africa (Roberts and Tshabalala, 2022).

As of January 2023, scientists have warned that there will be return of El Niño in the later part of 2023.<sup>3</sup> The countries that will be affected the most are the countries in the south of the region through the experiencing of droughts. The South African Weather Service has confirmed that parts of South Africa will be experiencing "extremely high temperatures that could lead to heat stroke and heat exhaustion" – this will have adverse effects on crop

---

<sup>3</sup> [https://www.cpc.ncep.noaa.gov/products/analysis\\_monitoring/enso\\_advisory/ensodisc.shtml](https://www.cpc.ncep.noaa.gov/products/analysis_monitoring/enso_advisory/ensodisc.shtml)



production (Ngwenya, 2023). As a result, there are concerns over crop production and subsequent price volatility in southern Africa.

Countering this requires appropriate measures such as buffer stocks, and better storage and logistics to enable regional trade between areas affected differently. These relate to adaptation requirements where regional integration plays an important role. In addition, Nsomba et al. (2022a) and (2022b) canvas how the structure of markets exacerbates the effects of climate change, where market information held by few integrated players affords them immense bargaining power that can be exerted against smaller market participants. Evidence of this is found in the poultry value chain in the east and southern African region (see Nsomba et al (2022a) and Gondwe, Nsomba and Roberts (2022)). In the poultry value chain, these outcomes have been found to manifest themselves in local markets but are nested in the regional context, given that there are few large players that are vertically integrated across borders with common alliances with each other.

However, backward linkages of agro-processing value chains into agricultural production mean that farmers play an important role in the upstream levels of agro-processing (Demmler, 2020). In the poultry value chain, for example, farmers involved in the production of inputs for poultry feed production are central to achieving competitiveness. If transformation is to be achieved, markets need to work well for these farmers. This means that mitigation and adaptation measures against climate change need to consider small farmers in order to aid the unlocking of opportunities as they relate to increasing production and accessing markets in a sustainable and resilient fashion. This includes the need for improved market information and addressing information asymmetries between large groups of farmers and a small number of buyers and processors, increasing access to inputs, storage and logistics as well as increased adoption of smart agriculture.

High levels of concentration in trading and poor storage alternatives have meant that small farmers must sell their harvest at low prices, which disincentivises farmers to increase their production. Powerful traders can then on-sell at much higher prices with big profit margins, with evidence of cross-ownership and vertical integration in trading, storage, transport and processing by few large players (Nsomba et al., 2022a; Nsomba et al., 2022b). Farmers are thus not able to reach local and regional markets due to a lack of information to facilitate their bargaining power, and lack of access to efficient and competitively priced trading, storage and transport facilities, which compound already existing trade barriers (Nsomba et al., 2022b; Banga and Balchin, 2023).

## **2.1. Implications of climate change on the regional soybean to poultry value chain**

Although South Africa is currently a large exporter of processed food products to the region (see Banga and Balchin, 2023), its commercial agricultural sector is expected to come under increasing pressure because of climate change. South Africa is located within what is considered a drought belt and is the fifth most water scarce country in sub-Saharan Africa; and approximately 50% of the country's water supplies are used by its extensive industrial agriculture sector (World Bank, 2021). On top of this, only 14% of the country is considered arable (USAID, 2018; World Bank, 2021). As with the rest of the region, South Africa is vulnerable to climate change due to its high dependence on rain-fed agriculture and a low climate change adaptive capacity (World Bank, 2021).

Forecasts to 2050 predict that the Northern Cape and the arid regions of the Free State and Mpumalanga will face the highest incremental increases in temperature in the country and will become drier as a result (Paremoer, 2021). In 2016, these three provinces accounted for

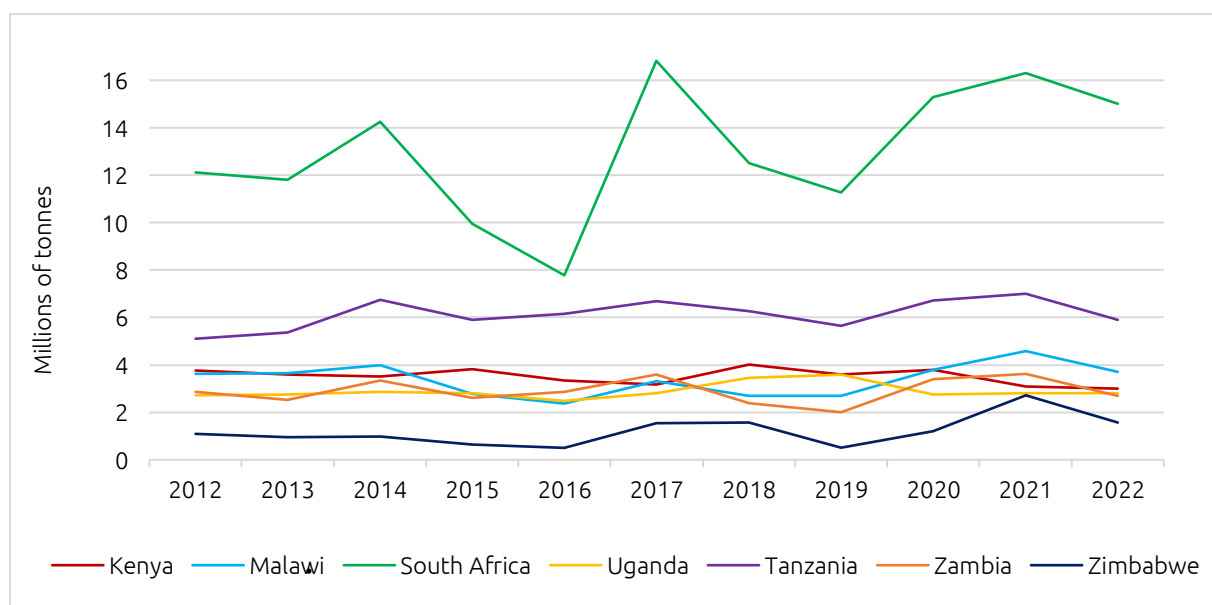
67% of South Africa's maize crop, 81.2% of the sorghum crop and 82.3% of the soybean crop. Declines in production and yield will have a significant effect on agricultural production in South Africa (Ainembabazi, 2018). The overall decrease in rainfall forecast within South Africa, coupled with increasing temperatures and more extreme weather events, mean that declining yield may be a long-term problem. Consequently, existing production capabilities may no longer be a good indicator of South Africa's future role within a given agricultural value chain.

These characteristics contextualise why regional trade is important to link agricultural production to areas across borders with investments and capabilities in agro-processing activities. We consider the regional poultry value chain in this regard. Maize and soybean represent key inputs into the production of poultry feed, which in turn is a substantial input into poultry rearing (see section 3). Critical to the value chain is the consistent and cost-effective supply of these inputs (together with day-old chicks). Given that weather variability, together with other factors, significantly impacts the production of maize and soybean, climate change adaptation measures need to be treated with urgency for the sustainability of the value chain. In order to support this, we analyse regional production and trade in maize and soybeans in the context of climate change to motivate for strengthened regional trade and integration as the basis for a competitive and sustainable poultry value chain.

### *Maize production and trade*

Maize is a major agricultural crop across southern Africa and is produced by smaller farmers in most of the countries, across large areas of land. Since 1970 maize production in the region has almost quadrupled reaching over 48 million tons harvested in 2018 (Bell et al, 2020). In 2015/16, South Africa together with other southern African countries such as Malawi and Zimbabwe experienced significant drops in agricultural production due to the severe drought. In general terms, crop production declined by approximately 66% across the region and led to a food crisis including in South Africa (Ainembabazi; 2018). South Africa produced 8 million and 10 million tonnes in 2016 and 2015 compared to 14 million tonnes in 2014 (figure 1).

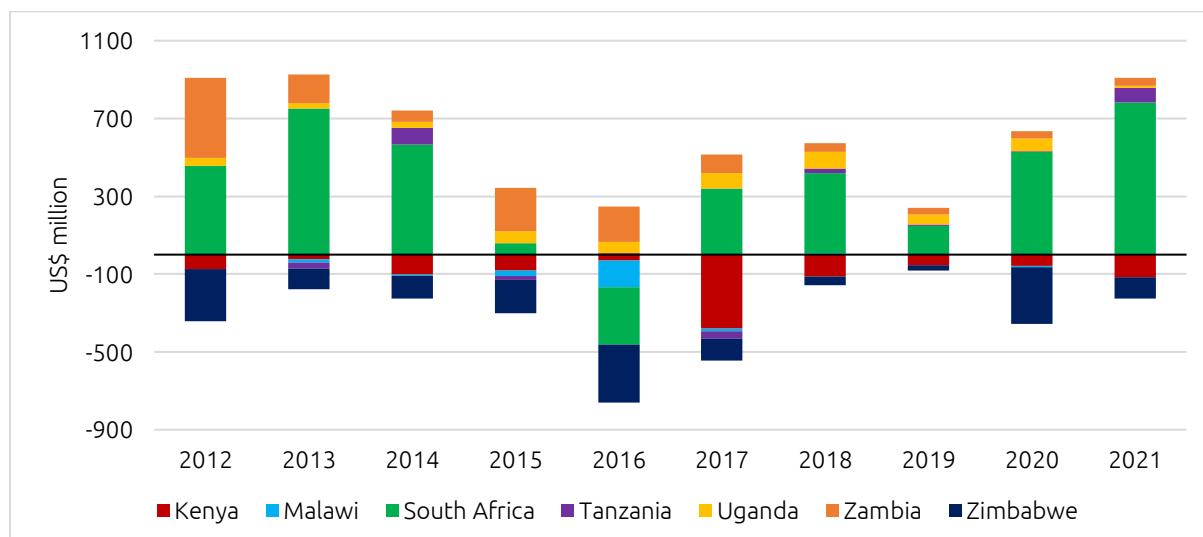
**Figure 1: Regional maize production**



Source: FAOSTAT

On the other hand, selected countries north of the region, such as Zambia and Tanzania, did not experience a significant drop in maize yields during the 2015/16 El Niño period. In fact, production in Tanzania grew slightly from 2015 to 2016, while Zambia has continued to maintain its export status in maize from 2012 to 2021 despite fluctuations in average production (figure 1 and 2).

**Figure 2: Regional maize trade balance**



Source: FAOSTAT

### ***Soybeans production and trade***

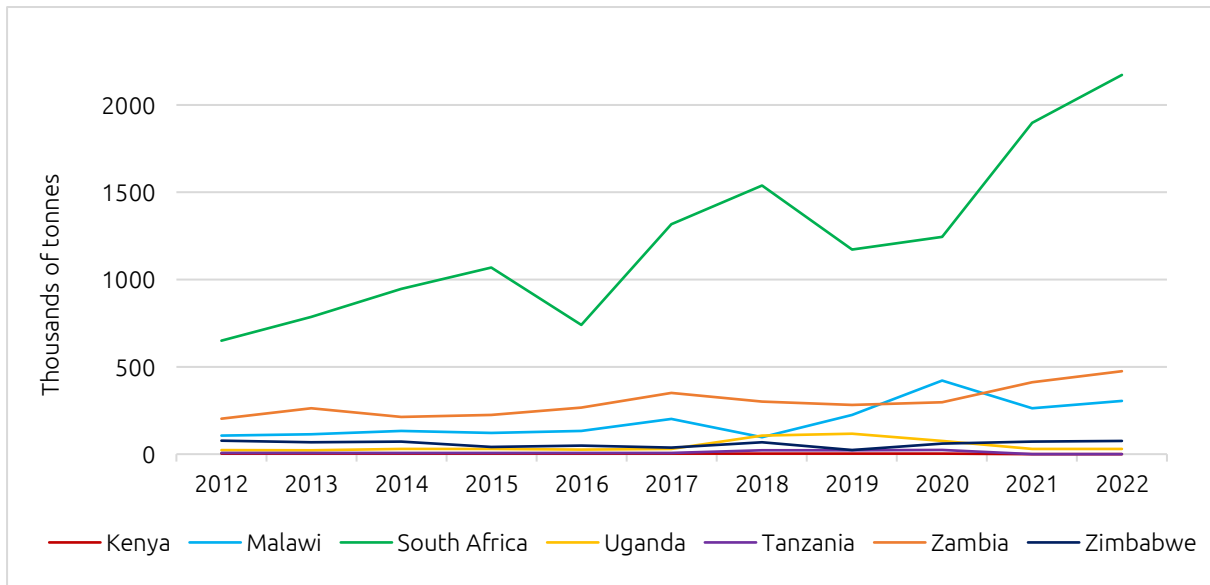
Soybeans are grown in tropical and subtropical climates and is one of the most valuable crops in the world, not only as an oilseed crop and for feed for livestock and aquaculture, but also as a good source of protein in the human diet and as a biofuel. The global soybean market is therefore driven by demand for the derivative products, through the crushing industry, where soymeal and soy oil are extracted. By far the most important driver of soybean demand is the animal feed industry which consumes around 80% of global soybean production (De Maria et al. 2020). A large proportion, more than 30% of soybean demand, is met by international trade (which would be an even higher proportion if we took trade in derivative products, such as animal feed, into account).

South Africa has made significant investments in expanding soybean processing capacity to meet the demand for animal feed primarily in the poultry sector. This has, in turn, encouraged increased soybean production. However, as a drought-prone country, South Africa's capacity to further increase soybean production is limited and investments have been made in developing drought resistant soybean cultivars more suited to the South African climate (Paremoer, 2021). However, increasing production levels in other regional countries motivates that a regional approach to increasing South Africa's soybean supply is appropriate, where countries such as Zambia and Malawi can serve as sources for unmet soybean demand. South Africa can then use scarce water resources for higher value crops such as fruit where it has already penetrated global markets (Cramer and Chisoro-Dube, 2021).

While South Africa, together with Malawi and Zambia, has recorded strong growth in soybean production, the 2015/16 drought also saw substantial drops in production levels (figure 3). However, despite the events of 2015/16, Malawi and Zambia did not experience

drops in soybean production. Malawi has experienced a steep increase in production, growing very strongly in 2019 and 2020, to over 400 thousand tonnes, quadrupling over two years and surpassing the levels of production which have been recorded in Zambia. Zambia's growth in production has been more gradual over the decade from a very low base and, given its demand which is relatively low compared to existing production capabilities (at around 200-250 thousand tonnes per annum).

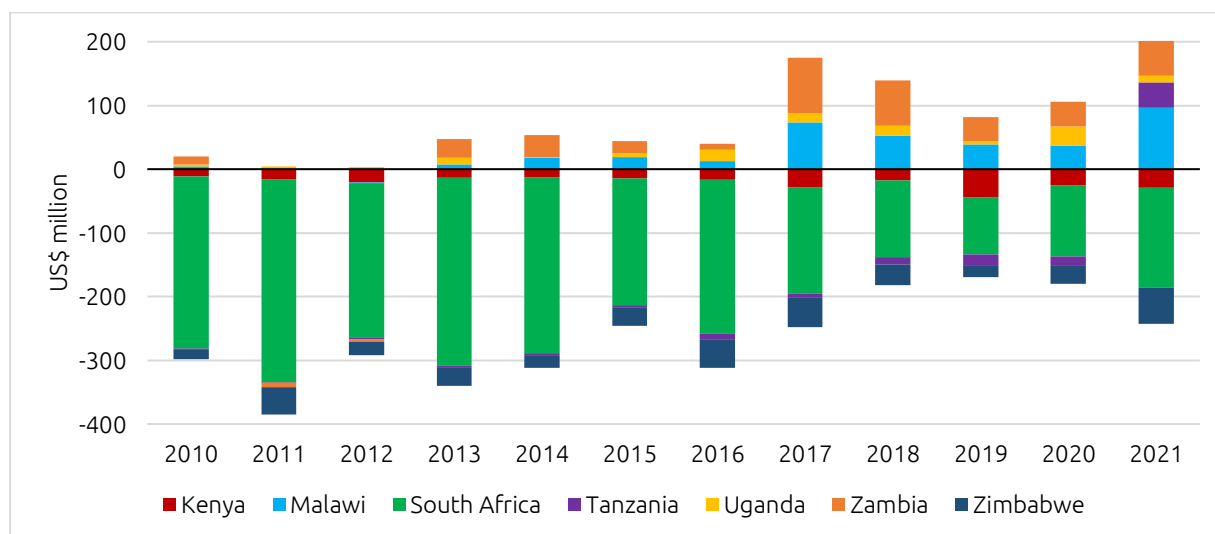
**Figure 3: Regional soybean production**



Source: FAOSTAT

Despite South Africa's growth in soybean production, it continues to experience a soybean deficit especially when derivative products are included. Demand is driven by commercial meat and dairy production, and the soybean price is a key factor in the competitiveness of local poultry production (Ncube, 2018). Urbanization and rising incomes mean and increased demand for poultry and other processed foods including fish and other meat products, this in turn means further pressures on the supply of production inputs such as maize and soybean. For example, South Africa imports around 20% of its poultry requirements which represents derived demand for animal feed, in addition to around 500,000 tonnes of oilcake in most years (Nsomba et al., 2022b).

Figure 4: Regional soybean and oilcake trade balance



Source: Trade Map

The potential for a regional value chain in animal feed to poultry is clear given unmet demand for soybeans and oilcake in South Africa. South Africa's soybean needs are currently largely being met by deep sea imports from South America yet there is high potential for increased production in Zambia and Malawi. We identify two specific challenges in the potential for soybean production in southern Africa in meeting processing capabilities in South Africa as the basis for a competitive regional poultry value chain. Firstly, how to increase soybean production in the northern parts of the region. Secondly, how to ensure access to markets in South Africa by soybean farmers and crushers in the northern parts of the region.

### 3. Building a competitive regional poultry value chain

The poultry value chain has multiple levels – from the production and processing of commodities, mainly maize and soybean, for animal feed through to quasi-industrial processes of production in the rearing, processing and distribution of poultry in live, fresh and frozen form (Nsomba et al., 2022a). Large-scale commercial producers are generally vertically integrated into key inputs such as animal feed and breeding stock, all the way to slaughtering operations.

Within the SACU and SADC regions, South Africa has the largest poultry industry, and poultry is the largest single contributor to the agricultural sector in the country. In 2021, some 16.6 % of the total agricultural gross value and 39.9 % of animal product gross value stemmed from poultry production (SAPA, 2021). It is estimated that the industry provides direct and indirect employment to over 110 000 people; is known to be the second largest consumer of maize in the country; and supports many peripheral businesses (including the feed industry) and those downstream in the value chain (SAPA, 2016).

From a regional perspective, there are a small number of major companies operating across southern Africa, majority of which originate from South Africa. These firms include Rainbow Chicken (a subsidiary of Remgro-controlled RCL Foods) and Astral Foods, the two largest firms in South Africa, as well as CBH Holdings and Quantum Foods (Ncube, 2018; Goga and Roberts, 2023). The five largest poultry producers in South Africa account for over 75% of the animal feed produced by members of the Animal Feed Manufacturers' Association (AFMA) (Ncube, 2018). In the case of Malawi, two firms produce 80% of poultry feed while in

Zambia, two of the three largest poultry producers are the largest manufacturers of poultry feed (Nsomba et al., 2022).

From this we draw three main points. Firstly, that vertical integration along the value chain represents significant scale economies, with the development of the industry depending on the decisions and behaviour of few large enterprises. Nsomba et al. (2022a) find that this poses challenges in ensuring local investments and competitive outcomes. We note that these challenges span across the region, given the regional reach of the main firms. However, within these challenges lie opportunities. The regional reach of South African firms represents an entry point to identify key capabilities in poultry production from which the region can build. This earmarks South Africa as a key role player in the development of a sustainable regional poultry value chain. Lastly, the feed industry represents opportunities for value addition, where links between farmers and processors can be amplified to spur agro-processing activities for the benefit of inclusion, participation and strengthening food markets. This is at the heart of why the value chain is mutually beneficial for southern African countries, with agriculture and small and medium scale farmers at the centre.

### **3.1. Key considerations for competitiveness in the poultry value chain**

As mentioned above, South Africa has a substantial poultry industry relative to the region and is in some respects (such as in terms of the technical efficiency of its breeds) is comparable to industries in countries that have managed to build a competitive value chain, such as Brazil. South Africa's poultry industry has however been found to fall short in terms of its competitiveness, seen specifically through rising imports and poultry prices against relatively low exports. In this section, we link South Africa's challenges with opportunities in the region as a basis for competitiveness.

The South African Poultry Sector Master Plan was developed as an avenue to achieve a more competitive poultry value chain through stimulating local demand, boosting exports and protecting the domestic industry. The master plan provides for a framework to grow the poultry industry in South Africa through five strategic objectives, including increasing production capacity at all levels of the value chain, increasing participation and ownership along the value chain as well as increasing production to meet local demand and for exports.

The South African Poultry Association (SAPA) has cited the poultry master plan as the underlying reason for much of the growth experienced in the industry between 2019 and 2021. Following the development of the master plan in 2019, by mid-2021 an additional 388 employment opportunities had been added on top of the 980 new jobs created in 2020 and the capacity to produce cooked chicken increased from 65 to 140 tonnes a week (SAPA 2021).

While there has been the successes stated above, of which the poultry master plan has been integral, there have also been indications that the South African poultry industry continues to face challenges regarding participation and cost competitiveness; and these need to be understood better. Bosiu and Nontenja (2023) and Nsomba and Shedi (2023) find that the poultry value chain remains highly concentrated, with significant barriers to entry that include high capital requirements, high costs of feed, limited access to markets, and limited access to breeding stock. These challenges generally affect SMEs disproportionately, but also in particular women-run SMEs (Bosiu and Nontenja, 2023).

We find it noteworthy that the master plan does not acknowledge the potential role the rest of the southern African region can play in developing a competitive value chain, given the potential for expanded agricultural production to support a competitive poultry feed industry. We discuss the regional opportunities below.

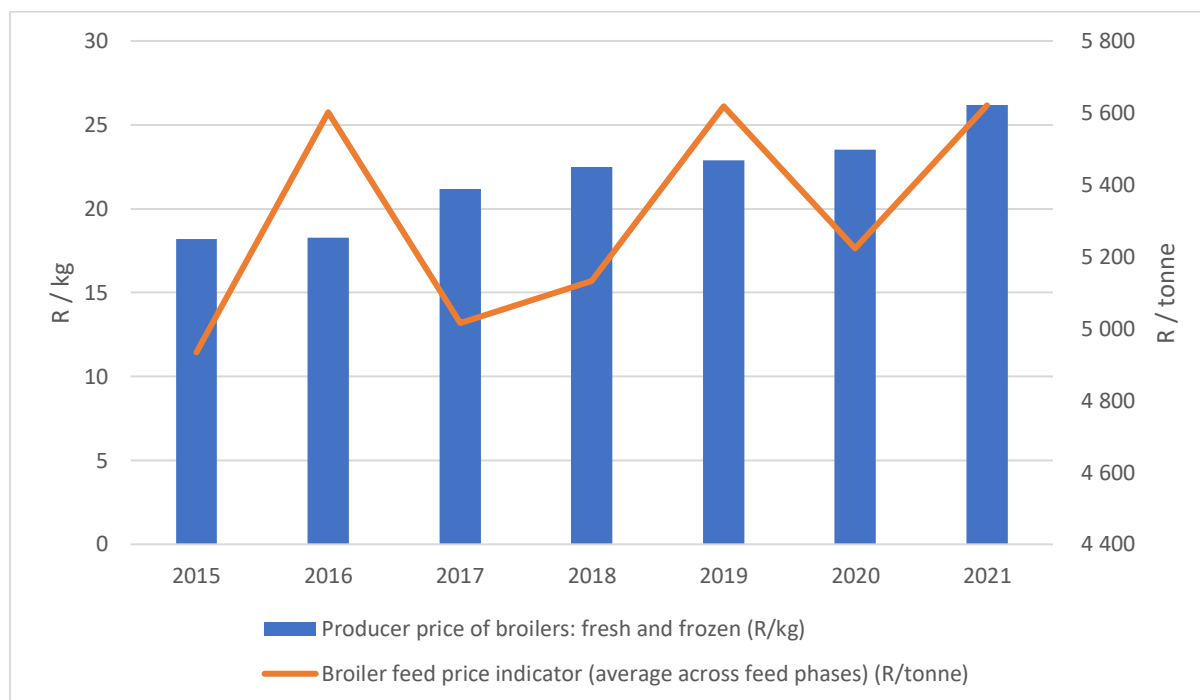
### *Input costs, regional integration and trade*

The main input cost to the production of poultry is feed, estimated to account for around 60-70% of total input costs (Bosiu and Goga, 2019; Nsomba et al., 2022a). The second most important cost in broiler production is day-old chicks, which also require feed for their production by breeding operations (Nsomba et al., 2022a). For the purposes of this paper, we focus on the main inputs into feed production.

Feed production comprises approximately 60% maize and 30% soybean/oilcake as the main inputs, with the two constituents being equal inputs in terms of value (Gondwe, Nsomba and Roberts, 2022). This means production levels and prices of these inputs are crucial for the cost competitiveness of poultry production.

Climate change and weather variability have had notable impacts on input prices and cost competitiveness in poultry production in South Africa. Extreme weather variations such as the drought in 2015/16 and flooding in 2019 had negative effects on production yields, supply into the value chain and subsequently on poultry feed prices (figure 6). As the drought broke in the South Africa's maize-growing regions, the country saw a reduction in maize crop for the 2016/17 season and a drop in feed prices. Late rains and the resultant drop in maize production in the 2017/18 and 2018/19 seasons also led to an increase in feed prices (Bosiu and Nontenja, 2023).

**Figure 5: Producer price of broilers: fresh and frozen (R/kg) and broiler feed price (R/tonne)**



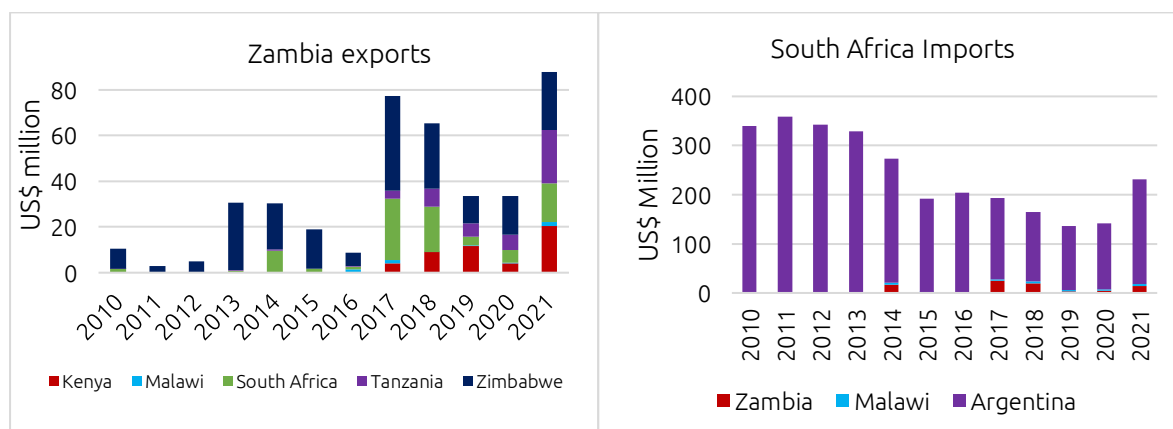
Source: Bosiu and Nontenja (2023)

Feed prices in 2016 increased by over 100% from the previous year reaching R5600 per tonne. A similar spike in prices is observable in 2019. This is evident of the effects of climate change in agricultural value chains. There are also notable considerations for participation along the value chain, given that higher input costs raise barriers to entry and participation at upstream levels of the value chain. These issues are explored further in Bosiu and Nontenja (2023) and Nsomba and Shedi (2023), who find that the rising costs of inputs typically affect small and medium scale producers most, and climate change compounds these outcomes.

While South Africa's trade deficit has improved over the last decade, the sources of the bulk of imports have not been from regional countries in the southern African region (figure 7). If South Africa is to increase its exports of poultry products into the region leveraging the AfCFTA Agreement, it has to have a sustainable way of sourcing inputs. This means that regional trade in itself needs work, including the need to address a range of non-tariff barriers, infant industry protections, quotas and bans, licensing requirements as well as issues with regional connectivity (Banga and Balchin, 2023).

Very little trade (in relative terms) in soybean takes place between South Africa and Malawi and Zambia. The bulk of South African imports of soybean and oilcake originate from South America, noting that there have been gradual increases in imports from Malawi and Zambia. In years where the La Niña weather phenomenon hits it means there is relatively good weather in the southern African region, but severe drought in Argentina and Brazil. Therefore, during La Niña periods South African imports are affected by the change in global soybean prices given that Brazil and Argentina are leading world producers, and their constrained supply affects the global market (also reflected in decreased imports from Argentina in 2019 and 2020). El Niño has the same effect on South Africa, with severe droughts and late rainfall affecting the southern parts of the region during this period (section 2).

**Figure 6: Zambia exports and South Africa imports of soybean and oilcake**



Source: based on AMO price tracker data from multiple sources

This is why South Africa needs to trade more with regional countries, allowing it to leverage off backward linkages from the rest of the region into South African value adding activities. However, trade restrictions, a lack of integration and concerns over sustained supply and quality have been some of the factors that have been attribute to the poor trade outcome exhibited above. The AMO also finds that price volatility across the region is another contributing factor. Analysis has shown that farmers in Malawi and Zambia receive low prices, while few large traders earn excess margins between producing and consuming areas (Nsomba et al., 2022b). A lack of access to finance, agricultural inputs, efficient transport and storage facilities are some of the contributing factors in these outcomes. Furthermore, while climate change and variability in weather lead to shocks in prices, this is compounded by exploitation in concentrated markets to drive prices up far above reasonable levels (Nsomba et al., 2022b). As a result, less than optimal trade is taking place in the region.



In analysing the workings of food markets, including for maize and soybean, the AMO has found that weather patterns and trade restrictions play a role in large price differences in maize and soybean across countries in east and southern Africa (Nsomba et al., 2022b). Together with markets being poorly integrated, substantial changes in prices over short periods of time together with large excess margins being made between producing and consumer areas have pointed towards shocks from climate change being exploited in concentrated markets to drive prices up far above reasonable levels.

Tapping into this potential means that farmers need to have an incentive to increase production. Essentially, markets need to work well for small and medium sized farmers and producers. Small and medium scale farmers are increasingly becoming the backbone of agricultural production. Zambia provides for a useful example. Soybeans were historically largely produced by commercial farmers in Zambia but the share of production from smaller farmers is increasing (Chapoto & Chisanga, 2016; Paremoer, 2021). In the 2016/17 season, small and medium sized farmers produced more than 40% of Zambia's soybean crop with their production being so significant and supply considered so reliable that the largest beef producer in Zambia, Zambef Products Plc, purchases about 70% of its soya demand from small farmers (Paremoer, 2021). The prices that farmers receive for their produce therefore plays a crucial role in linking markets and unlocking untapped production potential.

While the region depicts this potential, a challenge that persists is how to ensure access to markets of soybean crushers and feed producers by soybean farmers across the region. From the current evidence on how markets are working, not addressing this challenge is detrimental to the development of a stronger value chain. The production challenges mentioned above are more straightforward and are generally agreed upon from country to country. On the other hand, coordination on access to markets is more complex. For example, while South African soybean processors are more aware of regional supply for soybeans, experiences are that there remains scepticism about the reliability of supply and quality (Nsomba, Shedi and Roberts, forthcoming). South African processors also often have longstanding supply relationships with large international producers which increases their wariness to shift to regional alternatives (Paremoer, 2021).

Given the role that the poultry industry plays in South Africa's development agenda, South Africa's leadership in lobbying and pushing for reforms in regional trade is critical. While the factors stated above require extensive coordination between governments and stakeholders, South Africa, given its size, demand and national objectives, has the ability to initiate action and decision making in this area. For example, with indications and commitment that South Africa of offtake in soybean produced in Zambia, Zambian policy makers can also more concretely push for agricultural reforms to unlock investments and opportunities for farmers. Similarly, a regional approach to addressing concentration concerns in trading, with South Africa at the centre, will allow for opening up markets for fairer market outcomes – equally addressing some of the inclusion and participation concerns along the value chain in local and regional terms.

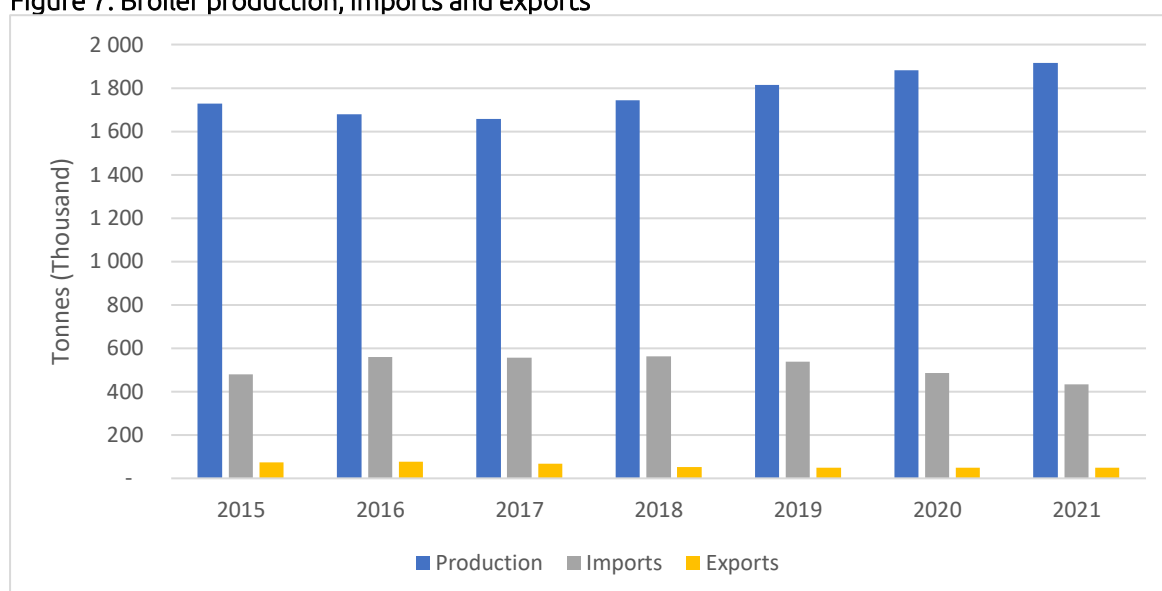
### ***Import tariffs and consumer prices***

We also consider import tariffs and high consumer prices in the poultry industry in South Africa as a basis for alternative sourcing of key inputs for poultry production. Various studies have underpinned that while there have been various protection measures for the support of the South African poultry industry, its competitiveness lies in the ability of producers to remain competitive through efficiently priced production inputs, such as maize and soybean for feed, and well as day-old chicks for the rearing process (Joen and Byeon, 2017; Muchopa,

2021; Ya and Pei, 2022). South America does provide for a source for competitively priced feed production inputs; however, we argue that this is not sustainable in the long run. Climate change will continue to have negative effects on agricultural production in the South American region in La Niña periods, and subsequently on the global supply of these inputs as seen in the last three years. This is why regional trade must work better to support the development of a regional animal feed to poultry value chain.

South Africa’s rising urbanisation has been accompanied by increases in per capita meat consumption, with poultry meat accounting for most of this growth (figure 8). However, production has not been able to meet that demand. While consumption continued to increase between 2011 and 2018, production has stagnated. This excess demand has been met by increased imports from major producing countries in South America and European Union. The poultry industry in South Africa has raised concerns about the high levels of import penetration in the local market. The local poultry market prefers bone-in products, unlike the US and European markets where boneless products such as breasts are preferred from where some imports originate (Bosiu and Goga, 2019).

**Figure 7: Broiler production, imports and exports**

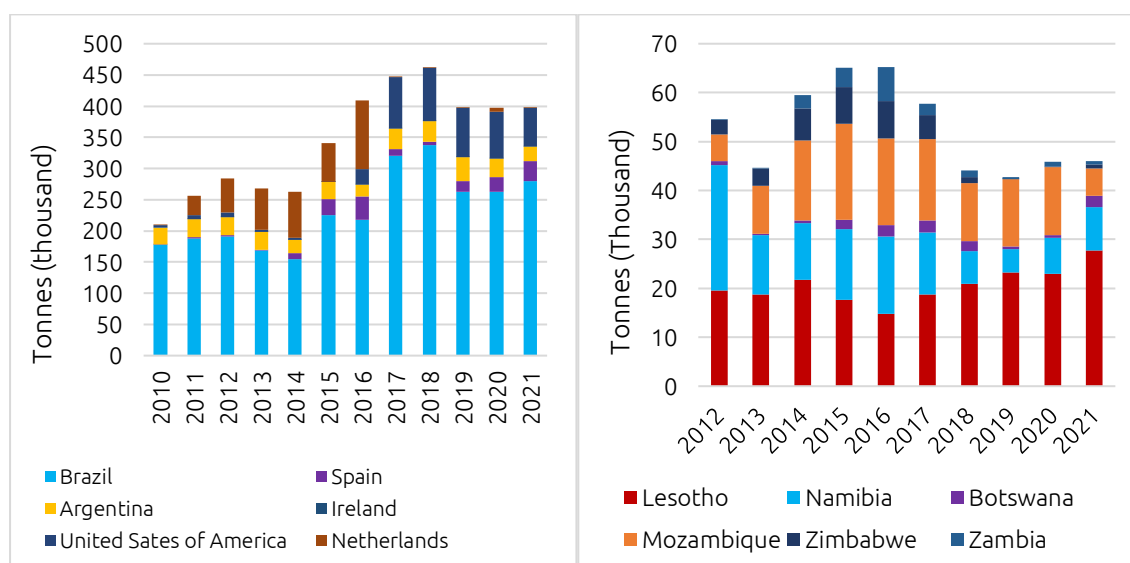


Source: FAO (2022); SAPA (2022); DALRRD (2019); Trademap

Most of the imports have originated from South America, with Brazil leading (figure 9). Following a 65,000 tonnes tariff free quota on imports from the United States of America under the African Growth and Opportunity Act (AGOA) agreement, imports from the USA increased sharply, but not to the levels of Brazil. Relative to imports, and other countries with which South Africa is benchmarked against in terms of poultry production given technical efficiency (such as Brazil), South Africa’s exports are low. The bulk of exports are destined for southern Africa, with SACU countries dominating.



Figure 8: South African poultry imports (left) and exports (right)



Source: Trade map

Poultry imports have been cited to continuously affect the competitiveness and development of the local poultry industry (Lemmer and Bowen, 2019; Nkgadima and Muchopa, 2022). To protect the industry amidst increases in poultry imports, some stakeholders have advocated for import tariffs and petitioned the International Trade Administration Commission (ITAC) of South Africa, such as in the form of the most recent an increase in the Ad Valorem tariff in 2020; with the previous tariff adjustments being made in 2013 (Nkgadima and Muchopa, 2022).

The issue around tariffs on poultry imports has been highly contested given differing interests between poultry producers, importers and exporters of poultry and poultry products. There are various studies that have shown that the use of tariffs must be afforded to industries that have significant impacts on the domestic economy however, at times the full intended benefits are not realized due to the presentation of certain inefficiencies (Joen and Byeon, 2017; Muchopa, 2021; Ya and Pei, 2022). On the other hand, there are also arguments that increase in protection may boost the comparative advantage status.

On a technical level, South African poultry production is widely considered to be efficient (Davids and Meyer, 2017; Bosiu and Goga, 2019). The coordinated structure of the market, where the majority of production is governed by production contracts that incorporate compensation based on broiler production tournaments is similar to international markets and encourages investment in order to improve production efficiency on a continuous basis (Davids and Meyer, 2017). Davids and Meyer (2017) have found that in terms of economic efficiency, there is a different reality. The cost of raw feed materials, particularly the cost of soybean and oilcake is the most significant driver of South African producers' lack of competitiveness (Davids and Meyer, 2017). As a result of South Africa being a net importer of soybeans and oilcake, the price trades at import parity levels. On the other hand, the price of soybean and oilcake in Brazil, the USA and Argentina trades at export parity levels. Export tariffs in Argentina, the origin of South African imports, further increases the cost to South African producers.

Increasing costs to poultry producers has underscored the South African government playing an active role in using import tariffs as a tool for championing the poultry industry against cheap imports, often referred to as anti-dumping duties. However, there have been

views that anti-dumping duties in fact raise the domestic price of poultry. Edwards et al. (2022) find that tariffs and other import duties have a powerful impact on import volumes and, in the case of frozen chicken, on consumer prices. Import duties are borne entirely by the domestic importer and thus directly impact the price consumers pay. While import duties reduce import volumes from countries directly affected, the aggregate impact on import volumes is mitigated by shifts in the sourcing of imports towards non-dutiable sources (Edwards et al., 2022). Davids and Meyer (2022) and Nkgadima and Muchopa (2022) reinforce this finding, highlighting that the challenges within the South African poultry industry are linked to economic inefficiencies, such as the persistently rising costs of poultry feed.

### *Issues on participation and inclusion*

Inclusion and sustainability must be addressed together, as the changes needed to respond to climate change require broad-based support from widening economic participation if they are to be implemented (Kaziboni and Roberts, 2022). Responding to the challenges of climate change, while opening up markets to greater inclusion, requires addressing gaps and traps along the value chains.

Issues of inclusion and participation at various levels of the poultry value chain have been documented both in terms of South Africa as well as other countries across the region (see Bosiu and Goga, 2019; Nsomba et al., 2022a; Gondwe, Nsomba and Roberts, 2022; Nsomba and Shedi, 2023; Bosiu and Nontenja, 2023; Goga and Roberts, 2022). For instance, few large-scale producers tend to participate at various levels of the value chain including in feed production, the supply of breeding stock and poultry rearing and slaughtering which affords them the ability to control the terms with which their rivals can access key inputs.

In the same vein, concerns have also been raised around the levels of inclusion and participation of key inputs such as maize and soybeans by small and medium scale farmers. Agricultural production in the region is dominated by small and medium scale farmers, yet they benefit very poorly. Farmers in the region have been found to operate well below efficient scale and scope; the average farm size in sub-Saharan Africa is 1.3 hectares compared to 22 hectares in central America and 51 hectares in South America (Suri and Udri, 2022). Farmers in the region have also been found to receive very low prices for their produce yet face high input prices such as for fertilizer (Nsomba et al., 2022b). This results in exclusion from participation in agricultural value chains by receiving poor returns for their production. Furthermore, interviews conducted with market participants under the AMO, with many of which were women, have shown that there is also little participation in more than one level of the value chain which further limits the ability of these women to effectively participate.

The issues and outcomes stated above point towards the need for a package of measures to unlock the potential that regional integration holds for the development of a stronger regional poultry value chain.

## **4. Conclusion and recommendations**

The potential for a strengthened regional poultry value chain exists through the possibility of expanded regional agricultural production for a competitive feed industry, together with capabilities and investments in breeding operations. This potential has not been realised in southern Africa because of some important factors, including poor regional trade and integration, markets not working well for small and medium scale farmers, and the structure of markets and conduct of firms hindering inclusion and participation at various levels of the value chain. The effects of this being cross-border in nature. These outcomes are

compounded by climate change, leading to supply shocks and price volatility, and ultimately a broken regional value chain.

At the heart of addressing these obstacles is regional coordination of efforts regarding investments, policies, production as well as in correcting market conduct. SADC as a regional economic community provides for a platform to table coordination efforts. However, South Africa is well positioned as a leader given its position as a source of demand, a hub for capabilities and its experience in addressing adverse market conduct.

A starting point is rethinking policies as they relate to the poultry industry. While the South African poultry master plan, for example, correctly identifies the challenges faced by poultry producers, it fails to recognise the importance of a regional value chain, especially in the context of climate change. The master plan provides for a basis to document the region as a key partner in developing the poultry value chain, with mutually beneficial partnerships with southern Africa. South Africa can earmark countries such as Malawi, Tanzania and Zambia as key partners for the sustainable sourcing of inputs, with the benefit of exporting final poultry products back to these countries under already existing trade agreements, including the AfCFTA. Exploring the regional as an avenue to achieving a competitive cost base can also serve to correct some of the competitive difficulties faced in the local industry, which import tariffs for example have failed to address.

This, however, also requires efforts from the other SADC member states, including commitments to unlock agricultural production for farmers such as water management, irrigation, the supply of inputs and smart agriculture. There must be substantial expansions in irrigation, storage and logistics. It should be self-evident that investing in better use of water is essential yet much of African agriculture is rainfed and at the mercy of more frequent and severe weather shocks. Better transport logistics is also part of the picture. Furthermore, member states need to meet agreed upon quality and standards of feed inputs as well as addressing the existing non-tariff barriers that's hinder efficient trade in order to encourage offtake agreements by sources of demand such as South Africa.

Furthermore, government policies need to support smaller producers, including through cutting down the barriers they face (Vilakazi et al. 2020). A package of measures should include access to routes to market for these businesses, providing development finance and effective support for skills and technology adoption. These are part of green and inclusive industrial policies tailored to sectors and value chains, investing in shared infrastructure, advisory services and finance as part of a green industrial policy for food (Andreoni et al., 2021; Nsomba et al., 2022a). Real economic transformation and sustainability of the value chain requires support for the capabilities of entrepreneurs and farmers.

It is also essential to monitor markets in real time as climate change implies more frequent and deeper shocks. Through collating prices within and across countries at different levels of value chains the AMO can assess where markets are not working well. It can identify where there are excess margins and obstacles which harm smaller producers and consumers, in particular. Through providing a robust knowledge base, the AMO is an agent for change for healthy, inclusive and resilient markets, identifying the mix of policies, investments, regulatory reform and also competition enforcement.

This leads us to the need for effective referees of markets. This is a role for competition authorities. It is imperative to ramp-up the powers and capacities of these institutions to make regional markets work more effectively. Competition issues and the conduct of firms in the poultry value chain have been found to be regional in nature (see Nsomba et al., 2022a and Gondwe, Nsomba and Roberts, 2022). While these require regional competition enforcement, South Africa has a key role to play in coordination activities between national competition authorities to inform regional enforcement and advocacy activities. This is given South Africa's experience in competition enforcement, and that some of the main regional companies originate from South Africa.

These main areas are mutually reinforcing if we are to achieve a competitive, sustainable and resilient regional poultry value chain based on investment in the future.

## 5. References

- Ainembabazi, J. H. (2018). The 2015-16 El Niño-induced drought crisis in southern Africa: What do we learn from historical data? Contributed paper for International Conference of Agricultural Economists (ICAE 2018) in Vancouver, British Columbia, Canada, 28 July – 2 August 2018.
- Andreoni, A., Mondliwa, P., Roberts, S., & Tregenna, F. (2021) (eds). Structural transformation in South Africa: The challenges of inclusive industrial development in a middle-income country. Oxford: Oxford University Press.
- Banga, K., and Balchin, N. (2023). Linking Southern Africa to South Africa's exports: New opportunities for regional value chains. *The World Economy*, 46, 346–362. <https://doi.org/10.1111/twec.13366>
- Bell, J., Fleming, J., Roberts, S. and Vilakazi, T. (2020). Maize and Soybeans Markets in the Southern and East African Regions: The Case for a Regional Market Observatory. CCRED Working Paper 2020/2.
- Bosiu, T. and Goga, S. (2019). Governance of poultry value chains – a comparative perspective on developing capabilities in South Africa and Brazil. CCRED working paper 10/2019
- Bosiu T. and Nontenja, N. (2023). Inclusive and sustainable gender-transformative value chains: Strengthening women's economic power in South Africa's poultry value chain. CCRED working paper
- Chisoro Dube, S., das Nair, R., Nkhonjera, M. and Tempia., N. (2018). Structural transformation in agriculture and agro-processing value chains. CCRED working paper 8/2018.
- Cramer, C. and Chisoro-Dube, S. (2021). The Industrialization of Freshness and Structural Transformation in South African Fruit Exports; In Andreoni, A., Mondliwa, P., Roberts, S. and Tregenna, F. (eds) (2021). *Structural Transformation in South Africa: The Challenges of Inclusive Industrial Development in a Middle-Income Country*. OUP: UK.
- Dauids, T. and Meter, F. H. (2017). Price formation and competitiveness of the South African broiler industry in the global context, *Agrekon*, 56:2, 123-138, DOI: 10.1080/03031853.2017.1302349
- De Maria, M., Robinson, E. J. Z., Kangile, J. R., Kadigi, R., Dreoni, I., Couto, M., Howai, N., Peci, J., Fiennes, S. 2020. "Global Soybean Trade. The Geopolitics of a Bean". UK Research and Innovation Global Challenges Research Fund (UKRI GCRF) Trade, Development and the Environment Hub. DOI: <https://doi.org/10.34892/7yn1-k494>.
- Demmler, K. (2020) 'The role of small and medium-sized enterprises in nutritious food supply chains in Africa' GAIN Working Paper series 2.
- Edwards, L., Ismail, Z., Kamutando, G., Mambara, S., Stern, M. and Venter, F. (2022). The consumer price effects of specific trade policy restrictions in South Africa. South African Reserve Bank working paper. Available at: <https://www.resbank.co.za/en/home/publications/Papers/working-papers>
- Goga and Roberts (2023). Multinationals and competition in poultry value chains in South Africa, Zambia and Malawi. CCRED working paper

- Gondwe, T., Nsomba, G. and Roberts, S. (2022). Competition and the challenges of inclusive development: an apparent margin squeeze in poultry farming in Malawi. CCRED African Market Observatory working paper 2022/10
- Jeon, Y. and Byeong, I. A. (2017). Effects of a Tariff Reduction on Grain Self-Sufficiency: Evidence from Country-Level Panel Data. *Sustainability* 9: 1838.
- Kaziboni, L., and Roberts, S. (2022). Industrial policy for a just transition to a green economy: The importance of regional food value chains in Southern Africa. SARChI Industrial Development Working Paper Series WP 2022-01. SARChI Industrial Development, University of Johannesburg.
- Lemmer, W. and Bowen, P. (2019). SA Poultry in Distress, *Farmer's Weekly*. Available at: [https://journals.co.za/docserver/fulltext/farmweek\\_n19018\\_a10.pdf](https://journals.co.za/docserver/fulltext/farmweek_n19018_a10.pdf)
- Mazenda, A. and Masiya, T. (2022). South Africa's small-scale farmers still can't find a place in the food value chain. <https://theconversation.com/south-africas-small-scale-farmers-still-cant-find-a-place-in-the-food-value-chain-190927>
- Muchopa, C. (2021). Economic Impact of Tariff Rate Quotas and Underfilling: The Case of Canned Fruit Exports from South Africa to the EU. *Economies* 9: 155
- Ncube, P. (2018). The southern African poultry value chain: Corporate strategies, investments and agro-industrial policies, *Development Southern Africa*, 35:3, 369-387, <https://doi.org/10.1080/0376835X.2018.1426446>
- Nkgadima, K. and Muchopa, C. L. (2022). Do Import Tariff Adjustments Bolster Domestic Production? Analysis of the South African-Brazilian Poultry Market Case. *Economies* 10: 318. <https://doi.org/10.3390/economies> 10120318
- Nkhonjera, M. (2020). Entry challenges in vertically integrated industries: insights from three agro-processing industries in South Africa. In Vilakazi, T., Goga, S. and Roberts, S. (Eds) *Opening the South African Economy: Barriers to entry and competition*. Cape Town HSRC Press.
- Nsomba, G., Roberts, S. and Tshabalala, N. (2021). Assessing agriculture markets in east and southern Africa: Implications for inclusion, climate change and the case for a market observatory. CCRED working paper 2021/7.
- Nsomba, G., Kachipapa Mhone, A., Mulozi, I., Oiro, R. and Roberts, S. (2022a). Competition issues and regional integration in soybean and animal feed to poultry markets, within and across Kenya, Malawi and Zambia. CCRED African Market Observatory working paper 2022/09.
- Nsomba, G., Roberts, S., Manjengwa E. and Tshabalala, N. (2022b). Assessing agriculture and food markets in east and southern Africa: an agenda for regional competition enforcement. CCRED working paper 2022/1
- Nsomba, G., Shedi, O. and Roberts, S. forthcoming. Study of the Soybean-to-Poultry Regional Value Chain in the Southern Africa, under the Empowering Women and Boosting Livelihoods through Agricultural Trade – Leveraging the AfCFTA Project. International Trade Centre brief.
- Nakamura, S., R. Harati, S. Lall, Y. Dikhanov, N. Hamadeh, W. Oliver, M. Rissanen, M. Yamanaka (2016) 'Is living in African cities expensive?', World Bank Policy Research Working Paper 7641
- Paremoer, T. (2021). Exploring linkages and opportunities in the agro-processing sector across five African countries. In *Transforming Southern Africa: Harnessing Regional Value Chains and Industrial Development for Development*. United Nations Conference on Trade

and Development. [https://unctad.org/system/files/official-document/gdsecidc2021d1\\_en.pdf](https://unctad.org/system/files/official-document/gdsecidc2021d1_en.pdf)

Roberts, S. and Tshabalala, N. (2022). High food prices in Africa: Causes, consequences and agenda for action. African Climate Foundation position paper 01.

SAPA (South African Poultry Association), 2016. Broiler industry production report <https://www.sapoultry.co.za/pdf-statistics/broiler-industry-report.pdf>

SAPA (South African Poultry Association) (2021). Industry profile. <https://www.sapoultry.co.za/wp-content/uploads/2023/01/2021-Industry-Profile.pdf>

Scholes, R. and Engelbrecht, F. (2021). Climate impacts in southern Africa during the 21<sup>st</sup> century. Report for the Centre for Environmental Rights, September 2021. Available at: [https://cer.org.za/wp-content/uploads/2021/09/Climate-impacts-in-South-Africa\\_Final\\_September\\_2021.FINAL\\_.pdf](https://cer.org.za/wp-content/uploads/2021/09/Climate-impacts-in-South-Africa_Final_September_2021.FINAL_.pdf)

Suri, T. and Udry, C. (2022). Agricultural Technology in Africa. *Journal of Economic Perspectives*, 36 (1): 33-56.

USAID. (2018). Building Urban Resilience to Climate Change – A review of South Africa. Available at: [https://www.climatelinks.org/sites/default/files/asset/document/180327\\_USAID-ATLAS\\_Building%20Urban%20Resilience%20to%20CC\\_South%20Africa\\_to%20CL\\_rev.pdf](https://www.climatelinks.org/sites/default/files/asset/document/180327_USAID-ATLAS_Building%20Urban%20Resilience%20to%20CC_South%20Africa_to%20CL_rev.pdf)

Vilakazi, T., Goga, S. and Roberts, S. (2020). *Opening the South African Economy: Barriers to entry, regulation and competition*. Pretoria: HSRC Press.

Woldemichael, A., Salami, A., Mukasa, A., Simpasa, A. and Shimeles, A. (2017). Transforming Africa's agriculture through agro-industrialisation. Africa Economic Brief Volume 8 Issue 7, African Development Bank Group. Available at: [https://www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/AEB\\_Volume\\_8\\_Issue\\_7\\_Transforming\\_Africa\\_s\\_Agriculture\\_through\\_Agro-Industrialization\\_B.pdf](https://www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/AEB_Volume_8_Issue_7_Transforming_Africa_s_Agriculture_through_Agro-Industrialization_B.pdf)

World Bank. (2021). Climate Risk Profile: South Africa. The World Bank Group

Ya, Z. and Pei, K. (2022). Factors Influencing Agricultural Products Trade between China and Africa. *Sustainability* 14: 5589.