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Navigating the European Union's Green Deal in at-risk agro-food sectors in South Africa: Case of citrus and wine

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Abstract

The global economy has begun to design and slowly implement policies and regulations to stimulate transition towards greener outcomes to combat the threats of climate change. The European Union (EU) has the most comprehensive set of mitigation policies. The European Union's Green Deal (EGD) is a broad basket of policies and initiatives that aims to reduce and tackle climate change and its impact. While the EGD purports to lead global production and trade systems towards greener and sustainable processes, it also poses unique challenges for export-oriented sectors such as the agro-food sector in developing countries. Based on interviews with firms, industry associations and other relevant stakeholders, this paper conducts deep-dive case studies to understand the risks, and reciprocal measures and policies that are being instituted to ensure sustainability and competitiveness in two of South Africa's highest-exported products to the EU: citrus and wine. Our findings reveal that the EGD poses fundamental sustainability and global competitiveness concerns for South African citrus and wine sectors. This finding raises key policy issues including the need for integrated industrial policy that aligns green energy transition policies with other policies such as trade, in order to reposition South Africa's export-oriented sectors and export-led industrial development strategy.

Keywords: Food systems; Agro-processing; European Green Deal; International trade; South Africa

JEL Codes: N14; N17; N57; Q17; Q18

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1. Introduction

Global production, trade, and consumption are moving towards greener and sustainable processes as means to adapt and mitigate the global climate crisis. A key policy driving the global transition to greener processes is the European Union's Green Deal (EGD). The EGD represents a broad basket of policies and initiatives that aim to reduce and tackle climate change and its impact on the global economy. The Carbon Border Adjustment Mechanism (CBAM), Farm-to-Fork (F2F) strategy, and new traceability requirements, among others, aim at ensuring sustainability along supply chains.

Although the EGD purports to lead global production and trade systems towards greener and sustainable processes, with several opportunities for sustainable development, it also poses unique challenges for developing countries (Bell et al., 2022). For instance, the EGD policy creates challenges for industrialisation and export-led growth strategies in developing countries (Bell et al., 2021), by imposing costs related to decarbonization and compliance. This implies that developing countries, including South Africa, now face the dual imperative of having to industrialize while decarbonising (Avenyo and Tregenna, 2022). On the other hand, green policies also present opportunities for developing economies to develop a new, future-oriented industrial policy agenda (Bell et al., 2021). This is more so for food value chains and the food system, with each level of the food system presenting several opportunities to adapt value chains to be more resilient and contribute to increasing global food security, for instance.

Hence, countries and export-driven industries, in particular, are devising strategies to rapidly transition to clean energy systems. However, South Africa faces unique and substantial challenges. This is mainly due to the fact that the country is heavily reliant on fossil fuels for energy production and has an under-diversified export basket with a relatively small set of exports (Andreoni et al., 2021; Bell et al., 2022). As a result, some of South Africa's key export industries are expected to face significant difficulties in moving to more sustainable production, threatening jobs and industrial capabilities. Available empirical studies have mapped the risk for South African export sectors (based on adverse effects from EGD policies; the relative importance of EU exports to the South African economy; and the carbon intensity of products exported relative to those of comparator countries) and have identified the steel, automotive and agro-food as the three most at-risk sectors as a result of EGD policies (Bell et al., 2022; PCC, 2023; Cameron et al., 2021; Wood, 2021).

However, there is little understanding of the risks the EGD poses for specific sub-sectors within the broad at-risk sectors, and their exposure at the firm and sub-sector level to the EU's proposed EGD policies. Also, there is little evidence on the specific measures and actions being taken to react to the evolving global climate policy landscape to mitigate emissions, ensure sustainability and compliance with green and climate change policies. This paper aims to fill this gap by looking at the risks the EGD poses for specific sub-sectors within the agro-food industry in South Africa.

The food sector is a significant emitter of greenhouse gas emissions. Globally, the agro-food sector accounts for around 30% of the world's total energy consumption (IRENA, 2021) and emits about one-third of total anthropogenic greenhouse gas emissions (FAO, 2022). Emissions comprise direct and indirect sources, including from primary production activities and changing land-use patterns and secondary activities such as cooling and drying, food

manufacturing, storage, transport, and distribution (FAO, 2022; IRENA, 2021). South Africa's food system accounts for around 18% of its total emissions (IEJ, 2023), and agro-food production in South Africa is more carbon intensive than in other countries importing into the EU (Bell et al., 2022). This means that there are risks for food exports into the EU, given the EGD policies.

At the same time, South Africa's agro-food sector provides opportunity for structural transformation, that is, moving productive resources to higher value activities. Within agriculture, there is scope to apply sophisticated technologies to produce higher value products such as fruit. Higher value in fruit is associated with functional and process upgrading to maintain the quality and preserve the quality of the fruit, referred to as the "industrialization of freshness" (Cramer and Chisoro, 2021). For exporting, this requires growing the most desirable fruit varieties as well as investments in packhouses, cold chain facilities, disease control and logistics (Chisoro-Dube et al., 2018).

The fresh fruit and wine sectors having been particularly successful in terms of exports, with South Africa being the second largest exporter of citrus and the eighth largest producer of wine globally. [1] As a significant employer within the economy and a growing sector globally, the fresh fruit sector presents substantial opportunities to drive structural transformation and employment creation when viewed from the perspective of the "industrialization of freshness" (Cramer and Chisoro, 2021). Wine, similarly, offers critical opportunities for structural transformation, development, and industrialization (Das Nair, et al., 2023).

However, the growth and expansion of these and other agro-food sectors is threatened by EGD policies related to sustainability and decarbonization embodied in the Farm-to-Fork (F2F) and other strategies (Bell et al., 2022). The F2F sets specific targets to achieve a more sustainable and resilient food system in the EU through, among others, a reduction in the use of hazardous pesticides, a reduction in the use of fertilizers, a reduction in the use of antimicrobials and making agriculture in the EU more organic. It also aims to ensure that production practices implemented through the F2F in the EU are extended to imports into the EU (Wesseler, 2022; Matthews, 2022). This will force exporters to the EU to adjust production processes and practices to meet requirements, including switching to more sustainable production methods, which could reduce yields and profit margins (Cortignani et al., 2022).

This paper examines the effect of EGD policies on two export-oriented industries - citrus and wine – in South Africa, and investigates the risks and opportunities, as well as measures and policies that are being instituted to ensure sustainability and competitiveness in light of EGD policies. In particular, we consider what specific changes will be required in the production of citrus and wine to comply with EGD policies, the compliance costs related to these changes, as well as what steps individual firms as well as the industry as a whole is taking. Specifically, the paper poses several questions which are unanswered in the literature: What are the main risks posed by EGD policies for citrus and wine sub-sectors in South Africa? What are the implications of specific EGD policies for the selected sub-sectors in terms of adjustments

[1] Our selection of citrus and wine sectors as case studies are informed by the initial mapping done to identify the most vulnerable as well as strategically important sectors for employment, industrialisation, and exports in South Africa (Bell et al., 2022).

and costs? What measures and actions are being taken by producers, industry associations and government agencies to comply with EGD policies to mitigate emissions and ensure sustainability and compliance?

While our analysis is limited to citrus and wine, the emerging implications are relevant for a range of other agro-food exports to the EU. In line with the foregoing, we structure the rest of the paper as follows. Section 2 provides a description of the EGD and possible implications on the agro-food sector in South Africa, given its orientation, main exports and carbon intensity. Section 3 provides a description of the methodology employed in the paper, highlighting the use of the sustainable food value chain framework in order to understand the views of multiple actors along value chains. Sections 4 and 5 provide analyses of the specific challenges and opportunities that the citrus and wine value chains in South Africa face in light of EGD policies. Section 6 reflects on emerging issues from both sectors, while section 7 concludes the paper with policy recommendations.

2. The challenge: EGD and the agro-food sector in SA

This section provides a general context to the agro-food sector in SA and the implications of the EGD. Specifically, section 2.1 characterises and describes the agro-food sector in SA, its economic contribution and role in emissions. Section 2.2 provides a broad overview of the EGD for agro-food sectors in South Africa.

2.1. Characterising SA's agro-food sector

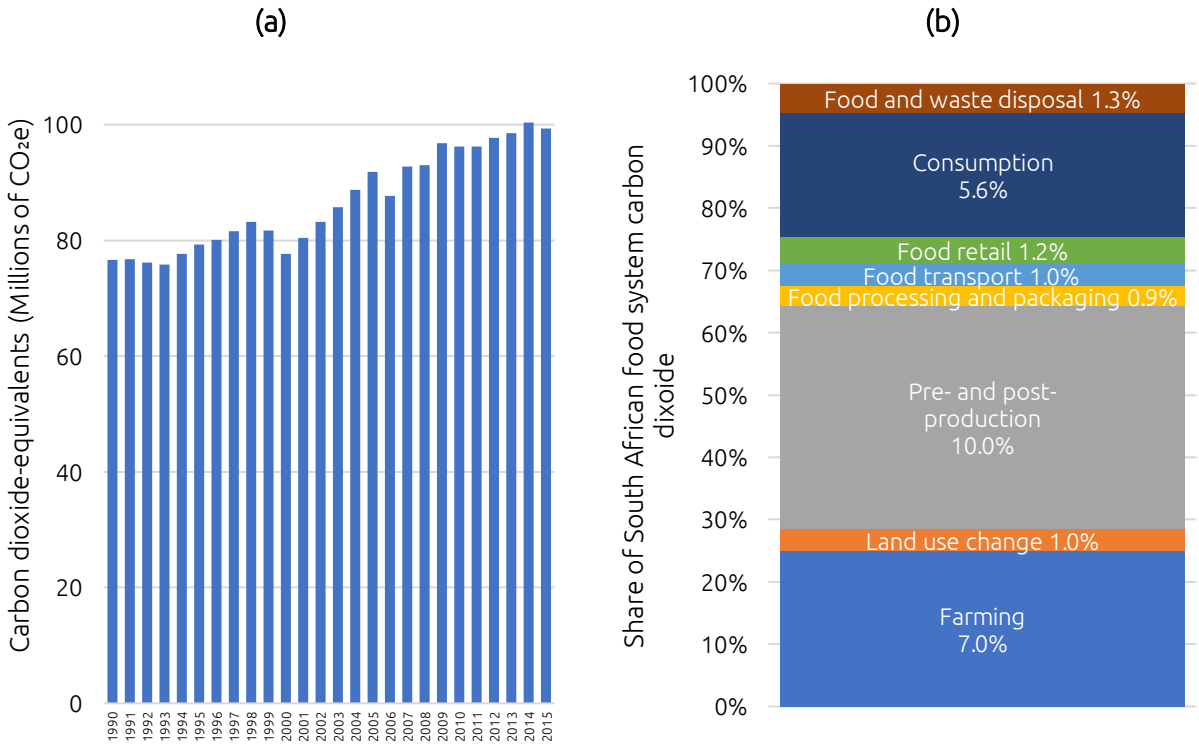
While the share of total value addition of diversified manufacturing sectors in South Africa declined between 1994 and 2019 from 10.8% to 9.4%, three diversified manufacturing sectors performed relatively well. The automotive, agriculture, food and beverages (agro-food), and machinery sectors experienced real value-added growth over the period (Andreoni, et al., 2021). Exports of agro-food sectors have grown by 6% in real terms (2015 constant prices) between 1994 and 2021, and agro-food ranks in the top four diversified exporting sectors. Exports from the agro-food sectors have gained greater importance within South Africa's export basket, growing their share from 5.6% of total exports in 1994 to 14% in 2021 (Error! Reference source not found.). The agro-food sector is thus considered important for South Africa from the perspective of export-led growth and structural transformation.

The global agro-food system emits about one-third of total anthropogenic greenhouse gas emissions (FAO, 2022), with primary production activities (agricultural production and changing land-use patterns) accounting for the most emissions (Poore and Nemecek, 2018; Crippa et al., 2021). In contrast, secondary activities along the supply chain, including processing (between 4.4% and 5%), transport (between 5% and 6%), packaging (between 4.4% and 6.3%), and retail (between 2.9% and 4.4%), account for much smaller shares of emissions of the global food system (excludng post-retail). Most of the recent increases in food system emissions emanate from the corporate industrialization of the food system under the control of agribusinesses and food corporations (GRAIN, 2021). As a result, the food supply chain is on course to overtake farming and land use as the most significant contributor to GHG emissions (FAO, 2022). Indirectly, energy is also used to manufacture

fertilizers, agrochemicals, pesticides, and machinery to boost soil fertility, crop productivity, yields, and protection from insects, pests, and weeds.

Between 1990 and 2015, South Africa's food system carbon dioxide-equivalents (CO_2e) emissions steadily increased from 76 million tonnes to 99 million tonnes (Figure 1a). These emissions account for around 18% of South Africa's total GHG emissions, most originating from pre- and post-production processes (10%) and farming (7%) (Figure 1b).

Figure 1: South Africa's food system CO_2eq, 1990-2015 and breakdown in 2021



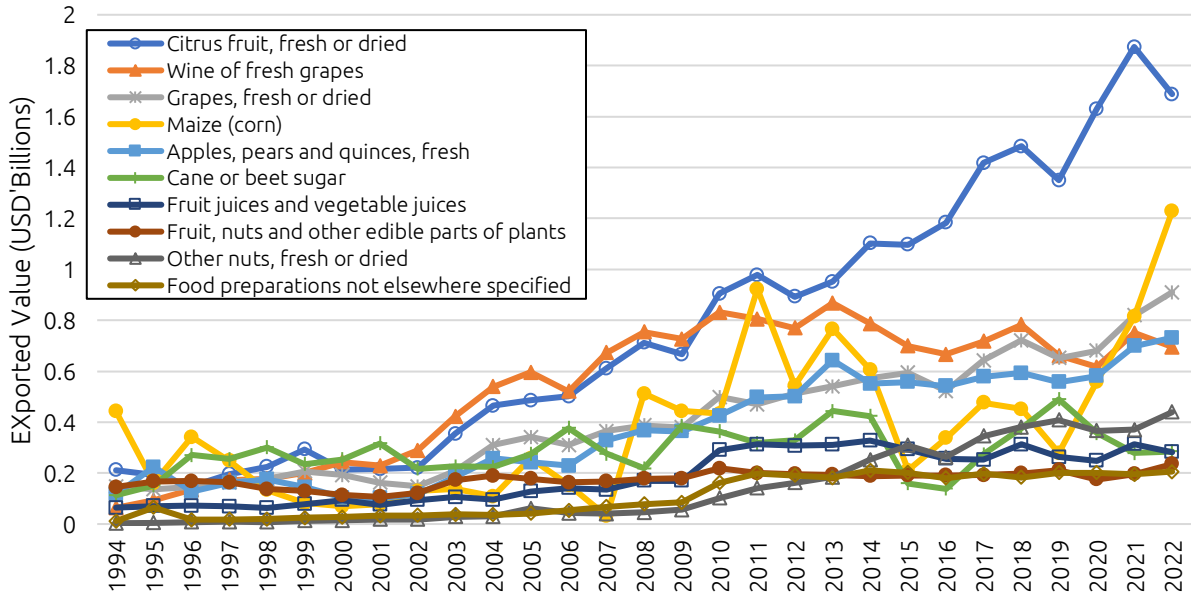
Source: Our World in Data and Crippa et al. (2021)

South Africa's agro-food system is highly dependent on the electricity sector and other fossil fuels (IEJ, 2023). The primary energy sources include diesel, petrol, and electricity, with electricity accounting for 38% of the energy used. Electricity is required to power pumps for irrigation, pump drinking water for livestock, processing activities like packaging and cooling, and refrigerating products and vaccines. Additional sources of emissions originate, for instance, from diesel/petrol transport inputs for farm machinery such as tractors and harvesters and for distribution of products. As far as fresh fruit is concerned, electricity is important for keeping fruit fresh for export, control of pests, and meeting other phytosanitary standards; and these are critical for access to EU and other markets (IEJ, 2023).

Several products led South Africa's agro-food exports between 1994 and 2022, including citrus, wine, grapes, apples, pears and quinces, and maize, whose cumulative exports totalled USD71.3 billion. Of this total, citrus and wine are the highest exported products accounting for 31.2% and 21.7% of the top 5 products, respectively, since 1994, and collectively 20.7% of all agro-food exports in the period. Citrus exports have grown 7.7%

since 1994, whereas wine has experienced a more robust export growth of 8.9% (**Error! Reference source not found.**).[2]

Figure 2: South Africa's top agro-food product exports, 1994-2022



Source: Authors based on data from Quantec

In terms of export destinations, the EU represented the biggest destination for South African citrus and wine exports in 2022 (30.4% and 31.4% respectively), followed by the United Kingdom (8.4% and 20.6% respectively) and the United States (6.2% and 7.9% respectively). Developments in the EU market in terms of sustainability and decarbonization are thus particularly important for South Africa.

Table 1: Prominent destinations for South African citrus and wine exports, 2022

Industry	SA export value to the World	Importance of EU for SA		Top 5 Export Destinations Outside the EU		
		Value of SA exports to EU	Share of EU exports for SA	Country	Value of SA exports to country	Share of exports for SA
Citrus fruit, fresh or dried	$1,727,446,000	$524,575,000	30.4%	United Kingdom	$145,656,000	8.4%
				Russia	$138,655,000	8%
				United Arab Emirates	$136,595,000	7.9%
				China	$132,693,000	7.7%
				USA	$106,827,000	6.2%
Wine of fresh grapes	$697,164,000	$219,054,000	31.4%	United Kingdom	$143,355,000	20.6%
				USA	$54,960,000	7.9%
				Canada	$37,139,000	5.3%
				Namibia	$32,089,000	4.6%
				China	$20,038,000	2.9%

Source: Authors based on data from Trade Map

The citrus industry creates substantial employment across its value chain, from growing, packhouses, marketing and logistics, and upstream in tree nurseries and other input supplies. In 2019, the growing and packhouse activities employed an estimated 112,000 workers. When considering multipliers into input supply and services such as logistics and

[2] Growth figures are calculated using compound annual growth rates.

downstream links into processed products such as concentrates and fruit juices, conservatively the value chain accounted for around 250,000 jobs in 2020 (Chisoro-Dube & Roberts, 2021). Employment from citrus mainly occurs in the poorest provinces in South Africa, namely the Eastern Cape (27% of total citrus production employment) and Limpopo (44%) (Chisoro-Dube & Roberts, 2021). The South African wine industry employs approximately 300,000 people directly and indirectly (amfori, 2019).

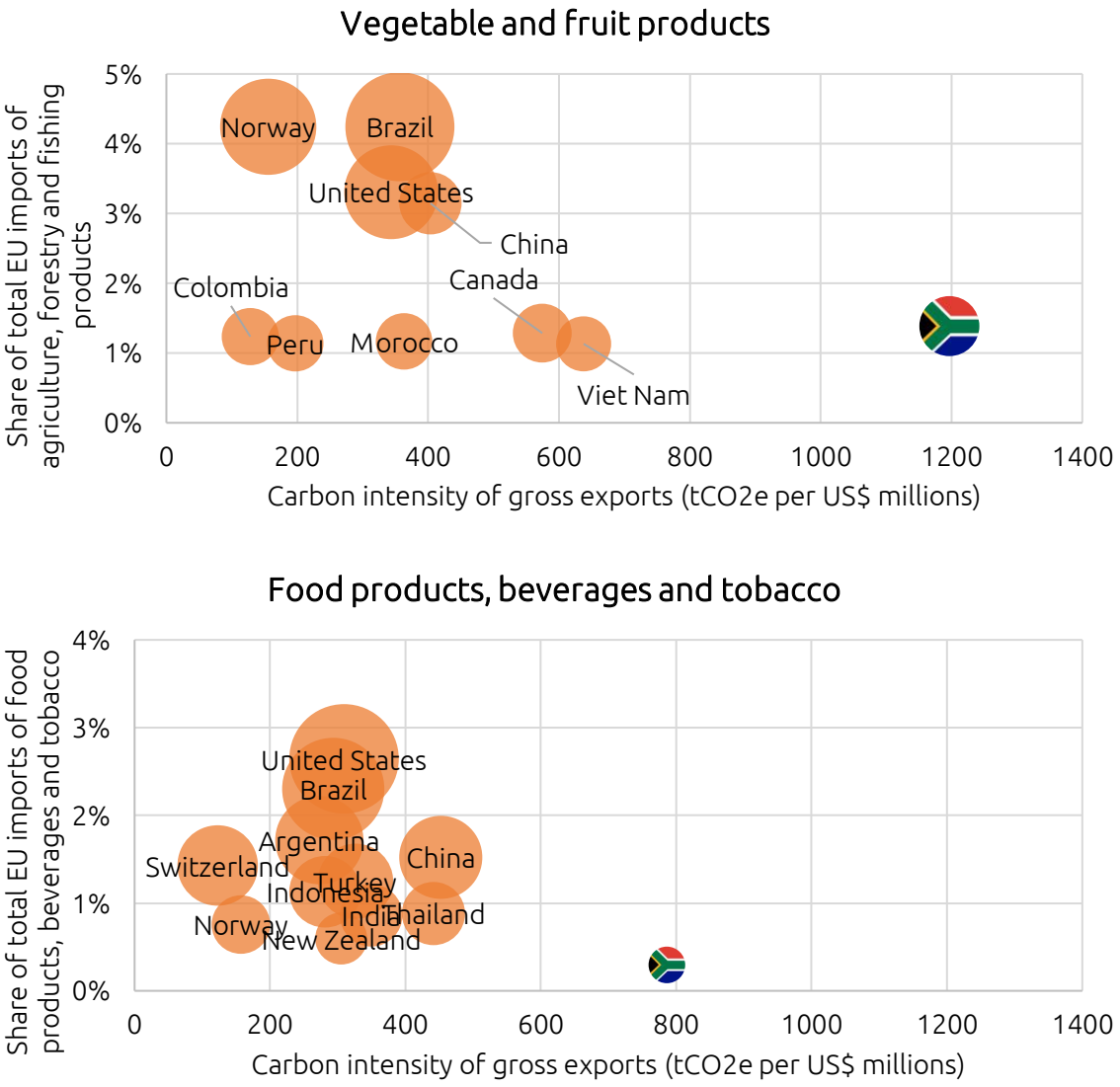
While both the citrus and wine industries are important sectors from the perspective of employment and exports, they are experiencing some challenges. The citrus industry is expected to experience some reduction in growth in the year 2023, due to accelerating farming input costs, new phytosanitary regulations by the EU, higher shipping rates, inflationary pressures on consumers in key markets, and infrastructure inefficiencies (Arnoldi, 2023). Further, recurrent and prolonged droughts mean farmers are experiencing water scarcity challenges, with water restrictions imposed, especially in the Eastern Cape region.[3]

The drought in 2016 and the COVID-19 pandemic exacerbated and negatively affected wine production in South Africa. Rising input costs have exerted further pressure on the wine industry, particularly at the grape grower level. A 2021 Vinpro survey of 257 wine grape farms found that only 23% of farms had sustainable earnings, and 32% were not profitable (Loots, 2021). Moreover, the planted area decreased from 101,607 ha of land under vine in 2005 to around 90,512 ha in 2021, cultivated by approximately 2,613 farmers (Das Nair, et al., 2023).

Given that the EU is the main market for South Africa's citrus and wine exports, the carbon intensity and sustainability of the two sectors viz. a viz. other countries importing into the EU are key. Error! Reference source not found. below shows that the carbon intensity of South Africa's vegetable/fruit and food/beverages/tobacco industries ranks well-above other countries that export to the EU. This is despite the relatively minor importance of South African produce in the EU market. In fact, South Africa is an outlier compared to all other countries that export both vegetable and fruit products as well as food products into the EU, with production in South Africa being far more carbon-intensive than other countries. We note that the data below includes emission through the value chain, including indirect emissions from electricity usage. The shift to greener and more sustainable production necessitated by the EGD will thus need to be addressed to maintain competitiveness.

[3] The region has experienced two prolonged droughts – in 2015/16 and 2019/20, which saw rivers dry up and the dam water levels drop. The Kouga Dam in Gamtoos Valley in the Eastern Cape – a key water source for farming saw water levels drop to below 7% in 2020/21 and growers were allocated a 20% water quota. https://www.news24.com/news24/community-newspaper/kouga-express/farmers-buckle-under-stringent-water-quotas-20220810

Figure 3: Key suppliers of vegetable and fruit products and food products, beverages and tobacco to the EU (28) with carbon intensity, 2015



Source: Adapted from Montmasson-Clair (2020) based on OECD data

Notes: Imports from EU countries are excluded. The carbon intensity of gross exports indicator shows the intensity of CO_2 emissions, tonne CO_2 per Million USD, in gross exports of exporting country c sector i to the importing partner country p. The emissions can come from any domestic or foreign sector upstream in the production chain.

Looking at energy sources, South Africa's wine industry relies heavily on coal-fired energy in its daily industrial processes, significantly contributing to CO_2 emissions (amfori, 2019). In processing one tonne of grapes into a finished bottle of wine, South African winemakers utilise 727,000 kWh. When extrapolated to the processing of 1.22 million tonnes of grapes in 2018, this equates to 1.22 million tons of CO_2 being emitted, accounting for

approximately 4% of South Africa's agriculture emissions (amfori, 2019).[4] South Africa releases between 0.41 kg and 1.6 kg of carbon dioxide per bottle of wine produced, nearly half of which is due to transportation.

A benchmarking report for the citrus industry provides data for the 2011 to 2022 period, as a means for the fruit industry to understand where reduction of emissions can be focused. By 2022, the data covered 31% of the citrus industry in South Africa or 30,059 unique hectares of citrus farms. The farm node, packhouse, and cold storage nodes of the value chain are included in the data. Distribution data (transport) is not included (CCC, 2023). Emissions mainly originate from the cold store node, with electricity accounting for the most significant proportion of emissions for both hard and soft citrus (Table 2). The farm node is the second largest carbon emitter, with electricity again accounting for this node's largest proportion of emissions. The energy utilised to power irrigation pumps is the most significant contributor to emissions at the farm level. On the other hand, South Africa's adherence to strict national standards necessitates minimum usage of chemicals that significantly reduces the emissions from fertilizers and agrochemicals.

Table 2: Carbon emissions by value chain node for citrus

	Soft Citrus	Hard Citrus
Farm Node	**0.24 kg CO2e/kg fruit**	**0.17 kg CO2e/kg fruit**
Electricity	0.11 (44%)	0.08 (46%)
Fertilizer	0.08 (32%)	0.05 (31%)
Fuel	0.04 (18%)	0.03 (16%)
Packhouse node	**0.12 kg CO2e/kg fruit**	**0.11 kg CO2e/kg fruit**
Packaging	0.06 (50%)	0.08 (77%)
Electricity	0.04 (32%)	0.01 (8%)
Fuel	0.01 (11%)	0.01 (8%)
Cold store node	**1.14 kg CO2e/kg fruit**	**1.62 kg CO2e/kg fruit**
Electricity	*0.91 (80%)*	*1.05 (65%)*
Refrigerant Leakage	*0.22 (19%)*	*0.55 (34%)*

Source: CCC, 2023

From the point of view of packhouses, the use of packaging materials is the most prominent contributor to emissions (CCC, 2023). Finally, because most citrus exports are transported by sea rather than air, the industry emits significantly lower CO_2 than other industries (Ntombela, et al., 2014). Overall, use of electricity, particularly in the cold store node and at the farm node, is responsible for the majority of emissions in the citrus sector.

The assessment above highlights the importance of the citrus and wine sectors for structural transformation, employment and exports for South Africa. Given EGD and related EU country-level policies aiming at less carbon-intensive and more sustainable imports into the EU, both sectors will face adjustment and compliance costs in the future to meet EU requirements.

[4] Based on data collected from Our World in Data Annual greenhouse gas emissions by sector for 2018.

2.2. The European Green Deal: Implications for SA's agro-food sector

As noted, the EGD is a broad set of policies and initiatives that is purported to help to mitigate and reverse the climate catastrophe. Led by South Africa's largest trading partner, the EGD is expected to have a major impact on South Africa's agro-food products. Within the broader EGD framework, the agro-foods sector is affected by the F2F strategy and indirectly (at this point) through CBAM (Matthews, 2022; Eliasson et al., 2022; Purnhagen et al., 2021).

The F2F strategy focuses on the entire food supply chain in the EU, from production to consumption, and addresses the environmental, health, and socioeconomic challenges associated with the current food system (Cortignani et al., 2022; Delgado et al., 2022). The strategy sets out a comprehensive plan with specific targets and actions to achieve a more sustainable and resilient food system in the EU (Wesseler, 2022). It primarily sets ambitious targets to put the EU food system on a transformative path to greater sustainability. Some of the key measures in the F2F strategy are the reduction of hazardous pesticides by 50% by 2030, the reduction in the use of fertilizers by 20%, reduction in the use of antimicrobials in agriculture by 50%, and making 25% of EU agriculture organic (Matthews, 2022).

The F2F also stresses the importance of the external dimension, providing insights on conditions under which agro-food trade will take place with external partners (Matthews, 2022; ARABSKA, 2021). One of the concerns for affected producers is that the F2F aims to ensure that European products are treated in the same way as products imported into the EU.[5] It highlights the importance of using trade policy to support, align, and be part of the EU's ecological transition. To this end, initiatives have been proposed, covering trade agreements, imported food and promoting standards (Matthews, 2022).[6]

The EU expects that the F2F strategy will lead to collective and international sustainability practices that will help promote a higher uptake of sustainability standards (Delgado et al., 2022; Purnhagen et al., 2021a). However, these measures may significantly impact agro-food sectors and supply chains in the middle- to low-income countries like South Africa (Faichuk et al., 2022; Sihlobo & T Kapuya, 2021). Requiring importers to meet specific environmental standards to access the European market are considered by some to be a form of trade barrier (Le Blanc, 2023; Leonard et al., 2021), as these measures might affect food exports to the EU by limiting market access or increasing the cost of exporting food products to the EU (West, 2022; Kazak, 2022).

[5] https://sagrainmag.co.za/2022/11/04/impact-of-eu-green-deal-on-south-african-agriculture/

[6] These include that "The EU will seek to ensure that there is an ambitious sustainability chapter in all EU bilateral trade agreements"; "It will ensure full implementation and enforcement of the trade and sustainable development provisions in all trade agreements, including through the EU Chief Trade Enforcement Officer"; "Imported food must continue to comply with relevant EU regulations and standards. The Commission will take into account environmental aspects when assessing requests for import tolerances for pesticide substances no longer approved in the EU while respecting WTO standards and obligations"; "A more sustainable EU food system also requires increasingly sustainable practices by its trading partners. In order to promote a gradual move towards the use of safer plant protection products (PPPs), the EU will consider, in compliance with WTO rules and following a risk assessment, to review import tolerances for substances meeting the "cut-off criteria" and presenting a high level of risk for human health."; "It will obtain ambitious commitments from third countries in key areas such as animal welfare, the use of pesticides and the fight against antimicrobial resistance."; "It will strive to promote international standards in the relevant international bodies and encourage the production of agro-food products complying with high safety and sustainability standards."

The emphasis in the F2F strategy on sustainable farming practices, reduction of pesticide and chemical use, and promotion of organic farming (Cortignani et al., 2022; Witzling et al., 2023) could force South African producers at all value chain stages to change their production processes and practices to meet requirements, including through switching to more sustainable production methods and switching to organic products. These changes would be costly for most producers and could further reduce yield and profit margins, including laying-off of workers (Cortignani et al., 2022). Furthermore, energy use, transportation, and logistics may also be impacted by increasing scrutiny regarding the carbon footprint associated with these activities (Matthews, 2022; Faichuk et al., 2022; Dekeyser & Woolfrey, 2021). Firms must reduce emissions throughout the supply chain or explore alternatives to minimize environmental impact (Dekeyser & Woolfrey, 2021; Monaisa, 2021; Roberts et al., 2022).

The implementation of the CBAM is also of concern. It is the most direct trade-related measure to be enforced and will force exporters from developing countries to pay a carbon price equal to local producers unless they are equally carbon taxed or have already decarbonised (Montmasson-Clair, 2021). While agro-food exports are not included under the EU's CBAM currently, it appears that these will face more rigid environmental standards in the future. The impact on agro-food and other sectors in South Africa will be particularly high if indirect emissions are included since South Africa's electricity supply is very carbon-intensive. Furthermore, shifts in energy markets are impacting indirectly on other value chains. For instance, the rising costs of artificial fertilizer due to rising gas prices, fuel, and chemicals have been putting increasing pressure on prices and food producers (BFAP, 2023b, IEJ, 2023). In particular, the expected impact of CBAM on fertilizer is an increase in prices (Grobler, 2022).

A further concern is the EU's Corporate Sustainability Due Diligence Directive (first proposed in 2022) which will oblige companies to comply with due diligence obligations related to human rights and environmental sustainability if they employ more than 250 employees. The directive will require certain large companies to have plans to ensure that their business strategy is compatible with limiting global warming to 1.5°C in line with the Paris Agreement.[7] In addition, some countries within Europe are considering their own measures. For instance, in June 2023, the German parliament adopted a law which requires large companies[8] to address human rights and environmental risks in their supply chains.[9]

These policies are expected to radically transform global production systems to greener processes given the investments required to transition export-oriented and -reliant sectors. The agro-food sector is expected to respond to the EGD, and while the full impacts of the EGD and CBAM are expected to arise in the medium- to long-term, the shifts and investments required to meet with these targets will need to occur in the short- to medium-

[7] https://commission.europa.eu/business-economy-euro/doing-business-eu/corporate-sustainability-due-diligence_en

[8] The law will apply to companies with more than 3,000 employees starting in 2023, and to companies with more than 1,000 employees from 2024.

[9] Companies will be required to comply with the Minamata Convention regarding production, use and handling of mercury; the Stockholm Convention on Persistent Organic Pollutions (POPs) regarding production and use of chemicals and handling of chemical waste; and the Basel Convention regarding hazardous wastes (https://www.ibm.com/blog/german-supply-chain-due-diligence-act-scdda-explained/)

term. However, there is little understanding of the risks the EGD poses for specific sub-sectors within the broad at-risk sectors, and their exposure at the firm and sub-sector level to the EU's proposed EGD policies. Also, there is little evidence on the specific measures and actions being taken to react to the evolving climate policy landscape to mitigate emissions, ensure sustainability and compliance with green and climate change policies. This paper aims to fill these gaps.

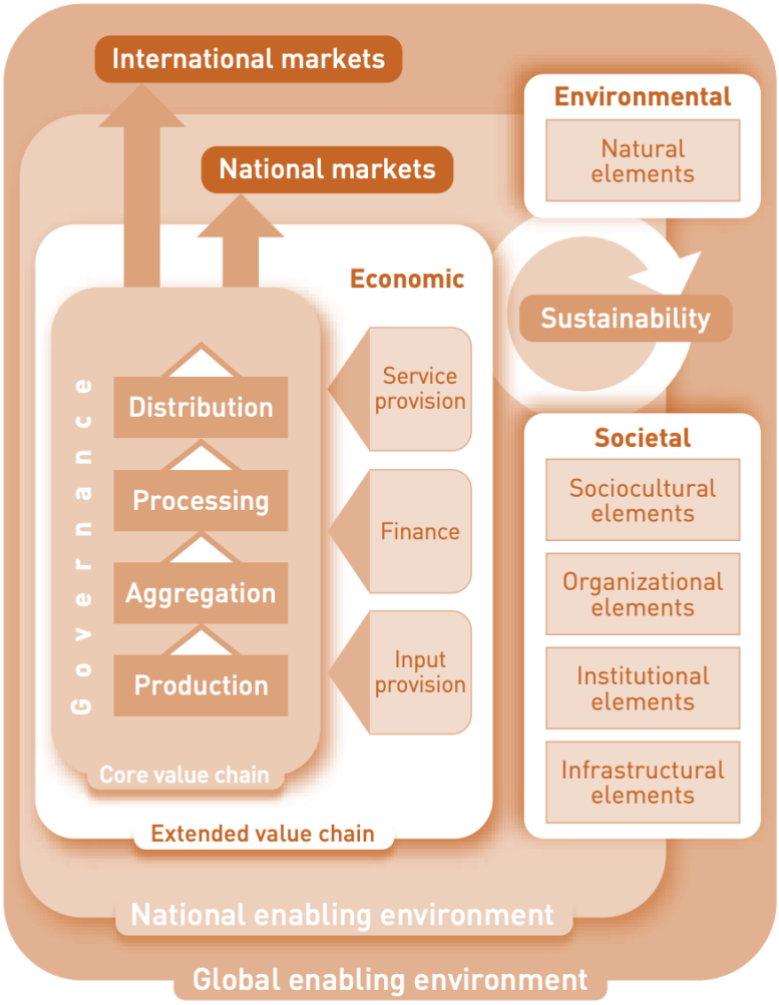
3. Methodology: Framework and data

This section discusses the data and method used to analyse the effect of the EGD on the citrus and wine value chains, and the responses of these agro-food sectors to the EU's proposed EGD policies.

Owing to its broad approach in forcing transitions related to sustainability and decarbonisation, the EGD's policies and initiatives necessitate adopting a suitable framework for understanding sustainability in developing agro-food value chains. For this, we first define sustainability as it relates to agro-food value chains as "the full range of farms and firms and their successive coordinated value-adding activities that produce particular raw agricultural materials and transform them into particular food products that are sold to final consumers and disposed of after use, in a manner that is profitable throughout, has broad-based benefits for society and does not permanently deplete natural resources" (FAO, 2014:1). Thus, sustainability as it relates to food systems rests on maximising the economic and social impacts while minimising negative environmental impacts such as carbon footprint, biodiversity loss, and toxicity (FAO, 2018). By harmonising these objectives through interrelated growth agendas (green growth and inclusive growth) while targeting eco-social progress, food systems can become sustainable and resilient to external shocks stemming from policies governing exports and domestic producer competitiveness like the EGD.

In this context, the introduction of a value chain lens to the analysis of food systems as well as introducing the broader system of input and support actors from government departments, institutions, associations, and finance bodies extends the scope of the analysis from a narrow set of value-adding objectives to one focused on improving the outcomes of those affected by policies (international and domestic) (Figure 4).

Figure 4: The sustainable food value chain framework



Source: FAO (2014)

To properly account for the potential impacts on the South African wine and citrus value chains, this paper thus adopts the sustainable food value chain framework presented above that necessitates the views of multiple actors along the value chain and within the larger network. The paper draws on publicly available information and previous and ongoing research in these industries and supplements this information with primary data collection through interviews. Stakeholders (producers, input suppliers and policymakers) within these value chains were interviewed through semi-structured interviews to understand these issues from their on-the-ground perspectives as those directly and indirectly affected by the requisite shifts. Interviewees were identified based on their current and expected capabilities to export their products to the EU or their knowledge of the sustainability pressure points impacting the industry.

The two industries are also well-organised (Chisoro-Dube & Roberts, 2021; Das Nair, et al., 2023), with strong industry associations which are key players in creating, overseeing, and enforcing standards and assurances within their industries. They are also critical in fostering and driving sustainability and decarbonisation initiatives to help the industries better prepare themselves for changes. Therefore, we also interviewed industry associations to

understand the extent of support from them in overseeing and coordinating sustainability and decarbonisation objectives.

The questions in the research instrument were grouped under themes that target several key areas of interest: markets, production, and exports; energy, carbon intensity, the EU Green Deal, and greening the value chain; industry association and state policy support; and cooperation and collaboration. The questions under each theme were designed to elicit responses to illuminate and contextualise the issues at the heart of the research.

In total, we conducted 10 interviews across the citrus and wine sub-sectors between June and August 2023. Table 3 shows the list of interviews and their sectors of operation. This information was then triangulated with data and information from secondary sources and research to ensure robustness and check the generalisability of the observations. Due to the confidentiality of the respondents necessitated by the obtained Ethical Clearance, the interviewees were designated codes to ensure their anonymity (see Table 3).

Table 3: List of Interviews

Date	Institution	Code
27 June 2023	Traceability Expert	Interview DC1
30 June 2023	Citrus Growers Association	Interview C1
6 July 2023	WIETA	Interview W1
11 July 2023	Blue North	Interview DC2
7 July 2023	WITU	Interview W2
7 July 2023	Ses'fikile Wines	Interview W3
7 July 2023	NAMC	Interview DC3
20 July 2023	Thokozani Wines	Interview W4
21 July 2023	University of Cape Town Graduate Business School	Interview W5
25 July 2023	Winetech (SA Wines)	Interview W6
1 August 2023	Wine and Spirits Board	Interview W7

The next two sections analyse and synthesise the information obtained from the interviews and available literature in line with our framework for citrus (section 4) and wine (section 5) respectively. To develop the discussion more systematically, we thematise the section based on key themes that emerged from the literature and data collected from our interviews.

4. Citrus sector in South Africa and the EGD: Overview and implications

This section analyses and discusses the effect of EGD policies on the citrus sector. It starts by providing an overview of the citrus sector and then focuses on the implications of the EGD on the sector in SA.

4.1. Overview of the citrus sector

South Africa's warm climate, ample sunshine, and suitable soil conditions provide an ideal environment for citrus cultivation. South African citrus is known for its competitive pricing and affordability compared to citrus from other producing regions. This, coupled with the high quality of the fruits, makes South African citrus attractive to international buyers (Boonzaaier, 2015).

Stakeholders in the citrus industry can be grouped as cultivar development and management companies, nurseries, input suppliers, growers and packhouses, marketing companies, fruit processors, government agricultural departments and industry associations (Chisoro-Dube & Roberts 2021, Figure 5).

Figure 5: Overview of the citrus value chain

Source: Table adapted from Chisoro-Dube & Roberts, 2021

While Figure 5 gives an overview of the citrus value chain, it is important to note that the structure of the value chain still reflects the remnants of apartheid. More specifically, there are several barriers to entry for black participants in the citrus value chain, with most small and medium-sized producers entering at the grower level. Small and medium-sized citrus growers are largely black-owned while the established commercial farmers are white. Of the total area planted, the black growers accounted for 8,103 hectares in 2020 (or just under 10%), with an average farm size of 56 hectares (Jasper, 2023; Cramer & Chisoro-Dube, 2021; Fairbanks, 2022).Understanding the racial disparity in the citrus value chain helps provide clearer insights regarding how the EGD is expected to impact stakeholders differently along racial lines within the South African context.

4.2. EGD and its implication on the citrus sector

The EU has a history of stringent SPS protocols and EGD regulations will impose further technical measures at a cost to producers. EGD requirements for the citrus sector mainly emanate from the F2F strategy, though other initiatives like Corporate Sustainability Due

Diligence Directive, the German Supply Chain Law and others could also affect South African citrus producers.[10]

South African growers had already been moving towards adopting more sustainable forms of production for many years. For instance, due to the Sustainability Initiative of South Africa (SIZA), farmers have been decarbonizing their operations and adopting more sustainable practices for several years (Jasper, 2023; Oduniyi et al., 2023; SIZA, 2016). However, with increasing global and local pressure to decarbonize, South African citrus growers and exporters will need to increasingly invest in sustainable practices and technologies to reduce their carbon emissions, including adopting cleaner production methods, investing in renewable energy, or implementing carbon offset initiatives (Jasper, 2023). They will need to do this to keep up with changing requirements if they are to continue accessing the EU market. This is because the new requirements demand more transformation than the current level of standards in South Africa. These adjustments would require additional investments and may take time to implement.

The discussion below focuses on the main challenges for the citrus sector related to EGD initiatives. Specifically, the discussion summarizes the challenges into two broad categories, namely; market access challenges related to the EGD, and adaptation and mitigation efforts; and inconsistent policies and lack of clarity.

4.2.1 Market access challenges related to the EGD, and adaptation and mitigation efforts

This sub-section provides insight into five specific challenges related to mitigation in the citrus industry.

i. Additional burden of compliance: SPS requirements and EGD initiatives

To comply with EGD policies and export to the EU, a farm will need to provide documentation of compliance with the various requirements. This can already be seen via the EU's sanitary and phytosanitary standards (SPS), where producers have to currently provide proof of adhering to certain standards in order to access the EU market (West, 2022; Motsoere, 2022). Phytosanitary requirements are regulations and measures to prevent the introduction and spread of pests and diseases by moving plants, plant products, and other regulated goods. Standards for the citrus industry include Global.G.A.P. Integrated Farm Assurance (IFA) certification, Sustainability Initiative of South Africa (SIZA) certification, compliance with labour laws, including basic employment and employment equity conditions, and food safety requirements.

The GlobalG.A.P. forms the *cornerstone* for all compliance standards and the GlobalG.A.P. IFA covers food safety, environmental sustainability and biodiversity, workers' well-being and production processes and traceability.. As far *social and ethical standards* are concerned, the SEDEX standard covers labour, health and safety, environment, and business ethics. The

[10] https://www.cips.org/supply-management/news/2021/june/citrus-sector-a-litmus-test-for-new-supply-chain-law/

GlobalG.A.P GRASP (Global Risk Assessment on Social Practice) can be used in combination with Global.G.A.P IFA and is a farm-level social/labour management tool, which considers local legislation and country-specific factors. The SIZA Social standard is a local standard which allows producers to report on sustainable agriculture and adherence to ethically fair labour practices. SIZA was established in 2008 to monitor ethical and environmental trade within South African agriculture (Grobler, 2022). As far *environmental standards* are concerned, GlobalG.A.P Spring is focused on sustainable water management, SIZA Environmental focuses on responsible agricultural practices for sustainable usage of natural resources, and Woolworths: Farming for the Future considers the entire farming processes. There are also *food safety standards*, TESCO Nurture, the Albert Hein AH-DLL GROW and the GlobalG.A.P FSMA which are all add-ons to the GLobalG.A.P IFA

The Global.G.A.P IFA certification is the cornerstone of all compliance standards, and every fruit producer exporting into the EU must adhere to this standard. Based on Grobler (2022)'s *Cost of Compliance* report[11], **Error! Reference source not found.** below shows which certification are complied with in the South African citrus sector. The GlobalG.A.P and SIZA standards are the most prominently used in the citrus industry.[12] The SIZA Ethical SAQ/SEDEX certification is also very popular. As far as *environmental standards* certifications are concerned, citrus producers mainly use the SIZA Environmental, GlobalG.A.P. Spring add-on and the Blue North Confronting Climate Change (CCC) standard (Grobler, 2022). The emphasis on meeting some or all of these environmental standards has started escalating from 2022. Only SIZA is local, while the rest are international.

Table 4: Citrus focus group social/ethical and environmental compliance

		Ethical / Social				Environmental			
	GlobalG.A.P IFA	SIZA Ethical SAQ	SIZA Ethical Audit	SEDEX via SIZA SAQ	GlobalG.A.P. GRASP Add-on	SIZA Environmental SAQ	SIZA Environmental Audit	Blue North CCC	GlobalG.A.P. SPRING Add-on
Small	100%	100%	67%	100%	0%	33%	67%	0%	33%
Medium	100%	100%	100%	100%	33%	67%	100%	33%	67%
Large	100%	100%	100%	100%	100%	75%	100%	50%	75%
Weighted Average	100%	100%	90%	100%	50%	100%	90%	30%	60%

Source: Constructed from Grobler (2022) (based on Table 19 and Table 20)

Given the variety of standards that need to be adhered to, the processes for exporting are becoming administratively intensive and costly. As a result, the large exporters have grown their administration staff dedicated to handling all export requirements, which smaller growers find difficult. The plethora of standards for the citrus industry impacts the time,

[11] The methodology was conducted as follows: the four participating industry bodies, one of which is the CGA, produced a list of 10 producer members representing small, medium, and large farming operations for each of the nominated produce types. Formal interviews were conducted with focus groups as well as other roleplayers (Grobler, 2022).
[12] There is a partnership between SIZA and GlobalG.A.P. which allows GlobalG.A.P. to display actual SIZA audit information and SIZA status updates in real-time.

investment and expertise required to reach the requisite export capabilities. As EGD policies kick in, the cost of compliance will increase.

Taking EGD initiatives into account in this context of extensive SPS regulations adds to the burden of access. Furthermore, SPS requirements for the citrus sector are becoming more stringent. In July 2022, the EU imposed new SPS requirements on South African citrus imports meant to address False Coddling Moth (FCM), a citrus pest native to the region. The new controversial phytosanitary legislation is contained in the EU plant health regulations of 2019 (EU 2019/1702), and requires exporters to implement costly cold storage facilities in a bid to stave off FCM infestation (Montilon et al., 2023). It requires mandatory cold treatment of 0°C to -1°C for at least 16 days for fruits exported from South Africa to the EU. The new rules are costly – the cost of Citrus Black Spot and FCM control across the value chain was estimated at R3 billion in 2020 alone.[13] The situation is even worse for small scale producers who may not have the financial means to adapt to these new requirements.

The Citrus Growers Association (CGA) has expressed concerns stating that these rules are negatively impacting agro-food exports from the country and seriously threatening the sustainability of the jobs in the sector (West, 2022).[14] South African producers do not have the means to resist the new EU rules due to heavy reliance on EU market and are thus forced to abide by them. This is despite the fact that the rules are contentious. The new requirements seem to go against the spirit of the F2F, which among other measures, aims to decrease energy consumption and waste. The new cold storage rules require more energy for precooling which is expected to significantly increase energy usage. In sum, the overall effect of these new requirements is to increase costs and reduce market access especially for small scale producers in South Africa, and also increase waste counter to the aims of the EGD.

ii. Pesticide use and Maximum Residue Levels (MRLs)

The F2F strategy contains ambitious targets to reduce the use of pesticides in the EU – the first target is to reduce by 50% the use and risk of chemical pesticides by 2030; the second target is to reduce by 50% the use of more hazardous pesticides by 2030 (Matthews, 2022). Pesticide regulation is expected to be the trade policy intervention emanating from the EGD that has the largest impact on the exports of low-income developing countries through rules on Maximum Residue Levels (MRLs) (Matthews, 2022). MRLs are legal limits established by regulatory authorities to ensure that the residues of pesticides in products are below levels considered to be safe.

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13 https://croplife.co.za/Article/NewsArticle?pv=Impact_of_EU_Green_Deal_on_South_African_Agriculture_Conference_Summary

14 Establishing or upgrading cold storage facilities can involve significant upfront costs, including acquiring or retrofitting refrigeration equipment, insulation, temperature monitoring systems, and appropriate storage infrastructure. Cold storage facilities require ongoing operational expenses, such as energy costs for maintaining the required temperatures, maintenance and repairs of refrigeration equipment, and monitoring systems.

Rules for Plant Protection Products (PPP) in the EU are much more stringent than for other countries or regions, with the result that there are far fewer substances approved for use by EU farmers as herbicides, fungicides and pesticides and other PPPs than for other counties with agricultural production of a similar scale. Under the EGD, there is gaining momentum to ban the import of products treated with PPPs not approved in the EU ("mirror clause"). In addition, it is proposed that not only should health impacts be considered, but environmental impacts of active substances would also be taken into account, as is currently done in the EU (Matthews, 2022). For example, the Pesticide Action Network (PAN) Europe has argued that if a substance has been banned in the EU due to human health and/or environmental concerns, it should not be supported for use in third countries (Matthews, 2022).

Countries have argued against the approach that the EU is proposing. In particular, three concerns have been raised. Firstly, MRLs for active substances based on hazard-based criteria tend to be based on risks that have not conclusively been identified[15]; secondly, there is a lack of clarity regarding how the EU intends to consider applications based on hazard-based criteria; and thirdly, inadequate time is proposed to adapt and find alternatives. They argue that the proposed policy of the EU to impose its own domestic regulatory approach on trading partners does not make sense because climate and environmental conditions differ around the world, thus requiring different management regimes. EU policies could thus impact farmers' livelihoods beyond EU borders. Both citrus fruits and grapes are considered crops that will particularly be affected (Matthews, 2022).[16]

MRLs are expected to impact exporters to the EU in several ways, including increasing the cost of compliance, as well as testing and changing actives used. For the citrus sector, new rules regarding MRLs are expected to result in the withdrawal of some pesticides, and there are costs associated with transitioning to new pesticides.[17] Countries' relative competitiveness may also be impacted, with countries that already meet the EU standard facing lower costs than countries that do not.

iii. Energy use in the value chain

Energy is used along various nodes of the citrus value chain in South Africa, including in irrigation, for management, as well as for cooling. Persistent loadshedding is currently the main driver of decarbonization related to energy usage, and has resulted in significant losses for agro-food companies in South Africa.[18] Electricity outages cause disruptions to farming operations, particularly those reliant on irrigation systems, refrigeration, and processing equipment. Unreliable power supply can lead to crop losses, reduced productivity, and increased backup power generation or equipment maintenance costs. Furthermore, the cost of electricity in South Africa has been increasing over the years, significantly impacting the

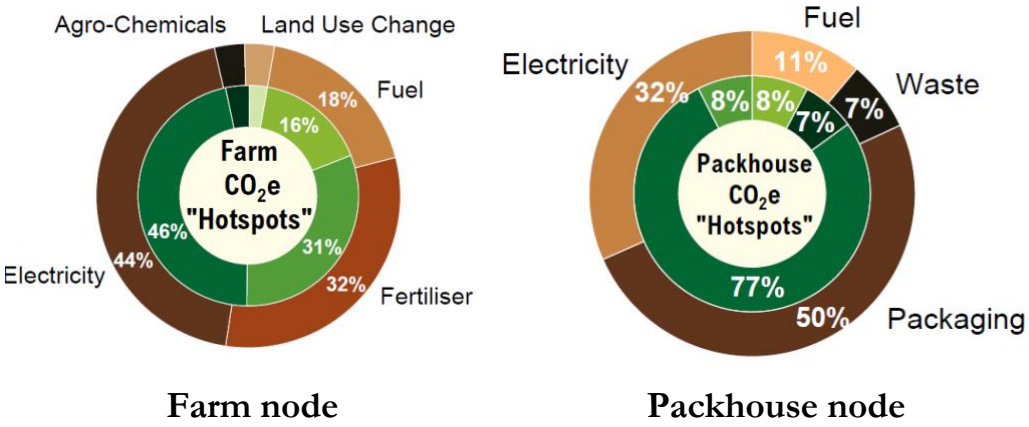
[15] A hazard is something that could potentially cause harm, while risk takes account of the probability that a person will be harmed or experience an adverse health effect if exposed to a hazard (Matthews, 2022).
[16] Others include bananas, tea, coconut, oil seeds, vegetables, rice, cocoa, coffee, cinnamon, mango, melons, watermelons, papaya, sweet potatoes, tree nuts and cranberries (Matthews, 2022).
[17] Interview C1.
[18] https://www.greenagri.org.za/blog/electricity-crisis-for-south-african-farmers-a-call-for-concern/

profitability of fruit farmers, particularly those with energy-intensive operations such as cooling, drying, and processing facilities.

There has also been increasing pressure through EGD initiatives impacting on decarbonization. Though EGD policies currently do not require citrus producers to show carbon footprints, this is increasingly a requirement from retailers in the EU, and there is an expectation that carbon footprinting and decarbonization will be required through EGD policies in the future.

Most emissions in the citrus sector (excluding emissions emanating from transport) emanate from the cold store node (CCC, 2023). For hard citrus, 77% of emissions at the cold store node are as a result of electricity, while for soft citrus, 65% of emissions are from electricity (Figure 7). This is followed by refrigerant leakage (34% for soft citrus and 19% for hard citrus). The farm node is the second largest contributor of emissions for the citrus sector (CCC, 2023). For both hard citrus (green in Figure 6 below) and soft citrus (orange in Figure 6 below) most emissions at the farm node originate from electricity usage (46% for hard citrus and 44% for soft citrus). Fuel is another significant carbon emitter at 16% and 18% for hard and soft citrus**Error! Reference source not found.**. The packhouse is the smallest emitter of carbon, and electricity usage is the second largest contributor to emissions at the packhouse node (after packaging) accounting for 32% of emissions for soft citrus and 8% of emissions for hard citrus.

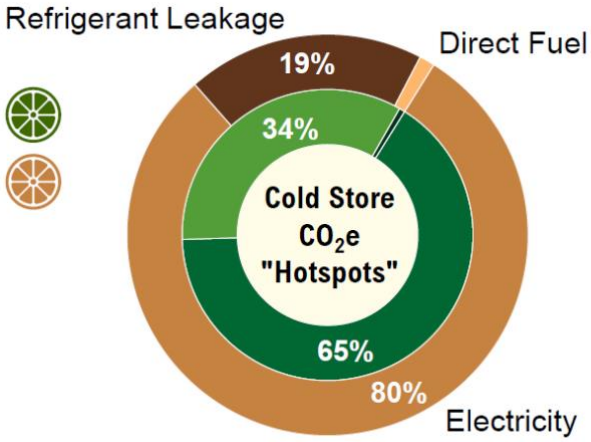
Figure 6: Carbon emissions at the farm and packhouse nodes for citrus



Farm node **Packhouse node**

Source: CCC (2023)

Figure 7: Carbon emissions at the cold storage node for citrus



Source: CCC (2023)

Given that the cold storage node and farm node are the largest emitters, and this is mostly accounted for by electricity usage, carbon reductions for the citrus industry should focus on using alternative sources of electricity such as solar energy and reducing refrigerant leakage at cold store node (CCC, 2023). At the farm node, carbon reductions can be achieved by optimizing irrigation (precision irrigation) and alternative sources of electricity.

Many fruit farmers recognize the need to improve energy efficiency and transition to more sustainable energy sources. At present, around 30% of citrus producers undertake carbon footprinting through Blue North's CCC initiative (see **Error! Reference source not found.** above) in order to understand carbon use in their value chains and begin the transition to less carbon-intensive production. The upfront costs of implementing energy-efficient technologies or installing renewable energy systems (such as solar panels or wind turbines) can be a barrier for some farmers, especially smaller-scale operations with limited financial resources. If EU rules around electricity-related decarbonization cover fruit sectors in the future, they will result in costs for South African farmers. This includes both the cost of transitioning to less carbon-intensive energy usage such as solar energy and the cost of calculating the carbon footprint (carbon footprinting). In addition, one interviewee noted that producers who transition also often still face the cost of having backup energy such as a generator since solar/wind energy production is dependent on weather conditions.[19] Increasingly though, companies are considering moving to renewable energy sources, though uptake is slow (WRC, 2022).[20]

iv. Transition towards organic

[19] Interview DC2.
[20] https://www.engineeringnews.co.za/article/renewable-energy-becomes-an-increasingly-tangible-option-for-farmers-2021-06-29

Currently, most of South Africa's production of citrus is inorganic. However, through the EGD, there is a push towards organic agriculture in the F2F, which may, in the future, impact on countries like South Africa. Given that there is very little organic production of citrus in South Africa, a potential move towards organic agriculture will result in significant challenges and costs for producers that aim to transition.[21] This will include adjusting farming practices, managing pests and diseases using organic methods, and potentially facing lower yields during the transition period. The transition process will require financial investments, training, and a dedicated transition plan.

v. Fertilizer use, packaging, and waste

Though fertilizer use, packaging and waste are not significant contributors to emissions in citrus (see Table 2Error! Reference source not found.), there are opportunities for decarbonization. At the farm node, fertilizer use is the second largest contributor to emissions, accounting for 32% of emissions in soft citrus and 31% of emissions in hard citrus (Figure 6) (CCC, 2023). A focus on soil health will reduce external inputs.

Packaging materials are the largest contributor to emissions at the packhouse node, accounting for 77% of emissions in hard citrus and 50% of emissions in soft citrus (Figure 6) (CCC, 2023). Corrugated cardboard and cardboard account for 80% of packaging material for both hard and soft citrus. Carbon reductions at the packaging level can focus on using recycled and recyclable materials (CCC, 2023).

Waste also contributes to packhouse emissions at 7% for both hard and soft citrus (Figure 6) (CCC, 2023). Reductions in emissions can focus on waste management facilities, including adequate infrastructure for handling and disposing of agricultural waste, such as packaging materials, chemicals, and organic waste (Pentikäinen, 2022; Grobler, 2022), while the cost depends on the production scale and the specific waste management requirements.

4.2.2 Inconsistent policies and lack of clarity

This sub-section provides a brief overview of the inconsistencies within the EGD that producers in SA are likely to encounter. The F2F strategy encompasses a wide range of policy areas, including agriculture, food production, consumption, and waste management. The complexity of the food system and the need to balance multiple objectives can result in inconsistency and misalignment, as discussed below. Further, there is a lack of standardized requirements across all EU countries, thus increasing the cost of compliance for South African citrus growers (Boerengroep, 2020; Purnhagen et al., 2021b; Živković et al., 2022).

Some market participants have noted that there are inconsistencies as well as a lack of clarity in benchmarks being pursued. For example, the EU has set benchmarks for decarbonization in the production processes of agricultural products, but there is

[21] Interview C1.

insufficient clarity on whether proposed reductions are based on South African or EU benchmarks.[22] Further, there are disparities in technology availability across countries. The availability and maturity of low-carbon technologies can impact the rate of decarbonization. If certain critical technologies are not yet widely available or economical for some countries, achieving the target may be more difficult if not unfair (Liu et al., 2021; Papadis & Tsatsaronis, 2020; Sparkman & Attari, 2020; Živković et al., 2022).

Some participants pointed out that some of the EU environmental policies are leading to wastage of products which is against the spirit of sustainability. One example is the use of plastic packaging for food products. Plastic has been widely used in the food industry for packaging and protecting perishable citrus during transportation. Its lightweight, durability, and moisture-resistant properties have made it an efficient choice for preserving citrus quality. EGD rules around use of plastics will result in alternative packaging materials being used, which may not offer the same level of protection, leading to higher spoilage and food wastage during export (Langley, 2022; Schweitzer, 2018).

4.3 Summary

The EGD presents challenges for the South African citrus industry as far as accessing the EU market is concerned. There are, in particular, three areas of concerns. Firstly, rules around MRLs may result in the use of some pesticides being withdrawn for products being exported into the EU. Secondly, with increasing pressure for decarbonization along the value chain as well as loadshedding in South Africa, citrus producers are increasingly considering transition to renewable energy sources. Thirdly, the burden and cost of compliance will increase for citrus producers as EGD initiatives kick-in, given that producers already have to comply with various SPS standards.

5. Wine sector in South Africa and the EGD: Overview and implications

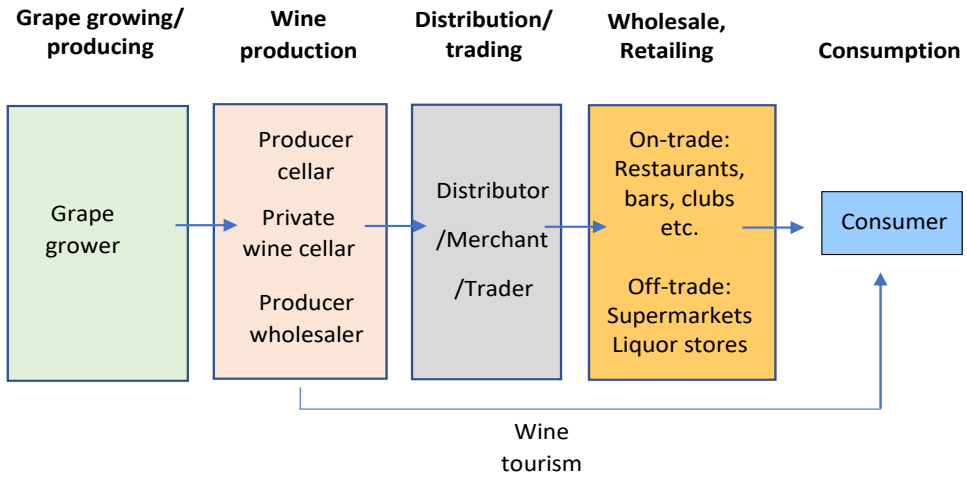
5.1 Overview and value chain

South Africa is the 8th largest wine producer globally. As noted, the wine sector plays an important role in the national economy, contributing significantly to economic growth in South Africa. In addition, the literature on the wine industry in South Africa highlights that the sector has highly complex production processes and is well integrated in the global wine value chain (Das Nair et al., 2023).

Generally, the wine value chain has five main stages: grape growing/producing; wine production; distribution and trading; wholesale and retail; and consumption (Goncharuk, 2017). Figure 8 provides a graphical representation of the wine production/value chain.

[22] Interview C1.

Figure 8: Simplified wine value chain



Source: Adapted from Goncharuk (2017) and das Nair et al (2023)

Grape producers are at the primary level of the wine value chain where the growing and selling of wine grapes to wine cellars occur. Grape growers can also be vertically integrated through ownership into wine production as well. At this level, wine cellars produce or blend wine which they sell domestically or to international markets, through traders, importers, agents, or distributors, or directly to retailers. The processing of grapes into wine at wine cellars is carried out through different organizational models led by private individual or group cellars.[23] Consumers access wine at the cellar door, or in on-trade and off-trade markets, where on-trade refers to sales for on premise consumption such as in bars, restaurants, hotels, nightclubs; and, off-trade refers to sales for off premise consumption such as through supermarkets, wholesalers, retail liquor stores and online.

As noted, South Africa is well integrated in the global wine production chain. As a result, the sector has built several capabilities and market presence over the decades. The sector also has key institutions that support the operations of sellers and promote research and development, market access/exports and transformation. These organizations include:

- *Wines of South Africa* (WOSA), a non-profit industry organisation with the objective of promoting and building South African brands globally. WOSA is funded exclusively by the wine industry through a statutory levy on exports.[24]

[23] SAWIS Statistical Booklet, 2021 and https://www.wosa.co.za/The-Industry/Overview/.
[24] Sources: https://www.wosa.co.za/home/

- *South African Wine Industry Transformation Unit* (SAWITU) is responsible for transformation in the industry, and aims to promote black-owned, particularly women-owned, brands with respect to access to markets and through capacity building initiatives, amongst other objectives.[25]
- *Winetech*, an independent non-profit corporation, undertakes R&D and technology transfer through a research statutory levy.[26]
- *Vinpro*, a non-profit corporation, represents around 2,500-2,600 wine producers, cellars and industry stakeholders. It carries out research and provides services on matters of government relations, profitability and sustainability, industry trends and technical expertise, specialised services in soil science to viticulture, agricultural economics, transformation, and development.[27]
- *South African Liquor Brand Owner's Association* (SALBA), non-profit corporation, represents manufacturers and distributors in the liquor industry on issues of common interest.[28]
- The *Wine & Spirit Board* is appointed by the Minister of Agriculture, Land Reform and Rural Development (DALRRD) and comprises a chairperson and 12 members with expertise in the wine and liquor industries. The Board, amongst other mandates, verifies claims on wine bottle labels on origin, vintage and grape variety, and administers the Wine of Origin, Integrated Production of Wine (IPW) and Estate Brandy schemes.[29]
- The *South African Wine Industry Information and Systems* (SAWIS) deals with the collection and dissemination of data both to the public and for its membership base.[30]

Despite the above characteristics of the wine industry, it remains one of the less inclusive industries and least transformed sectors (das Nair et al., 2023). For instance, 80% of wine farms are still owned by white men, while only 3% of total industry sales are accounted for by black-owned brands. This lack of inclusivity of the industry may have implications for transition and decarbonization responses in SA.

The next section further discusses implications for the wine industry in the context of the impending EGD. In line with the section on citrus (section 4), we do this by synthesising and contrasting our interviews with stakeholders and available literature in South Africa.

5.2. EGD, sustainability, and decarbonisation in the wine value chain

The South African wine industry is susceptible to threats and disruptions, as shown by the COVID-19 pandemic, which exposed fundamental structural problems in the industry (Montmasson-Clair et al., 2021). Hence, impending regulations such as the EGD are expected

[25] See also https://witu.co.za/
[26] See also https://winetech.co.za/
[27] See also https://vinpro.co.za/
[28] See also https://salba.co.za /
[29] See also https://www.wosa.co.za/The-Industry/Wines-Of-Origin/Wine-and-Spirit-Board/
[30] See also https://www.sawis.co.za/

to exert market pressure on the industry to transform and reduce its carbon footprint (DEA, 2015; Montmasson-Clair & Mataba, 2020). This is because wine is a highly traded good and new regulations will have implications on the cost structure and viability of the wine industry.

Generally, the wine industry faces various socio-environmental problems and concerns (Christ & Burritt, 2013; Valero et al., 2021). One of the main concerns is around the use of pesticides that generate substantial volumes of greenhouse gases (GHG). Further, the actual production of pesticides results in further GHG emissions (Verra, 2023). Secondly, the use of energy in the wine value chain in the production, bottling and transportation of wine is a further concern (Libres de contaminantes hormonales, 2023).

The empirical literature in South Africa highlights that sustainability in the South African wine industry has been driven by three factors namely horizontal initiatives, vertical top-down initiatives, and vertical bottom-up initiatives (das Nair et al., 2023). Vertical top-down governance relates to the sustainability demands that are placed by global buyers and retailers (both in the global north and domestically) on their suppliers and sub-suppliers to address social and environmental challenges. Top-down vertical demands for sustainability have been driven by the alcohol monopolies of the Nordic countries (Sweden, Finland, Norway) and some Canadian states (Quebec, Ontario). Some of these demands have included the following i) Fairtrade certification; ii) Organic and biodynamic certification; iii) WIETA compliance; iv) lighter glass bottles; v) recyclable or greener forms of packaging; vi) bulk exports; and vii) carbon footprinting (das Nair et al., 2023). In the EU markets, carbon footprinting is coming into effect because wine buyers and retailers in the EU expect the implementation of CBAM in the future, with some retailers requiring suppliers to develop 5-year carbon plans.

Vertical bottom-up governance operates through individual sustainability initiatives undertaken proactively by suppliers, including to enhance their relative competitiveness. The bottom-up represents the collective efforts by companies to pioneer sustainability initiatives (das Nair, et al., 2023). Horizontal sustainability governance refers to initiatives driven by industry associations, civil society groups and/or government at the local, regional, and national levels. Horizontal sustainability governance initiatives that the various industry associations have introduced include plant and environment protection more specifically related to climate change issues, carbon footprinting, market access and entrepreneurship, labour conditions etc.

The EGD is one such initiative that aims to achieve net-zero GHG emissions by 2050, with the pressing concerns for South African producers around emissions standards, and related monitoring efforts (Montmasson-Clair and Mataba, 2020). While the CBAM does not currently cover the agro-food subsectors, the wine industry will indirectly be impacted by the CBAM through:

- the coverage of **biomass in energy-generating facilities** and the industrial production of **ammonium nitrate used in agricultural pesticides**;
- the pass-through of impacts on inputs, such as **electricity**, **agro-chemicals**, and **transport services** (Montmasson-Clair & Mataba, 2020).

Sustainability concerns have also gained significance as consumers pay increasing attention to sustainable wine products (Dressler & Paunovic, 2019). This change is seen in the increased calls for aspects such as traceability and supply chain auditing. The consumer drive towards sustainable wine is further pushing for the adoption of sustainable practices in the industry and could be a potential source of competitive advantage.

We discuss these issues further below. In particular, we reflect on the sustainability concerns relating to traceability, carbon footprinting and supply chain auditing; energy use; transportation; and packaging in the wine value chain.

5.2.1. Traceability, carbon footprinting, and supply chain auditing

The EGD introduces specific actions and targets to drive sustainability and the resilience of the EU food systems. Wine sold in Europe must be safe and traceable 'from-farm-to-fork', contamination risks must be limited by defining hazard analysis critical control points (HACCP), and food products must be subjected to official controls (CBI,2021). While sustainability has been considered from various perspectives in the South African industry for some time, the South African wine industry lags on carbon footprint, with scattered farm, cellar, and industry initiatives and growing demands for carbon footprint information (das Nair, et al., 2023).

Traceability (more commonly understood as supply chain auditing and reporting and tracking) in the wine industry remains a central theme in the current world market, largely driven by changing sentiments and demands by international consumers for more accurate reporting of the quality and origin of food and drink (Kshetri, 2018). Traceability, originally initiated as part of the United Kingdom's import regulations, led to the development of voluntary traceability regulations in the wine industry in the late-1990s[31], and has become a substantial issue for the wine industry.

Currently, traceability in the wine value chain is governed by different laws, including the International Organization of Vine and Wine (OIV). Additional certifications for the wine industry come in the form of the Integrated Production of Wine (IPW), Wine of Origin (W0) seal, fairtrade, organic and biodynamic certification and WIETA compliance. The IPW is an environmental sustainability scheme first established by the South African wine industry in 1998 (Wine and Spirit Board, 2023) (see Appendix 1 for a list of certifications for the wine industry). The WO seal certifies origin, vintage year and cultivar and guarantees consumers that their wines comply with WO requirements (Wine and Spirit Board (WSB), 2023). The IPW was the first scheme of its kind in the wine industry to comply with international wine industry environmental sustainability criteria. The IPW functions across multiple levels of the value chain (Wine and Spirit Board, 2023). Without the IPW seal, South African winemakers may find accessing EU markets challenging. For example, to qualify for tenders by monopoly buyers in Scandinavia, producers must have an IPW certification (das Nair, et al., 2023).

From the 2010 harvest onwards, developments in this area introduced the creation of a joint voluntary seal for WO and IPW that acts as an alternative seal, which would simultaneously certify producers in line with the IPW and WO requirements (Wine and Spirits Board, 2009).

[31] Interview W1.

The joint seal became a critical selling and marketing point for Wines of South Africa's (WOSA) push to strengthen South African brands internationally. As part of its qualification requirements, the new seal required that "[e]ach link in the production chain must comply with the IPW guidelines and requirements" and "[t]he IPW information of all prospective users of the new seal must annually appear on the new electronic IPW data base" (Wine and Spirits Board, 2009: 2). Crucially too, this combined seal employed a self-audit system combined with spot-checks by independent auditors (Wine and Spirits Board, 2009). As of recent figures, more than 95% of wine farms are certified through the WSB's Integrity & Sustainability seal (WWF South Africa, 2022). These are expected to be ramped up with EGD initiatives.

Fairtrade certifications represent approaches that seek to enable farmers and workers to have more control of their lives and making decisions on where to invest with the objective being to transfer wealth back to farmers and workers (Back et al.,2019). The certification is awarded to farmers practicing social standards, good labour practices, environmental awareness among workers, work conditions and freedom of association (Fairtrade, 2019). In South Africa there are 7,000 ha of certified Fairtrade vineyard spearheaded by about 20 wine grape growers (das Nair, et al., 2023). As a result, the sales of Fairtrade wine from South Africa has increased tremendously from 2015-2020. In addition, another increasing demand is the organic and biodynamic certifications. However, in South Africa the certification of organic grapes for the production of wine and biodynamic certification is relatively small compared to the total (das Nair, et al., 2023).

Compliance requirements are exacerbated by the costs that rigorous traceability systems and measures place on the entire value chain. Supply chain auditing is a significant issue. Not only does it aim to ensure that first-tier compliance is upheld at cellar level, but that that the highest international and local labour and health and safety standards are implemented at wine farm level and throughout the supply chain.[32] More recently, traceability has extended to include, as some examples, minimum legal compliance, particularly in areas of seasonal worker contracts and leave provisions, housing, minimum wages, and occupational health and safety compliance.[33]

Given the numerous number of labels, seals and schemes already in place to promote sustainability and also acting as guarantees of quality and adherence to numerous local and international standards across the South African wine value chain, additional traceability requirements in the context of the EGD will add to the cost of compliance by South African producers.

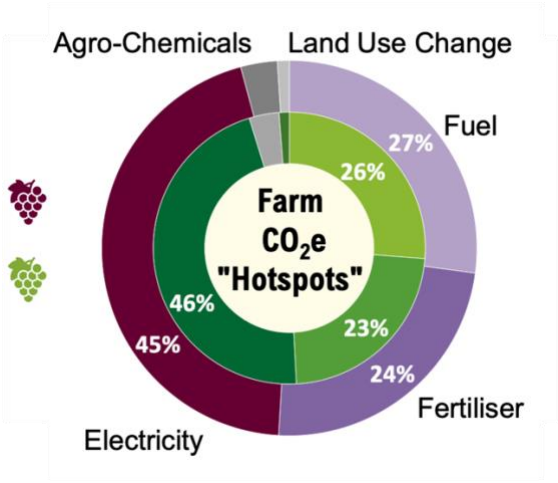
5.2.2. Energy and carbon intensity

The wine industry is energy- and carbon-intensive (Sovacool, Bazilian, Griffiths, Kim & Foley, 2021). Across the value chain, many diverse applications, including production and post-harvesting operations and winemaking, contribute to the industry's emissions. A closer inspection of the emissions breakdown of the different levels of the wine value chain (farm and winery) shows that electricity is the largest emitter of CO_2 across white and red wine

[32] Interview W1.
[33] Interview W1.

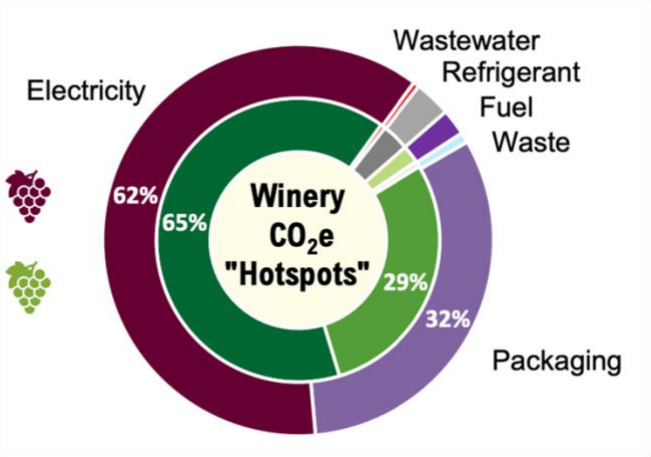
grapes. For the farm node, fertilizer and fuel are also significant contributors (Figure 9). For wineries, packaging is the second-largest contributor (Figure 10).

Figure 9: CO_2 emissions at the farm node for the wine sector



Source: CCC (2023)

Figure 10: CO2 emissions at the winery node



Source: CCC (2023)

While the EGD has brought to the fore issues around sustainability and environmental protections[34], carbon footprint reduction is not new in the wine industry.[35] However, the pressure to provide increasingly detailed documentation, report emissions, and track other sustainability metrics means the wine industry must adhere to a growing nebulous of standards targeting reporting and tracking inputs, carbon emissions, and working conditions. Many of these concerns are driven by a growing demand for climate consciousness in developed export economies forcing international regulators to alter their product tracing regulations. In the local market, similar audit demands originate from

[34] Interview DC2.
[35] As highlighted by Interview DC2, carbon footprint reduction is not new to South African industries as these were originally requirements for exporting but also smaller farmers who saw it as a way to be cost competitive.

downstream players in the value chain, mostly retailers.[36] The pressure for carbon calculators in the wine industry is also driven by wineries and wholesalers, with the exception of Swedish Systembolaget which is developing a tender for carbon-neutral wine (das Nair et al., 2023).

An additional concern for the industry with regard to carbon footprinting is the fact that different methodologies and emissions factors are being used to calculate carbon footprints.[37] One methodology being implemented is the "cradle-to-grave" approach. The "cradle-to-grave" approach considers the impacts at each stage of a product's life cycle (European Environmental Agency, 2023). For the wine industry, this entails having "sight" of its carbon emissions and other sustainability concerns from farm to packhouse, distribution, and cold storage.[38] Without understanding their carbon footprinting, it will become increasingly difficult for South African farmers to do business.[39]

5.2.3. Transport

Transportation is a central feature of the wine industry. However, transport is one of the largest energy consumers and carbon contributors (Kaya, Yamaguchi, & Geden 2019; Colman, 2009). This is because wine is transported from producers to the consumers (Weiser & Dornfeld, 2010). The transportation mode determines the variability in the emissions since in calculating the emissions, the fuel type combusted is the key determinant (Noussan, Campisi & Jarre , 2022) The GHG emissions emanating from transportation relate to two components: i) weight of the goods transported, and ii) distance travelled. The first component has implications on the weight of the transported wine, which also influences the material used in the packaging. Second, the distance travelled is dependent on the proximity of markets and destination of the product. Given the significance role of transport in the wine industry it makes imperative for the explore means to reduce the transportation greenhouse gas emissions. The mitigation strategies for transport should be inclusive and could focus on fostering beneficiation and industry capacity in the transport sector.

5.2.4. Packaging

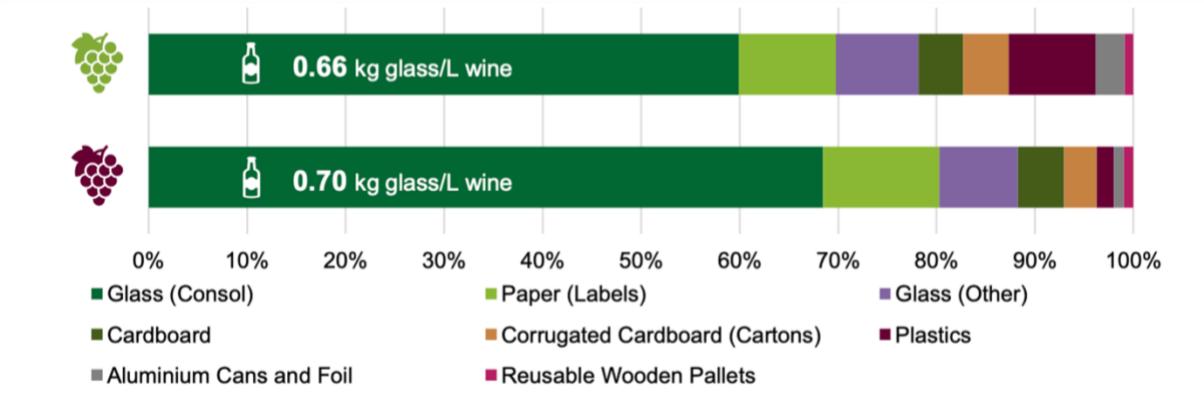
The wine industry relies heavily on glass bottles for reliable packaging (Berrigan, 2021). Producing these bottles requires a significant amount of fossil fuel-based energy, which has implications for carbon emissions.[40] Although the bottles can be recycled, it is a fairly difficult process that many winemakers opt not to do (Berrigan, 2021). Switching from glass bottles to other packaging is an additional concern for many winemakers since the presentation and appearance of their products as high value is critical in such a niche luxury market.[41]

The most recent data from the South African wine industry shows that between 60% - 70% of CO_2 comes from the production of glass bottles which are the common packaging for the

[36] Interview DC2.
[37] Interview DC2.
[38] Interview DC2.
[39] Interview DC2.
[40] Interview W5.
[41] Interview W3; Interview W5.

wine industry in South Africa (CCC, 2023). Labelling also contributes significantly to these emissions, with 10% - 15% of total emissions emanating from these (Figure 11).

Figure 11: Wine industry emissions breakdown in packaging



Source: CCC (2023)

In addition, on the European market there are several recent regulations dictating what information must be shown on the label and how this information must be presented. For example, requirements are set for the size of characters used on the label and about what information must be visible simultaneously from the same point of view. The information that can be mentioned on labels is divided into compulsory and optional. Compulsory particulars must be shown on the labels, while optional particulars may be shown (under specific conditions) (European Union, 2023). For example, after 2023, the EU's CAP regulations on wine labelling will require all wine bottles sold in the EU, irrespective of country of origin, to include critical information such as ingredients, nutrition information, allergens, and energy information about the product (SA Wine Industry, 2023). These changes are designed to provide more information to consumers but come at additional costs relating to more accurately tracing their emissions and auditing their supply chains.

5.2.5. Agro-chemicals and pesticide use

One of the issues for South Africa going forward is the use of glyphosate for weed control and viticulture. The trend in the EU of banning herbicides/fungicides in viticulture could lead to additional restrictions banning glyphosate in the future (das Nair, et al., 2023). Most farmers use large amounts of pesticides to generate stable yields and high-quality grapes (Da Silva and Da Silva, 2022). However, this usage raises concerns on the potential toxic compound's assimilation during wine consumption and human health risks (Gabur et al., 2021). As a result, there has been shift in the industry to practice sustainable wine grape production. The Integrated Production of Wine (IPW) sustainability scheme represents such initiatives focused on plant protection and food safety. Only more recently were issues relating to climate change and environmental sustainability embedded into the IPW in response to inquiries from industry players regarding carbon and water neutrality (das Nair, et al., l 2023). However, despite these improvements, issues regarding the IPW still remain, with one of the outstanding issues being the use of glyphosate for weed control.

5.3 Summary

In sum, the EGD represents a significant barrier to the export growth of the South African wine industry. Given the importance of the EU market, South African winemakers are making efforts to integrate and comply with the EGD's regulations. While adhering to social sustainability standards is not new in the wine industry, the EGD adds additional costs to their production processes. In the wine industry the EGD regulations will have a bearing on traceability, carbon footprinting and supply chain auditing; energy use; transportation; and packaging in the wine value chain. Compliance will lead to increased cost and in turn low profit margins, impacting negatively the industry's competitiveness in the EU.

6. Emerging issues impacting on both citrus and wine

The EGD is expected to impact significantly on agro-food producers in both the EU as well as its trading partners. Models point to lowered agricultural production in the EU, which is expected to increase imports into the EU. This will result in opportunities for South Africa and other exporters into the EU if they can comply with regulations. However, it could also present risks for South African producers in remaining competitive in an important export market if they struggle to meet additional requirements.[42] In the discussion below, we reflect on the main challenges from the EGD and F2F that are expected to impact South African producers of citrus and wine, and the possible routes to sustainability.

6.1. Changing rules impacting changes in production processes

For the citrus sector, the main risks presented by EGD policies at present revolve around the possible withdrawal of some pesticides from the market due to rules around maximum residue levels (MRLs). This will limit the crop protection tools that can be used. Stakeholders have argued that the EU imposing its own domestic approach on trading partners is problematic since environmental conditions differ around the world requiring different management regimes (Matthews, 2022). It is a lengthy process to get new active substances approved in South Africa, taking up to 7 years or longer.[43] For the citrus sector, there may be good alternatives though meaning that the impact on the citrus sector may be limited.[44] For the wine sector, the possible withdrawal of glyphosate for weed control may be a challenge going forward.

More generally, given the trajectory of sustainability and decarbonisation, there is a discussion around moving to a more regenerative system of agriculture, which considers soil health, cover crops, reducing agrochemical inputs and use of organic fertilizers.[45] However, there are significant costs to the industry in moving towards a more regenerative production system.

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42 https://croplife.co.za/Article/NewsArticle?pv=Impact_of_EU_Green_Deal_on_South_African_Agriculture_Conference_Summary

43 https://croplife.co.za/Article/NewsArticle?pv=Impact_of_EU_Green_Deal_on_South_African_Agriculture_Conference_Summary

44 Interview C1.

45 https://www.farmersweekly.co.za/crops/field-crops/regenerative-farming-can-producers-afford-not-to-make-the-change/

6.2. Burden of compliance will increase with EGD initiatives

Sustainability considerations have been considered in both the citrus and wine value chains for some time. Both sectors are already meeting several requirements through various standards that must be met to access the EU market. Processes for exporting are already administratively intense with the result that larger firms have grown their capacity for handling exports. The increasing requirements through the EGD will add to the burden of compliance for these value chains, through changing production processes as well as the costs related to reporting on compliance, including personnel costs and costs related to reporting and auditing fees.

For the citrus sector, the additional requirements that the EU has introduced around meeting regulations for control of FCM have been costly for the industry. Furthermore, stakeholders have argued that they go against the spirit of the EGD since the new requirements require additional cooling and will therefore require more energy, while the F2F strategy of the EGD aims to reduce energy consumption.

For the wine industry, one of the challenges is that there are several different standards and regulations, contributing to ever-higher compliance costs.[46] Thus, an area of concern around the need for standards is the ever-growing list of standards a producer must adhere to continue access to these critical markets. One of the critical problems in adhering to standards in the wine sector is offsetting social targets over environmental targets while trying to maintain relatively small margins.[47] The focus on social over environmental outcomes, along with the preference of winemakers to sell their products in bottles over bulk, contributes to higher carbon footprints in the wine industry. Adding carbon footprinting reporting and reducing CO_2 will further pressure struggling farmers and producers in both the wine and citrus value chains.

6.3. Compliance Costs

Compliance costs related to decarbonisation and sustainability present challenges particularly for smaller producers. Compliance related to EGD initiatives will raise the costs for producers, particularly since there are already a range of global and local standards and certifications in both the wine and citrus industry that producers have to adhere to, including those related to seasonal worker contracts and leave provisions, housing, minimum wages, and occupational health and safety compliance. We reflect below on the main costs of compliance related to meeting requirements.

i. Capital expenditure for required infrastructure, systems and procedures to meet compliance

The impetus for switching to using alternative forms of energy emanates from loadshedding challenges in the domestic context and initiatives associated with the EGD. In the citrus and wine sectors, carbon footprinting, supply chain auditing, and shifts to alternative energy sources are at the early stages, with limited progress across the value chain. Any changes to

[46] Interview W1.
[47] Interview W5.

the existing production processes to align with new environmental standards will mean more investment in infrastructure, systems, and procedures by producers in South Africa.

The cost of such significant shifts can vary depending on the size of orchards, water availability, the need for advanced water-saving technologies, costs of alternative energy, switching to alternative pesticides and other sustainability considerations emanating from EGD policies. As far as energy-use related to irrigation is concerned, farmers can reduce energy consumption through more efficient irrigation methods, as pumping water for irrigation is a significant energy cost. Thus, more efficient irrigation methods will result in a reduction of the carbon footprint.[48] The capital/upfront cost of transitioning to more energy-efficient and sustainable solutions (renewable energy) is substantial but there are long-run benefits.

Despite the benefits, such financially resource-intensive transitions are particularly challenging for smaller businesses with limited financial resources. This is because many smaller businesses lack the necessary human capital to properly establish systems and processes to track and report carbon emissions associated with their products (carbon footprinting).[49] This may involve investing in new software, training staff, and ensuring accurate measurement and reporting of emissions (Moosa, 2022). Larger companies are better placed to negate the burden and costs of compliance due to their greater human and financial capital to invest in carbon footprinting and supply chain auditing infrastructure.

ii. The physical audit cost levied by independent certification bodies

Typically, to report on compliance with social/ethical, environmental and food safety standards within the fruit sector, a firm must use one of the globally accepted standards and have their compliance to standards certified by a certification body. There are costs associated with both. A firm or grower in South Africa can use any certification standard to assess their compliance. South African firms pay certification bodies membership fees (Grobler, 2022).

Each of the standards and certifying entities charge different fees (Grobler, 2022). Based on the main ethical/social and environmental standards used within the citrus industry (**Error! Reference source not found.** above), partial fee structures are shown in **Error! Reference source not found.**5 below for the smallest producers (single site) for standards that need to be met currently. We note that the table does not include compliance standards related to food safety and does not include other costs charged by certification bodies (CBs) and certification standard (CS) owners.

Table 5: Approximate single site partial fees (ex-VAT) related to main ethical/social and environmental standards used by citrus growers

		Ethical / Social		Environmental		
	GG IFA	SIZA Social	GG GRASP Add-on	SIZA Environmental Add-on	Blue North CCC	GG. SPRING Add-on
Audit (CB)	R7,960	7,506	2,115	9,250		3,270

[48] Interview C1, Interview DC2.
[49] Carbon footprinting is driven by exporting requirements (Interview DC2).

Registration Fees (CS)	R1,944	1,240[1]	450	1,240	2,500	570
Total	R38,045 per year per site					

Source: Constructed by authors based on data in Grobler, 2022

For SIZA which is a local standard, the costs range from R1,240 up to R17,800 per year in membership fees depending on the size of the firm (Grobler, 2022). These are just fees to be a member of these platforms to use their tools for compliance. Audit costs are separate from this and are negotiated between private auditors and the firm but are typically significantly more than the costs for use of a standard (CS), as in the table above. As far as emerging farmers are concerned, there is a specific SIZA membership level (level 1c) for emerging farmers to participate on a three-year programme free of charge. Participants receive assistance with registration and completion of the self-assessment questionnaires and pre-audit assessments leading up to full-fledged social and environmental audits of their farms (Grobler, 2022).

Regarding MRLs, demonstrating compliance may include providing detailed information on the pesticide treatments used, keeping records of applications, and providing evidence of compliance. The costs associated with maintaining proper documentation and obtaining necessary certificates will add to the overall export costs. Associated with this, the EU may specify packaging and labeling requirements to identify the nature and origin of the products (Pentikäinen, 2022; Grobler, 2022). Labeling requirements at present mainly emanate from retailer requirements.[50]

The cost of decarbonisation and demonstrating compliance mean that exporters from South Africa will experience more challenging conditions in doing business as their compliance costs increase. While these negative effects will mostly be experienced by producing firms, compliance reporting also opens opportunities for certification, auditing, and reporting companies.[51] The need for reporting compliance activates these companies' business opportunities and subsequently develops job opportunities and skills. Therefore, compliance opens up potential opportunities through improved training of certified carbon and supply chain auditors.

iii. Personnel and time for preparing and conducting audits

The additional administrative personnel to manage compliance and reporting on EGD regulations and requirements could include hiring specialised staff or training existing employees to handle administrative tasks effectively. This process will result in wages, benefits, training, and administrative expenses associated with compliance management (ComMark Trust, 2010; Ndlovu, 2010; Motsoere, 2022). These fees and wages vary from company to company, but South Africa is characterized by relatively high audit costs (SIZA, 2016). For firms that hire auditors, the costs of auditors can be high.

The first time a business undertakes a carbon footprint assessment requires substantial effort and time to understand where the data is and what needs to be calculated.[52] The cost

[50] Interview C1.
[51] Interview DC1.
[52] Interview DC2.

of obtaining a carbon footprint report from the CCC programme is relatively low at R 2,500 (excl VAT) though the producer bears the cost of collecting and inputting data.[53] The standard cost of R 2,500 for the carbon footprint report, the time spent in gathering and collating data, the high wages and fees for auditors, and other administrative costs means increased overall cost of production for South African producers.

Given the various compliance costs highlighted above, Grobler (2022) calculated actual costs to citrus industry producers (direct and indirect) based on focus group interviews, and these are shown in the table below. Compliance costs range from R206,152 for small businesses per year, to just under R2 million for large producers annually. [54]

Table 6: Weighted Costs – Direct and Indirect

Cost Description	Small Single site	Medium Multisite (4 sites)	Large Multisite (10 sites)
	DIRECT COMPLIANCE AUDIT COSTS (citrus)		
SIZA Social/Ethical	13,620	44,803	93,741
GG Grasp Add-on	0	88	2,565
SIZA Environmental	9,123	47,290	115,990
GG Spring Add-on	1,280	2,560	2,880
CCC (Blue North)	0	2,933	11,000
GG Nurture Add-on	1,218	13,000	31,690
GG AH-DLL Grow Add-on	0	885	1,991
GG FSMA Add-on	0	0	2,625
Average S&T's	3,400	6,300	26,500
Total Audit Costs	**R29,541**	**R118,627**	**R288,982**
	INDIRECT COSTS (all producers, including citrus)		
Indirect manhour cost	117,293	285,536	371,078
Indirect CAPEX cost[55]	60,218	190,684	1,240,740
Total Annual Compliance Cost	**R206,152**	**R594,079**	**R1,900,800**

Source: Constructed from Grobler 2022 (Table 31 and 37)
Note: The direct costs are based on the weighted focus group for the citrus industry focus group and the indirect costs are based on the weighted average annual cost for all producer focus groups (fruit).

Grobler's (2022) study notes that the largest compliance cost related to capital expenditure is labour housing. Focus group participants interviewed in the Grobler (2022) study noted that while for the past 3-5 years, overseas customers have focused on social/ethical standards and less on environmental compliance, the focus on environmental compliance is expected to increase over the next 3-5 years. This will mean an increase in capital

[53] Interview DC2.
[54] Due lack of response, our study did not interview citrus producers.
[55] Capital cost of meeting farm level market access compliance requirements was estimated by asking respondents to guestimate the capital investment required to bring a greenfields operation of the same size as their farm up to standard. Added to that was the annual maintenance CAPEX and lastly the estimate incremental CAPEX resulting from ongoing changes to compliance standards. The average annual compliance CAPEX was calculated by adding the year-1 "greenfields" CAPEX to 8-times maintenance CAPEX and one-year incremental CAPEX divided by 10 to arrive at the average compliance CAPEX number.

expenditure costs (Grobler, 2022), presumably as farmers increasingly implement renewable energy and other infrastructure solutions.

iv. Compliance with EGD and small businesses

Both the wine and citrus sectors in South Africa are significantly challenged in terms of transformation, with very little penetration of black producers. The EGD and F2F are expected to challenge smaller producers further. The EU's policies and regulations can be complex and vast, making it challenging for smallholder farmers to keep up with the latest updates and changes.

Most black farmers in South Africa are classified as smallholder farmers (Fairbanks, 2022) making this demographic especially vulnerable to new challenges. Historically, black farmers in South Africa have faced significant socio-economic challenges, and have struggled with issues like land access, financial support, and infrastructure (Fairbanks, 2022). Furthermore, there are communication gaps between regulatory bodies and smallholder farmers, resulting in limited knowledge of EGD regulations for smaller farmers.[56] Farmers who are unaware of the EU's EGD regulations cannot invest in making changes to their operations to comply. Furthermore, often where smaller farmers do have knowledge, they lack the resources to make the changes.[57] Thus, EGD policies create an additional challenge for emerging/black farmers who are already struggling to penetrate white-dominated sectors.

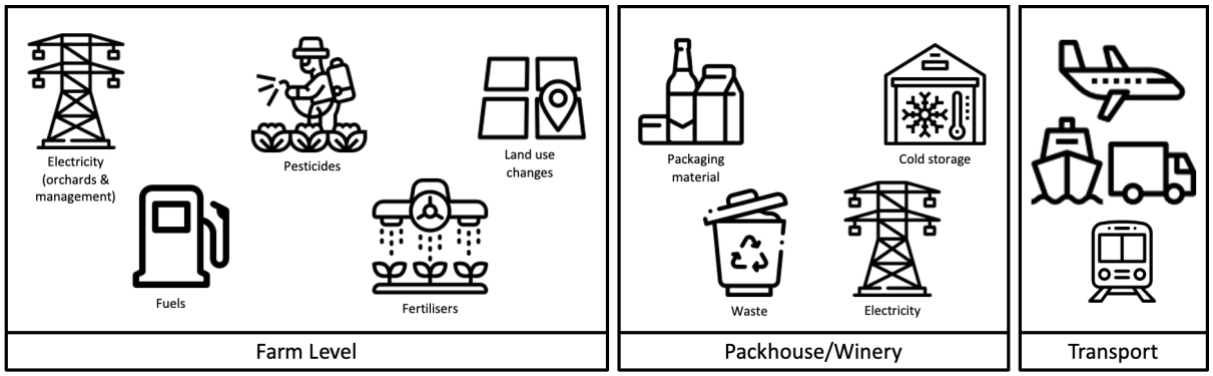
There is a lack of specific policies to help mitigate the vulnerability of black and smaller farmers, including, for instance, access to credit. The CGA established the Citrus Growers Development Company (CGDC) in 2016 to drive transformation and inclusion in the industry; it assists black growers with production infrastructure, technical and business management support, and achieving regulatory compliance for exporting. Black farmers however still struggle to establish themselves in the sector. Some scholars have called for establishing social safety nets to protect vulnerable farming communities from potential negative impacts during the transitional period. However, as it stands, there seems to be little to no specific social protection mechanism for black producers in South Africa (Bennie et al., 2023; Jasper, 2023; Fairbanks, 2022; Ngam, 2021).

6.4. Summary

The foregoing further highlights that the EGD and F2F will negatively impact South African producers of citrus and wine sectors. Error! Reference source not found. below illustrates where carbon emissions can be tracked along the citrus and wine value chain, and therefore where decarbonisation opportunities exist. This involves implementing more costly sustainable farming techniques, reducing the environmental impact of production, and obtaining certifications and standards or adhering to specific labelling requirements that demonstrate compliance with the EU's environmental standards (Sihlobo, 2023; Department of Transport, 2018; West, 2022).

[56] Interview DC1.
[57] Interview DC2.

Figure 12: Opportunities for decarbonization along the citrus and wine value chains



Source: Own construction, based on interviews and literature

At the farm level, a significant proportion of emissions originate from using carbon-intensive electricity. Pumping of water for irrigation purposes is a significant user of electricity, while diesel/fuels are used for tractors. In addition, pesticides and fertilizers are used in the growing of products. At the packhouse/winery level, emissions largely emanate from cold storage and some from packaging material. Waste also accounts for some emissions. Finally, emissions embedded in transporting goods for sale to the final destination also account for a significant proportion of emissions. Identifying carbon emissions at the farm level than at the packhouse/winery level is typically more difficult.[58]

Developing cleaner and low-carbon technologies can help reduce the carbon footprint of industries in South Africa. However, South African producers may face challenges in adopting such technologies due to limited resources, technology transfer barriers, or lack of research and development capabilities (van der Berg, 2022; Monaisa, 2021; Sihlobo & Kapuya, 2021).

7. Conclusions and policy recommendations

Within and across the citrus and wine value chains, several issues are impacting the ability of firms to effectively navigate the numerous, and sometimes contradictory regulations set out in the EGD. Nonetheless, the importance of the EU market for South African wine and citrus exporters makes an analyses of the risks and challenges that the EGD poses critical. Also, the significant number of issues earmarked to be governed under the EGD necessitates a more holistic approach to understanding the implications of the EGD on the wine and citrus sectors in South Africa.

Based on interviews with firms, industry associations and other relevant stakeholders, this paper conducts deep-dive case studies to understand the risks and reciprocal measures and policies that are being instituted to ensure sustainability and competitiveness in two of South Africa's highest-exported products to the EU: citrus and wine. Our findings reveal that the EGD poses fundamental sustainability and global competitiveness concerns for South

[58] Interview DC2.

African citrus and wine sectors. In fact, our interviews with industry stakeholders suggest that emerging climate change imperatives do not drive most of the industry actions being taken.[59] A primary reason cited for the wine industry transformation, for instance, includes cost-cutting, while climate mitigation is considered a secondary decision.[60] However, producers are recognizing that decarbonization and carbon footprinting will increasing become an imperative for them. These findings have several policy implications in the agro-food sector in South Africa.

South African agro-food producers will need to start adapting their farming methods and practices to meet evolving EU standards if they wish to remain competitive in exporting to the EU market. The emerging evidence highlights where carbon emissions can be tracked along the citrus and wine value chain, and therefore where decarbonisation opportunities exist (see for instance, van der Berg, 2022; Roberts et al., 2022; Sihlobo & Kapuya, 2021). This involves implementing more costly sustainable farming techniques, reducing the environmental impact of production, and obtaining certifications and standards or adhering to specific labelling requirements that demonstrate compliance with the EU's environmental standards (Sihlobo, 2023; Department of Transport, 2018; West, 2022). South African producers require government support to implement the new and costly sustainable farming technique. The EU's current Common Agricultural Policy (CAP), which runs until 2027, provides support of around R6.4 trillion for European farmers, partly because European farmers themselves find the targets in the EGD and F2F difficult to meet.[61]

Given the domestic fiscal constraints, South African policymakers and the various industry associations and bodies must cooperate and dialogue to:

- Ensure coherence across standards, rules, and regulations in domestic and export markets: Contradictions within the EU's regulations are causing confusion within the citrus and wine industries. This presents a significant planning problem for producers and associations in these value chains as they begin to transition their production toward more sustainable and less carbon-intensive methods. Furthermore, the lack of coherence in the domestic market's rules and standards presents an additional layer of complexity for firms struggling to comply with both domestic and international compliance. For example, in the wine industry, multiple industry-specific sustainability labels and seals that track various metrics are part of individual producers' sustainability ambitions. However, compliance with these invariably adds to the burden and costs of compliance in the wine industry. The additional burden of compliance related to the EGD will negatively impact the smaller players and fledgling black-owned wineries more as their costs to comply increase, decreasing their cost competitiveness in the EU.

  Local standards need to be aligned to the evolving international standards. Moreover, stronger dialogue between EU and South African regulators is required on some of the

[59] Interviews W1-W7, DC1, and C1.
[60] Interview W2: Out of 30 selected brands that are capable of supplying wine to the domestic market, only about 5-6 are noted as having sustainability as one of their main concerns. This is driven largely by their engagement in exports.
[61] https://croplife.co.za/Article/NewsArticle?pv=Impact_of_EU_Green_Deal_on_South_African_Agriculture_Conference_Summary

noted contradictions including, for instance, chilling related to FCM and actives in pesticides, as well as timelines regarding implementation of various measures.

- **Provide information:** There is a lack of information among smaller and black producers on EGD and its implications for producers. Initiatives under the EGD are coming into effect quickly and the initiatives themselves are also evolving quickly. There is a need for better provision of information, particularly to smaller producers, on what the EGD means for them, what will be required in the future to access EU markets, and where they can access support.

- **Provide support for energy-transitions:** Given both loadshedding in the local context and global initiatives pushing producers towards less carbon-intensive and more sustainable value chains, producers are being forced to consider the transition to renewable energy, with some large producers already having transitioned.[62] In the context of energy constraints and excellent renewable resources, government should consider more targeted and widespread initiatives to support producers to transition.

- **Support for improved access to the domestic market, infrastructure, land, and means of production:** For a country already suffering from apartheid-precipitated inequality, the EGD is expected to entrench inequality in the country further (van der Berg, 2022; Shahaboonin et al., 2023). Resource-poor farmers seem likelier to be left out of the new sustainable agro-food system due to their lack of financial and technical capacity to conform to the new standards. The introduction of the EGD could exacerbate these disparities by making it harder for smaller and black farmers and producers to access international markets and compete on a level playing field, as they lack resources, social capital, and other relevant mechanism to protect themselves from the impact of these measures (Bennie et al., 2023; Jasper, 2023). Therefore, policy interventions should prioritise improving access to the domestic market for smaller and black-owned firms through greater financial and human capital support, including through development finance institutions, to obtain and effectively utilise infrastructure, technologies, and networks.

- **Assist to ease the burden of costs of compliance over time:** As the burden of compliance steadily grows with future amendments to the EGD regulations, South African firms will increasingly face greater pressure to comply with these international demands if they want to keep or expand their market shares. With the growing burden of compliance comes increased costs that these firms (many operating on small margins) must pay to remain compliant. Policymakers and regulators must work with industry associations to lessen this financial burden for compliance by addressing several issues with conducting traceability and supply chain audits. The national government must work more closely with industry associations at a national level to scale up the reach of initiatives such as the Confronting Climate Change (CCC)[63] initiative which assists producers in understanding carbon emissions in their value chains (carbon footprinting) and the CCC's Carbon Heroes platform which acts as recognition (through the WWF's Conservation Champions label) for those firms committed to tackling environmental risks while also

[62] https://thegreentimes.co.za/citrus-farmer-celebrates-two-years-of-solar-energy/
[63] CCC is a joint-initiative with South Africa's fruit and wine sectors.

being at the forefront of land conservation, water management, and adopting energy-efficient solutions (Carbon Heroes, 2023). Leverage these existing pockets of excellence to improve carbon footprinting and supply chain auditing along the value chains is critical.

Overall, the early reflections from the wine and citrus industries reveal that measures to respond to the EGD and decarbonisation are still tentative and in the early phase. However, Government and industry stakeholders in wine and citrus will need to consider a collective response strategy in light of the EGD.

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9. Appendix

Appendix 1: Additional seals in the wine industry

The WSB's WO and IPW seals are just two of the wine industry's many labels and seals. As recognition of the importance of sustainability has grown locally and internationally since the early 2000s, the wine industry has seen commensurate growth in eco-certifications and labelling schemes (WWF South Africa, 2022). In addition to the WIETA label, the IPW and WO seals, the South African wine industry adheres to multiple other labels, seals, and schemes to ensure sustainable wine production (Table 7).

Table 7: Labels, guarantees and certifications in the wine industry

Label	Guarantees and certifications
Fairtrade	Promotes compliances with international ethical and fair economic, social and environmental standards
WIETA	Promotes and certifies ethical trade and fair labour practices in the wine industry value chain based on local regulations and best practices
Sustainable Wine South Africa (WSB's Integrity & Sustainability seal)	Certifies that all label information relating to origin, cultivar and vintage is correct and guarantees the wine was produced in an environmentally responsible manner, with every link in the wine's supply chain meeting the IPW criteria for sustainable production
Certified Heritage Vineyards	Guarantees the wine is from vineyards older than 35 years
WWF Conservation Champion	Guarantees that the wine is from one of the 55 WWF Conservation Champion wine farms across the Cape Winelands. The programme is not a certification, but a voluntary membership model that requires achieving 70% or more in South Africa's IPW wine industry environmental certification scheme as well as adhering to WWF conservation principles, including biodiversity-friendly and regenerative farming practices, conserving natural areas and continually improving water and energy efficiencies

Organic, biodynamic and vegan labels 	A wine certified as 'organic' is produced without synthetic chemical pesticides or fertilisers. Biodynamic wine production entails a holistic system that avoids synthetic chemical pesticides or fertilisers; uses natural pest control and soil health solutions; and plants according to lunar cycles. Vegan certification verifies that the wine production techniques are vegan (i.e. no egg whites or milk protein are used as fining agents)
Farming for the Future & EnviroWines 	Driven by Woolworths, this label guarantees sustainable practices on Woolworths-supplier farms and wineries, as well as EnviroWines, a local independent label recognising wine farms using above average environmentally sustainable practices, verified according to auditing criteria based on the IPW scheme.

Source: WWF South Africa (2022)