

Full Length Research Paper

Exploration of challenges and associated recommendations to livestock sector development in South Africa using a stakeholder-driven approach

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Development of the livestock sector in South Africa has the potential to contribute significantly to national development. The aim of this study was to explore challenges and propose recommendations to support livestock sector development in South Africa using a stakeholder-driven approach. Interviews with high-level stakeholders across major livestock industries were conducted to gather insights. Responses were verified by a literature review and supplemented with an event study analysis on parameters for livestock production and exports. Interview respondents revealed livestock disease management in the face of increasing disease burden, high input costs, and limited government resources as a major challenge to national livestock-sector development. Implementation of national and international regulations on controlled diseases severely limits profitability. Emerging farmers are discouraged from investing in livestock disease management and are thus excluded from entering and remaining in the commercial value chains. Inclusive growth of the sector can be achieved through strengthening public-private partnerships through joint mentorship, training, and awareness-raising programmes. Evidence- and risk-based approaches to the national and international regulations and official guidance on outbreak management are needed. National animal identification and traceability systems and wider adoption of compartment systems for biosecurity, growth stimulants and poultry cages can enhance disease management and exports.

Key words: African swine fever, event study analysis, foot-and-mouth disease, highly pathogenic avian influenza, livestock disease, livestock sector development, South Africa, stakeholder-driven approach.

INTRODUCTION

Although South Africa remains one of the most developed economies in sub-Saharan Africa, it struggles to develop past the middle-income stage. Enhancement

of agricultural production can be a cornerstone of national development due to the contribution to food security, jobs and economic competitiveness through international

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trade. The livestock sector in South Africa contributes significantly to agricultural production (44%) (Department livestock species in South Africa include poultry (meat and eggs), cattle (beef and dairy), sheep, and swine. However, the country's livestock industries face several challenges including climate change, environmental impact, land reform concerns, stock theft, and livestock disease management that are hampering sector and thus national development (Meissner et al., 2013). Livestock disease in particular has been identified as one of the major risks to the sector (Meissner et al., 2013; Malusi et al., 2021). The structure of the sector and the regulations on controlled diseases create political challenges to disease management and thus sector development in the face of increasing disease outbreaks.

Structure of the livestock sector

All the major livestock industries comprised three sub-sectors in varying proportions: subsistence, emerging, and commercial. Subsistence farmers use traditional methods of small-scale farming in rural areas for personal household consumption (Malabo Montpellier Panel, 2020), emerging farmers aspire to commercialise (Zantsi et al., 2019), and commercial farmers use advanced farming techniques for large-scale farming. There are imbalances in the sector that inhibit development, including that commercial production and exports and thus the majority of profits are in the hands of a minority of farmers.

While only one third of farms are considered commercial (Farming of Animals in South Africa, 2020), large enterprises contribute 78% of the total income from national livestock production (Stats SA, 2019, 2020).

Exports are limited to a subset of commercial farmers who can meet international import requirements. Poultry meat is the highest value export commodity from the livestock sector followed by concentrated milk and cream, fresh or chilled beef, and unconcentrated milk and cream ("South Africa Trade," n.d.). The red meat industry exports about 5% of beef produced ((The Bureau for Food and Agricultural Policy (BFAP), 2021b) and the dairy sector exports about 6% of national consumption (respondent from a dairy association). Exports of closer to 20% of production have been identified as a goal (BFAP, 2021b).

At the same time, the livestock sector remains segregated due to the former apartheid regime, with subsistence and emerging farmers consisting of a mostly black demographic, and commercial farmers consisting of a mostly white demographic (Zantsi et al., 2019).

Despite public and private efforts to promote participation of the black population in the South African economy, there are still challenges to support emerging farmers to enter and remain in the commercial value chains and thus contribute to the development of the

sector.

Livestock disease and control

Of the highest-priority diseases, outbreaks of Foot-and-Mouth Disease (FMD), Highly Pathogenic Avian Influenza (HPAI) and African Swine Fever (ASF) have the greatest impacts on production and exports from the respectively affected industries, not due to illness in the animals, but due to the official control methods and due to the closure of export markets. All three diseases are considered "controlled," for which the No. 35 of 1984: Animal Diseases Act (1984) forms the regulatory basis that grants government officials the authority to manage them. The No. 7 of 2002: Animal Health Act (2002) is intended to replace the Animal Diseases Act (1984), but it has not yet been promulgated. The Department of Agriculture, Land Reform, and Rural Development (DALRRD) issues guidance on recommended control measures in veterinary procedural notices that are published on their website as well as distributed to livestock associations and producers. The national guidance for the control measures is based on guidance from the World Organisation for Animal Health (WOAH) (FMD expert for southern Africa) and include recommendations for the isolation, detention, inspection, testing, vaccination, observation, sampling, marking, treatment, care, destruction and disposal of animals ("Animal Diseases Act," 1984).

FMD in particular causes the most economic harm to the livestock sector due to losses in productivity and income (Update on Diseases, 2020). Since the FMD-infected, protection and free zones were defined in 1995 based on surveillance data as per WOA recommendations, South Africa has experienced three periods of freedom-status suspension (2000-2002, 2011-2014, and 2019-today) (Brückner et al., 2002; Agriculture Notes, 2015; WOA, 2019). FMD outbreaks are predominantly of the Southern African Territories (SAT) serotype. The same control measures can be applied to an outbreak regardless of the serotype as per the veterinary procedural notice (Department of Agriculture, Forestry and Fisheries, 2014).

Similar to the impact of outbreaks of FMD on the beef and dairy industries, outbreaks of ASF and HPAI are devastating to the respective swine and poultry industries. In the swine industry, the frequency and intensity of ASF outbreaks have been increasing since the 2019 outbreak resulting in significant losses to farmers (BFAP, 2021a). For the poultry industry, the 2017 outbreak of HPAI resulted in widespread losses amongst poultry producers, sharp increases in egg prices, and in the suspension of exports (Malabo Montpellier Panel, 2020; BFAP, 2021a). Outbreaks of these diseases in South Africa are increasing over time, with ongoing outbreaks of all three diseases occurring simultaneously

at the time of writing.

The Animal Diseases Act (1984) and associated veterinary procedural notices dictate strict control measures that impede daily operations in the affected areas until the outbreak has been resolved, and trade regulations dictate an immediate and complete ban on product exports from the whole country ((Malabo Montpellier Panel, 2020; BFAP, 2021a). Daily operations and exports of livestock products are at much greater risk in the event of an outbreak of a controlled disease than production and health of the animals themselves (Brückner et al., 2002).

Study aims and relevance

The aims of this study were to (1) explore the challenges to livestock sector development associated with sector structure and livestock health regulations in South Africa and (2) propose associated recommendations using a stakeholder-driven approach. While previous studies have evaluated challenges to the major livestock industries, a perspective-based study using interviews of stakeholders with high influence, with high interest, and with high-level knowledge of major industries at national level has not yet been published. Unlike previous studies, the current study focuses on livestock disease management, the impact of disease-related events on livestock production and exports, and recommendations to address challenges that can contribute to livestock sector development. The perspectives of this group of stakeholders on these particular challenges offer new insights and informed recommendations that are not available in the published literature.

MATERIALS AND METHODS

This study was conducted remotely as primarily qualitative based on semi-structured interviews supplemented by a quantitative event study analysis.

Qualitative stakeholder interviews

The target study population was stakeholders with high influence and high interest in their respective livestock industries in the public and private domains at national level. Around twenty candidate stakeholders were identified and invited to participate in a semi-structured virtual interview based on guidance described by Grégoire (2022) and Marshall (2015).

A participant information sheet and the interview questions were shared with each respondent in advance of the interview. Consent to record and transcribe the interview was acquired verbally. Affiliations of all respondents were generalized based on the preferences of the majority of respondents for confidentiality.

Key topics addressed in the semi-structured interview included perspectives on challenges and recommendations to livestock sector development in the country with a focus on diseases of importance, production and export markets. Interview respondents were asked to explain certain major deviations in livestock

production and exports over time (that is, the outcome variables). A list of possible causative events was compiled based on interview responses. These events were used for the quantitative event study analysis. Transcripts and recordings were reviewed for familiarisation and used to generate a matrix of responses. Since each individual respondent had his or her own subjective perceptions within their own framework of judgement, their responses were not considered to be precise in isolation as per methods described by Roberts and Fosgate (2018). The matrix of responses was categorized, sorted, and evaluated for consensus and verified with the literature where possible.

Quantitative event study analysis

Existing published time series data on beef, dairy, swine and poultry production and exports of the top revenue-generating commodities as outcome variables were collected at the monthly level where possible from January 2010 up to January 2021 subject to data availability. The reported data is likely restricted to the commercial industries, which make up the minority of livestock holders for cattle, dairy, swine and poultry industries.

The data of the outcome variables was smoothed using International Business Machines (IBM) Statistical Package for the Social Sciences (SPSS) version 28.0 (2021) to reduce the volatility. Stationarity was applied to the smoothed data of the outcome variables using first order differencing to remove trends in the data and thus enhance visualisation of any major deviations from the threshold. The peaks and troughs of greatest magnitude and those that deviated from normal patterns in previous years over the study period were considered to be major deviations. Major deviations from the threshold were evaluated for associations with possible causative events identified by interview respondents. These associations between events and the major deviations in outcome variables were verified by a literature review.

RESULTS

Eleven respondents representing livestock associations in the beef, dairy, swine, and egg laying industries, government, a non-governmental organization, and private industry agreed to participate in the virtual semi-structured interviews, which were conducted between December 2021 and May 2022. The number of interviews was considered sufficient based on representation of the target industries and data saturation as per methods described by Degeling and Rock (2020). A representative of a broiler industry association, an expert on South Africa's animal health regulations, and an FMD expert for southern Africa were consulted for review of the manuscript. Challenges affecting all major livestock industries are presented first, followed by industry-specific challenges.

Challenges to livestock sector development

Interview respondents indicated that the major challenges to livestock sector development in South Africa include meeting domestic and international animal health regulations, lack of trust between industry and government, a poor performing economy,

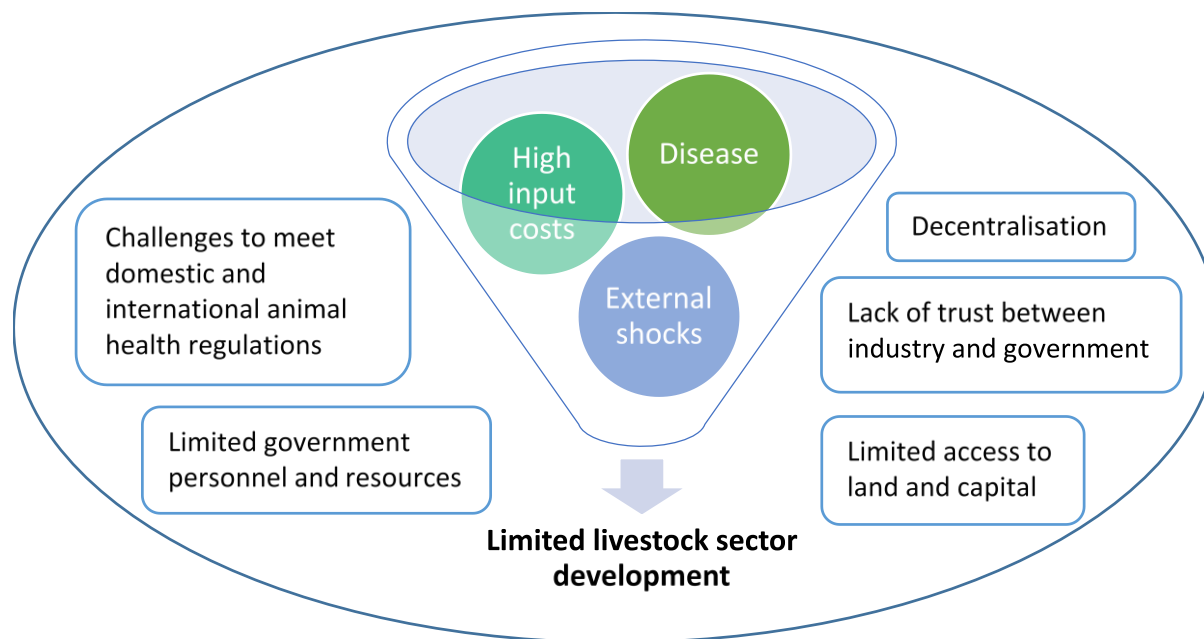


Figure 1. Schematic diagram of the major challenges to livestock sector development in South Africa identified by interview respondents. Efforts to mitigate disease burden, high input costs, and external shocks are hindered by challenges to meet national and international animal health regulations, lack of trust between industry and government, a poor performing economy, decentralisation, limited government personnel and resources, and limited access to land and capital. The existing veterinary procedural notices are difficult to update and to effectively implement due to lack of government resources and capacities. There is a lack of alignment between the provincial veterinary services and an environment of distrust between government and industry exacerbated by decentralisation. High-level political challenges are resulting in poor performance of the economy, which hinders profitability in the face of high input costs and consumer spending power.

decentralisation, limited government personnel and resources, and limited access to land and capital. These challenges are hindering public and private efforts to mitigate disease burden, high production input costs, and external shocks like drought, heavy rains, and the coronavirus disease 2019 (COVID-19) pandemic (Figure 1).

These challenges are in line with those identified in the literature review and are supported by the event study analysis, while respondents offered new insights in this stakeholder-driven approach.

The management of FMD, ASF, and HPAI in particular is getting more difficult over time because of the national (that is, “Animal Diseases Act,” 1984 and veterinary procedural notices) and international regulations on these controlled livestock diseases that severely limit operations and exports in the face of increasing outbreaks, high input costs, and reduced government resources. Quarantine and movement controls are particularly devastating to operations as most farmers do not have an abattoir on site to slaughter their livestock (respondent from a private diagnostic company). The replacement Animal Health Act prohibits the export of livestock products based on occurrence of a controlled disease anywhere in the country (2002). The “Animal

Health Act” (2002) has not yet been operationalized by the president because the associated guidance has not been prepared non-governmental organization). The existing veterinary procedural notices are also rarely updated due to lack of government resources and capacities (respondent from animal health non-governmental organization). For example, the veterinary procedural notice for the control of FMD has not been updated since 2014 despite the 2019 outbreak and FMD-free status suspension (Department of Agriculture, Forestry and Fisheries, 2014). Although the national guidance is based on WOAHA guidance, the national guidance is still open to interpretation, and could be too strictly applied on farms by veterinary authorities (FMD expert for southern Africa). (respondent from beef association). Such guidance protocols have not been finalised in the last twenty years to date because of lack of government resources and capacities (respondent from animal health non-governmental organization).

The existing veterinary procedural notices are also rarely updated due to lack of government resources and capacities (respondent from animal health non-governmental organization). For example, the veterinary procedural notice for the control of FMD has not been updated since 2014 despite the 2019 outbreak and FMD-

free status suspension. Although the national guidance is based on WOAHA guidance, the national guidance is still open to interpretation, and could be too strictly applied on farms by veterinary authorities (FMD expert for southern Africa). The lack of clear and up-to-date guidance which is open to interpretation often leads to inconsistent and unpredictable actions taken by veterinary authorities in response to an outbreak of a controlled disease (respondent from beef association). While the regulations themselves may be appropriate at the time of outbreak detection, limited government resources result in a slow reaction time of the veterinary authorities to adapt the on-farm measures according to surveillance data and thereby creates an added challenge for farmers to resume operations as soon as possible (FMD expert for southern Africa).

The stakeholders along the livestock value chains, including the producers, the livestock associations, the private industries, and the government, are working together and are motivated to help the livestock sector develop using an inclusive growth approach. Sector progress is more in the hands of the industry than in the hands of the government to improve production and profitability for all producers at all levels (private veterinarian respondent). Livestock industries have taken on major initiatives such as establishment of animal traceability systems, animal identification systems, vaccination programmes, enhanced biosecurity systems, compliance with international trade regulations, and programmes that support black economic empowerment.

However, industry efforts toward livestock health management and support of emerging farmers are hampered by several political challenges. On one hand, government structures and operating procedures between the livestock sector and government established after apartheid are hindering the development of the sector today (respondent from beef association).

Decentralisation and an environment of distrust between government and industry hamper national development efforts. On the other hand, challenges within the political landscape of the country aside from the legacy of apartheid are resulting in poor performance of the economy, which hinders profitability in the face of high input costs and low consumer spending power (respondent from egg laying industry).

Livestock health challenges are exacerbated by the decentralised nature of the government (respondent from beef association). Each province has their own state or veterinary services which are not required to conform to national regulations (BFAP, 2021b). Provincial governments have the authority to prioritise and manage their regional-level concerns, impeding national coordination of livestock health management. These clashes between levels of government make it difficult for the industries to operate (respondent from beef association). The trust and cooperation between the livestock industries and government has been damaged

over many years by apartheid. After apartheid ended in 1994, the new government set up the current structures for the commercial sectors that exist today. As a result of the lack of trust at the time, the communication channels established between industry and government exacerbated the rift between industry and government (respondent from beef association). This rift and the history of apartheid created the perception that industry and government have competing interests rather than a joint interest in addressing livestock sector issues together.

Livestock health challenges have also worsened over time due to reduced government resources and thus support. Resources are allocated first to priority areas such as economic transformation, job creation, education, and health before they are allocated to land reform and rural development where livestock disease plays an important role (DALRRD respondent; "Key Issues," 2021).

As a result, government support for the agricultural sector today is limited to the communal, small-scale and emerging farmers. The commercial sectors have taken initiatives to manage the health of their livestock themselves through implementation of biosecurity measures, employment of private veterinarians and direct purchase of vaccines. Small-scale farmers who cannot afford such management practices are becoming even more dependent on government services where resources are deteriorating. (DALRRD respondent).

The de-prioritisation of the livestock sector is evident in the moratorium on government appointments to non-critical vacant posts as part of measures to contain costs since April 2016 (Government to Freeze Non-Critical Vacancies, 2016). The moratorium places a strain on the existing government personnel and thus hinders support for all livestock industries (respondent from beef association; National Treasury, 2016). Fewer and fewer resources are being made available to support livestock production, and so disease management especially among emerging and subsistence farmers is deteriorating (DALRRD respondent).

Finally, access to capital and land was consistently identified as a long-standing challenge for emerging farmers (Khapayi and Celliers, 2016). Access to capital is needed to 1) access land, especially for cattle farming, 2) to invest in livestock health management such as biosecurity requirements and vaccines, and 3) to invest in input costs, such as feed. Land reform to achieve a more balanced distribution of land has been facing challenges, including corruption within the land reform system and concerns from farmers that they will lose their land without compensation ("Land Reform," n.d.; respondent from swine association). The investment required for profitable farming businesses is prohibitive for emerging farmers, and therefore leads to the concentration of farms into large enterprises and in the exclusion of emerging farmers from the commercial sectors (Mtombeni et al.,

2019). With lack of funding and incentives for emerging farmers to manage the health of their livestock, national-level disease management remains sub-optimal and thus continues to create challenges for production, exports, and sector development.

Barriers to exports

Respondents consistently identified livestock disease management and compliance with export requirements in the face of increasing disease outbreaks as the most important challenges to exports across the different livestock industries. When the country experiences FMD, ASF, and HPAI outbreaks outside control zones, many export markets close completely (Mugido, 2019). Closures can be temporary while trading partners negotiate whether products from certain enterprises are still safe for exports despite disease outbreaks in the country. However, many trade partners including neighbouring African countries do not accept the disease risk mitigations implemented in South Africa, especially when an official disease-free status is suspended (DALRRD respondent; Mugido, 2019).

Furthermore, bilateral trade agreements with individual countries in the European Union (EU) are not possible, because all EU countries must conform to the same import requirements (respondent from private diagnostic company). Many countries outside the EU also base their import regulations on EU standards, thus limiting exports to some countries outside the EU.

The lack of national animal traceability and identification systems is another major reason South Africa has been unable to meet certain import requirements. In the event of an ongoing outbreak, animal identification and traceability for export becomes an even more important requirement to demonstrate that livestock products are safe for export. Although the government has attempted to implement a national livestock identification and traceability system since 2002, there has been limited success (BFAP, 2021b). For this reason, many industries have established their own identification and traceability systems while the government is working on developing and implementing the national systems. Such private industry initiatives have significantly improved livestock health in the beef, dairy, sheep, swine, and poultry industries in the last few years (private veterinarian respondent), but these systems are not adequate for national level tracing of outbreaks or of food safety incidents (BFAP, 2021b). While individual enterprises can ensure compliance with international trade regulations for export, there is not a consistent system to support producers throughout the country, and the trading partners still require government approvals. Drawn-out government processes due to reduced resources for official livestock services make it difficult for the enterprises to confirm trade deals.

Beef industry

The biggest challenges for beef sector development according to interview respondents and the literature review are associated with FMD (interview respondents; BFAP, 2021b; Mtombeni et al., 2019).

Beef production was steadily increasing between 2000 and 2020 with a peak in 2016 ("Crops and Livestock," n.d.) despite the drought cycles, declining cattle population and declining number of cattle slaughtered. Between 2011 and 2016, there were no FMD outbreaks to hinder beef production. There is some speculation that the FMD outbreaks outside the infected zone are due in large part because the effective zones during peacetime were defined in 1995 on political bases rather than on strictly scientific bases (respondent from a private diagnostic company). Nevertheless, the zones have been maintained over time as per WOAHA guidance (FMD expert for southern Africa). An alternative explanation for the outbreaks outside the infected zone is the limited government personnel available to ensure compliance with the regulations by a small number of farmers (FMD expert for southern Africa).

The reduced growth in beef production in 2016 and onwards is due indirectly to the FMD outbreaks, not because of direct influence of the virus on the growth rates of the animals but because of the indirect restrictions on operations due to the outbreaks (respondent from a private diagnostic company). The SAT 3 serotype responsible for the February 2016 outbreak in fact caused only subtle clinical signs in animals that lasted typically for one week and then resolved (respondent from beef association). In some cattle that tested positive for FMD, it was difficult to detect any lesions within their mouth or on their hooves (respondent from the beef association).

Exports of beef sustained losses but recovered within a few months following FMD outbreaks between 2010 and 2020. Following the FMD outbreak in February 2011, the export ban of red meat and milk was lifted by April 2011, and South Africa was able to continue exporting despite the FMD-free status being suspended until February 2014. There was a surge in volumes frozen beef exports by July 2011 (Figure 2a) and of fresh and chilled beef exports in May 2012 (Figure 2b) associated with the lifting of the export ban (Geldenhuys, 2011).

The steady increase in beef export volumes from 2013 until 2016 can be explained by the lack of FMD outbreaks during that period. Producers who export increased their production to benefit from the export markets, and new entrants from the emerging sector joined the commercial industry (respondent from a private diagnostic company). There was a surge in volumes of fresh and chilled beef exports in November 2014 (Figure 2b) and of frozen beef exports in December 2014 (Figure 2a) most likely due to the reinstatement of the official FMD-free status earlier that year. Beef exports started declining after January

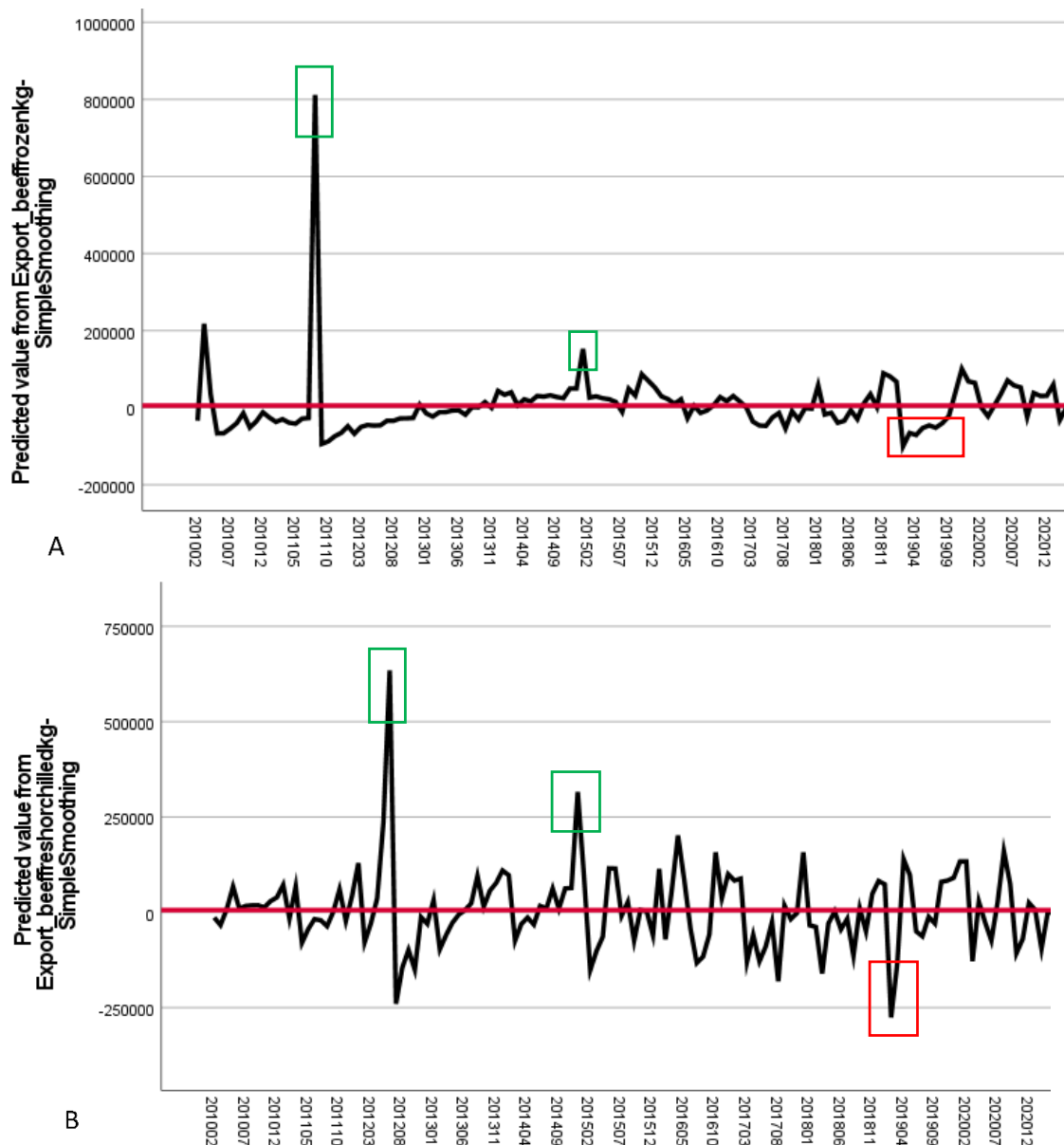


Figure 2. (a) Time series chart of exports of frozen beef (kg) from January 2010 until January 2021 (“Trade data,” n.d.) with smoothing and first order differencing shows a surge in July 2011 (green box) associated with the lifting of the export ban and a peak in December 2014 (green box) most likely due to the reinstatement of the FMD-free status that year. The drop between January and August 2019 (red box) was most likely due to the suspension of the FMD-free status that year (interview respondents). (b) Time series chart of fresh and chilled beef exports (kg) from January 2010 to January 2021 (“Trade data,” n.d.) with smoothing and first order differencing shows a surge in May 2012 (green box) associated with the lifting of the export ban and a rise in November 2014 (green box) associated with the reinstatement of the FMD-free status. The drop in January 2019 (red box) was most likely due to the FMD outbreak at the time (interview respondents).

2017 due to supply constraints as a result of drought and FMD outbreaks. Many new entrants from the emerging sector were unable to sustain their businesses in the event of the FMD outbreak, reducing the resilience of the entire industry to FMD.

In January 2019, most exports ceased as a result of the FMD outbreak that compromised the FMD-free zone (Mugido, 2019). There was a drop in frozen as well as fresh and chilled beef exports in January 2019 (Figure 2a

and 2b), most likely due to the suspension of the FMD-free status. The government of South Africa and the industry successfully negotiated the resumption of beef exports and a new trade deal with China by reassuring trade partners in these countries about the safety of its meat products, particularly those products which do not pose a risk of transmitting FMD (Mugido, 2019). These markets rebounded just two months after the outbreak was announced, with the Middle Eastern market (Kuwait

and Jordan in particular) importing more beef from South Africa than ever before, while China simultaneously began importing beef from South Africa for the first time.

The rapid reopening of the beef export markets shows that the exporting enterprises were able to ensure continued safe beef exports and thus maintain business continuity in the face of FMD outbreaks and the suspension of the FMD-free status. However, emerging farmers are excluded from export markets, as they are unable to meet biosecurity, animal identification and traceability requirements that would allow for trade agreements (Mtombeni et al., 2019).

The commercial beef industry was relatively resilient in the face of COVID-19 pandemic lockdowns in 2020 and 2021, in part because few slaughterhouse workers tested positive or showed symptoms for COVID-19. Therefore, it can be considered that although the commercial beef industry and export markets are resilient in the face of drought and the COVID-19 pandemic lockdowns, beef production is vulnerable to FMD outbreaks.

In addition to challenges associated with FMD, an imbalanced earning structure in the beef value chain creates discontent among the primary producers, disincentivizing them to optimise the health of their animals (respondent from a private diagnostic company). Around 40% of cattle are in the hands of communal or small-scale farmers, which make up the majority of primary producers (BFAP, 2021a). Feedlots purchase most of the livestock for the commercial value chain from the emerging and subsistence farmers for “fattening” until they reach a suitable weight for slaughter, sale, and export (Cole, 2016). However, these primary producers earn substantially less on each of their animals as compared to the commercial producers who have the means to process the animals (respondent from a private diagnostic company).

The beef industry has an added challenge to meet phytosanitary requirements for growth stimulant usage (respondents from a private diagnostic company, beef association, DALRRD). The use of growth stimulants in feedlots, which house the majority of cattle in the commercial value chain, excludes beef products from being exported to countries in Europe (respondent from DALRRD). Other major challenges specific to beef industry development include insufficient implementation of biosecurity that is also hampering exports, limited funding for research such as for vaccine development, and stock theft (BFAP, 2021b).

Dairy industry

Respondents highlighted several challenges specific to dairy sector development including profitability due to high input costs, milk that is “dumped” from other countries at prices which outcompete domestic milk prices, disease management especially for brucellosis,

meeting animal welfare standards, and updating the food safety standards for milk to the satisfaction of European standards for import. According to the South African Milk Processors’ Organisation (SAMPRO), the South African primary and secondary dairy industries are regularly confronted by sudden and unexpected increases of the prices of inputs such as feed, fertilizer chemicals, packaging materials, electricity, fuel and capital equipment (SAMPRO, 2022). SAMPRO points to weather conditions, developments in the international market, the riots in South Africa in July 2021, and poor service delivery of electricity, water and security by the public sector as causes of the price increase (2022).

South Africa’s dairy industry is not subsidised by the government, unlike many other countries including in Europe and the United States. The industry operates under a free-market system and therefore competes with other products within the country and with dairy products from countries like in Europe which are subsidised. When those countries have a surplus of milk, they export or “dump” the surplus in South Africa at a relatively low cost with which the domestic industry is unable to compete.

Brucellosis was highlighted by all of the seven of seven respondents who answered the question as the most important disease for the dairy industry. According to one respondent, about 30% of female large-animal veterinarians are infected with brucellosis. There is limited information on the prevalence and incidence of brucellosis in veterinarians in South Africa. Other diseases that threaten the dairy industry include FMD, tuberculosis, mastitis, and antimicrobial resistance (respondents from dairy associations).

The effects of FMD outbreaks on dairy exports are evident. There was a drop in exports of unconcentrated milk and cream in January 2011 (box, Figure 3a) and concentrated milk and cream in March 2011 (Figure 3b) most likely as a result of the red meat and milk export ban in response to the FMD outbreak (Geldenhuys, 2011).

There was a surge in exports of unconcentrated milk in February 2012 (Figure 3a) and of concentrated milk in September 2013 (Figure 3b), as South Africa was able to maintain trade deals with SADC countries despite the suspension of the FMD-free status during this period. The drop in exports of concentrated milk and cream in January 2019 (Figure 3b) corresponds to the suspension of the FMD-free status that year, however, the export market reopened by the following month. First order differencing shows that exports of unconcentrated and concentrated milk and cream were relatively resilient to the FMD-related events after 2011, drought, and the COVID-19 pandemic lockdowns.

Swine industry

Similar to the dairy industry, respondents highlighted that

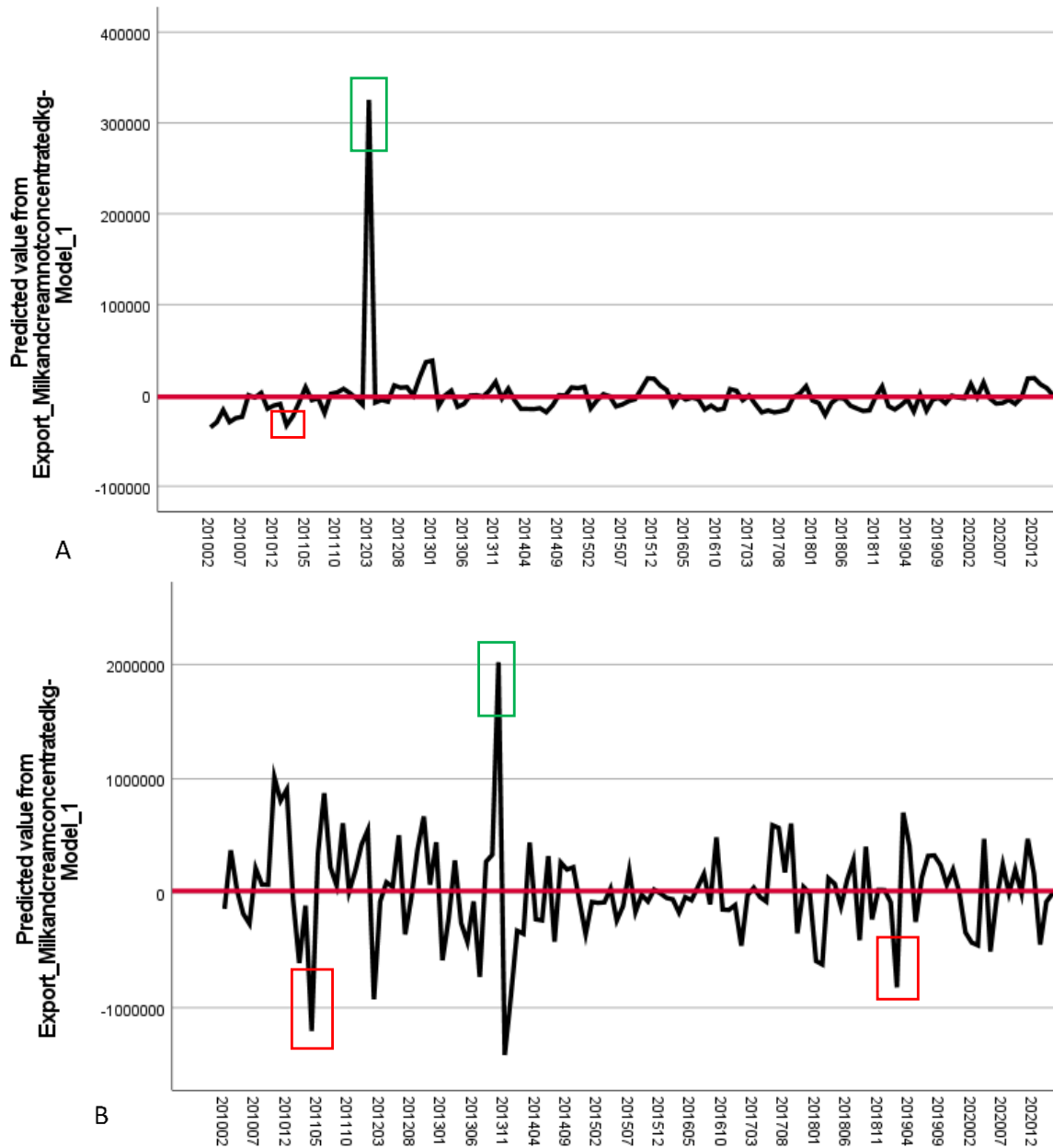


Figure 3. (a) Time series chart of exports of unconcentrated milk and cream (kg) from January 2010 until January 2021 (“Trade data,” n.d.) with smoothing and first order differencing shows a drop in exports in January 2011 (red box) most likely as a result of the red meat and milk export ban in response to the FMD outbreak. **(b)** Time series chart of exports of concentrated milk and cream (kg) from January 2010 until January 2021 (“Trade data,” n.d.) with smoothing and first order differencing shows drops in exports in March 2011 and in January 2019 (red boxes) which correspond to the FMD-free status suspensions.

one of the greatest challenges to swine industry development is that the capital required for emerging farmers to establish a swine farm with enough pigs to be economically viable is prohibitive (swine association respondent). Few emerging farmers can afford to enter the commercial industry due to limited access to capital including business loans (swine association respondent). Furthermore, the value of the South African rand has

been volatile, so feed prices at the time of writing are at an all-time high. High feed prices combined with low pork prices make profitability a challenge (swine genetics respondent).

The commercial swine industry generally maintains a good health status with sufficient biosecurity measures. Commercial swine production and exports were relatively stable in the face of the ASF outbreaks, the FMD

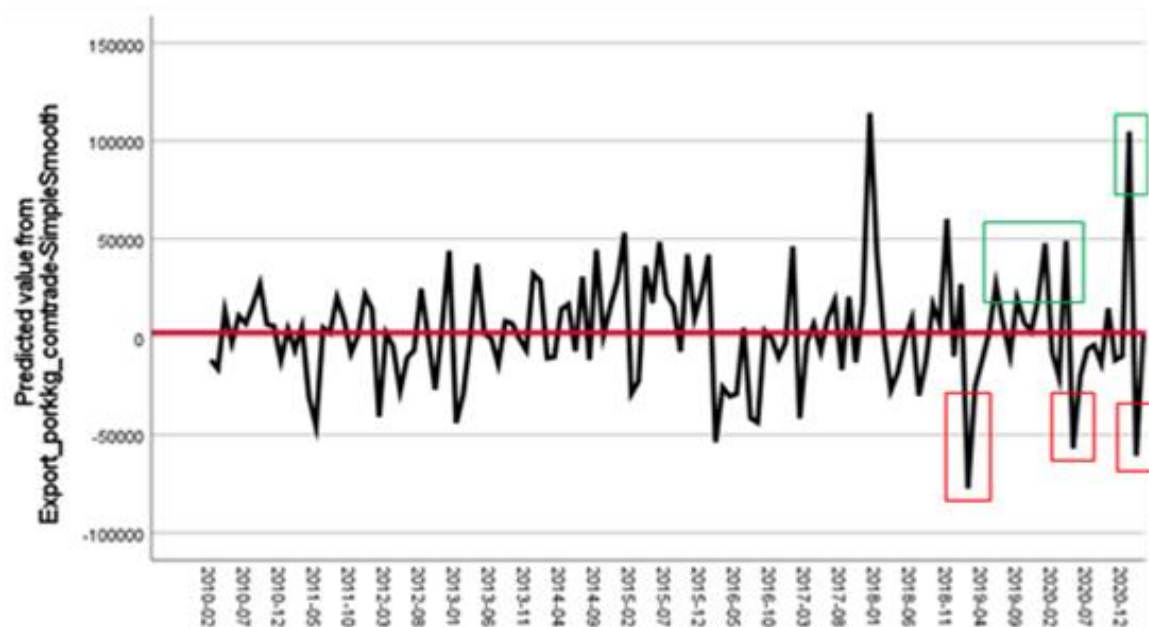


Figure 4. Time series chart of pork exports (kg) from January 2010 to January 2021 (“Trade data,” n.d.) with smoothing and first order differencing. The drop in January 2019 corresponds to the suspension of the FMD-free status, the drop in April 2020 corresponds to ASF outbreaks, and the drop in January 2021 corresponds to COVID-19 pandemic lockdowns (red boxes). The export market recovered well soon after the FMD and ASF outbreaks (green boxes) thanks to compartmentalisation (swine association respondent).

outbreaks, and the COVID-19 pandemic lockdowns. The drop in pork exports in January 2019 is most likely due to the closure of markets in response to the suspension of the FMD-free status (Figure 4). Since swine are susceptible to FMD, even though there were no cases of swine with FMD, pork exports were affected by the FMD-free status suspension.

The export market recovered a few months after the FMD outbreak, suffered in April 2020 most likely as a result of the ASF outbreaks, and then opened again a few months later (Figure 4). The majority of South Africa’s commercial swine industry has been operating under a system of compartments since the 1950s (Maja et al., 2020). Swine enterprises are required by the government to meet minimum standards for biosecurity and have a distinct health status with respect to specific diseases for which mandatory surveillance, control and biosecurity measures have been applied in order to be certified as a compartment (Department of Agriculture, Forestry and Fisheries, 2011). The compartment system is promoted to farmers, abattoirs and potential importing countries of South African pork. WOAHA has since published international standards and guidance for establishing and maintaining compartments (2022a).

When there are ASF outbreaks, importing countries request reassurance that the swine compartments are ASF free (swine association respondent). It takes from two to six weeks to obtain results of additional serological testing or passive surveillance and then the markets open

again (respondent from swine association). Therefore, the swine exports are relatively resilient in the face of ASF outbreaks; thanks to the compartmentalisation system. The export market was also quick to recover after the drop in January 2021 due to the COVID-19 pandemic lockdown.

The compartment system is successful in keeping many diseases out of the commercial industry, and this reassurance allows export markets to open soon after an outbreak. Nevertheless, ASF has become an important issue for the commercial industry in light of the spread of the disease throughout the country in 2021. The high poverty rate drives many people to keep pigs for subsistence purposes. The free-roaming pigs are at greater risk of contracting ASF due to lack of biosecurity controls and are a greater risk for spreading ASF to commercial farms throughout the country. Therefore, the spread of ASF throughout the country presents a continuous threat to the entire industry.

Poultry meat and egg industries

The poultry meat and egg industries share challenges associated with high input costs which trigger “dumping,” with controlled diseases including HPAI and Newcastle disease, and with international import requirements especially for cage-free products (respondent from egg laying industry). The greatest challenge is the high price

of feed, electricity, and raw materials (respondent from egg laying industry). The cost of egg production is particularly challenging when consumption of eggs is low. Increases in the cost of eggs trigger “dumping” of eggs from countries that have a competitive advantage. As in the dairy industry, significant volumes of poultry meat are imported into South Africa from Europe, United States, and South America at cheaper prices compared to the domestic products (Growing South Africa’s poultry exports quickly, n.d.). 70% of poultry meat is consumed from the local market and 30% of eggs consumed are imported (respondent from egg laying industry). South Africa has been enacting trade remedies to protect its industries from dumping since 1914 (Joubert, n.d.). However, the exporting industries find ways around international anti-dumping legislation, creating an intractable problem. For example, exporting industries use trade deals to leverage their interests on dumping. The United States allows imports of poultry meat from South Africa on the condition that such anti-dumping duties are mitigated (Williams, 2015). For this reason, this anti-dumping initiative has been ongoing for over one hundred years with no resolution in sight and is a persistent source of tension between the international poultry industries (Growing South Africa’s poultry exports quickly, n.d.). “Dumping” of products in South Africa continues to be detrimental to domestic production, and thereby impedes local emerging producers from entering and remaining in the commercial value chain (Mtombeni et al., 2019).

HPAI was identified by all seven of seven respondents who answered the question as the disease of highest concern to the poultry and egg laying industries, followed by Newcastle disease. As these are controlled diseases, entire flocks are culled if these diseases are detected on a farm. However, the event study analysis showed that poultry slaughters, poultry meat production, and poultry meat exports did not detect any major deviations between 2010 and 2021 (South Africa Poultry Association, n.d.; Trade data, n.d.) by the HPAI outbreaks, drought, and COVID-19 pandemic lockdowns.

However, the negative impacts of HPAI outbreaks from June 2017 to May 2018 and from April 2021 to February 2022 on both egg production and and egg exports improved after the first 2017 HPAI outbreak resolved from April 2018 until May 2020, at which point they declined in large part due to the first COVID-19 pandemic lockdown (Figures 5a and 5b) (respondent from egg laying industry).

The impact of an HPAI outbreak on exports is immediate but temporary because biosecure compartments were already recognised by most of the trading partners, especially with the neighbouring countries (DALRRD respondent). It takes one or two weeks to reconfirm which farms have HPAI-free flocks through conducting and sharing results from surveillance testing in those establishments with the trade partners.

Egg exports thus recovered quickly after the 2017 HPAI outbreak back to the peak level.

Exports had to be reduced mostly to meet the high demand for domestic consumption during the COVID-19 pandemic (respondent from egg laying industry). Production and exports of eggs were relatively resilient in the face of drought, temporarily vulnerable to HPAI outbreaks, with production increasing and exports decreasing during COVID-19 pandemic lockdowns to meet the increased local demand. Poultry exports to Europe have been historically limited mainly because they do not meet the sanitary standards and due to high import levies (Growing South Africa’s poultry exports quickly; European Commission, 2019). Europe does not import chicken products that contain antibiotics, hormones, brine and feed that contains animal by-products (Slater, 2022; Raite, 2017). Furthermore, Europe’s commitment to ban poultry cages by 2027 implies that imports meet the same conditions (Hartmann, 2021). South Africa uses a predominantly cage-system to maintain the affordability and thus the market of poultry meat among South Africans in the face of high rates of poverty (respondent from egg laying industry). Consumer demand for cage-free eggs would have to increase first in order to incentivize producers to invest in changing their production systems to cage-free (respondent from egg laying industry). Egg exports are thus limited to prioritizes the affordability of eggs to meet the current demands for the South African population at the cost of being able to export to Europe.

DISCUSSION

Respondents offered their insights on how best to address each of the challenges to sector and industry developed that they identified. Initiatives toward inclusive growth for the entire sector throughout the country were highlighted, which can be achieved through enhanced coordination and partnership between government and industry.

Recommendations to address sector challenges

Respondents agreed that a recommendation to address both livestock health and challenging government structures in the livestock sector is to strengthen public-private partnerships. The livestock industries are encouraged to take initiatives and accountability for managing livestock health and to avoid relying on the government to lead disease management. Private enterprises should be encouraged to invest in disease management and to coordinate with stakeholders along the value chain to develop a comprehensive management plan, such as the Red Meat Industry Strategy 2030 (BFAP, 2021b). The government should

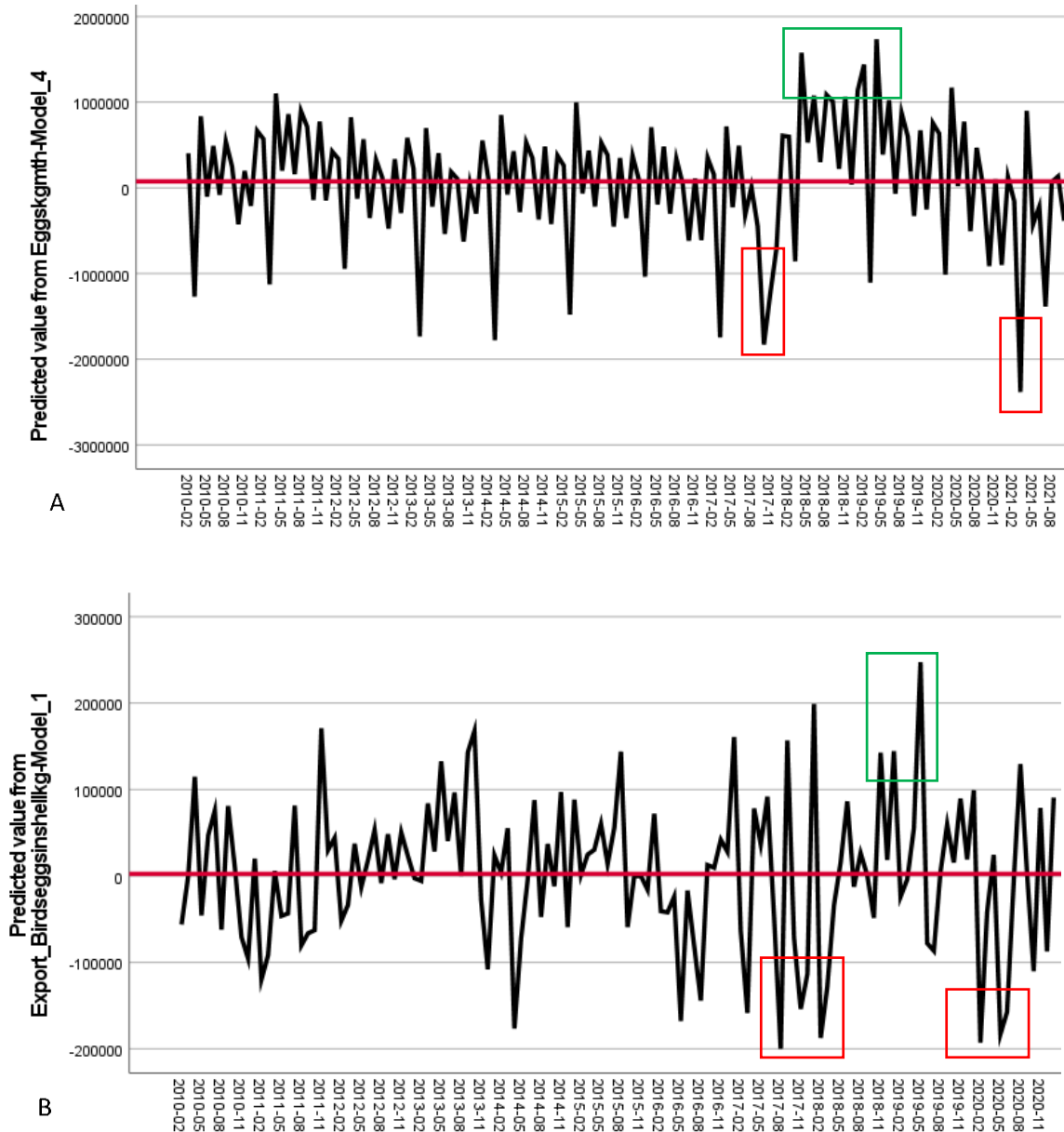


Figure 5. (a) Time series chart of egg production (kg/month) from January 2010 to October 2021 (South Africa Poultry Association, n.d.) with smoothing and first order differencing shows a drop in egg production from September 2017 to April 2018 (red box) due to HPAI outbreaks. Egg production recovered well (green box) but then suffered initially as a result of the first COVID-19 pandemic lockdown in 2020. Production dropped again in February 2021 (red box) corresponding to HPAI outbreaks. (b) Time series chart of egg exports (kg) from January 2010 to January 2021 ("Trade data," n.d.) with smoothing and first order differencing shows drops in exports in 2017 (red box) due mostly to the HPAI outbreak, after which exports recovered well (green box). Drops in exports in 2020 (red box) are due mostly to the COVID-19 pandemic lockdowns (respondent from egg laying industry).

consider the capacity of the private sector to manage its livestock health, while maintaining oversight to facilitate official procedures such as export approvals.

To repair and improve the relationship between the industry and government as well as other stakeholders in the industry, a revision of the structures in place that guides these relationships should be considered.

Restructuring of the industry coordination can be achieved by establishing independent entities for each of the industries with the support of statutory funding to deliver services such as passive surveillance, coordinate implementation and communication and establish a system that integrates data and information throughout the value chains with the support of statutory funding and

in partnership with government (BFAP, 2021b); respondent from beef association, FMD expert for southern Africa. Such entities under the management of a board of directors can be authorized to deliver some of the services for which government is lacking resources and thus play a critical role in livestock disease management at the national level. Through these entities and a system for international compliance, public awareness, private investment, and government oversight, trust can be built that could secure sustainability and growth of the industries (BFAP, 2021b).

Enhanced biosecurity, surveillance, awareness, and education are also needed to improve national livestock health. Biosecurity can be enhanced for more enterprises especially in the emerging sector through private-public partnerships that support capacity development trainings with farm personnel and further extension work at the community level. Where enhanced biosecurity is not possible, awareness and education initiatives among farmers and community members on the risks of livestock diseases, especially zoonotic diseases and antimicrobial resistance, should be strengthened to improve livestock management and health.

Emerging farmers require training and education in livestock disease management and biosecurity to boost their productivity and profitability and thus grant them access to markets. Awareness raising efforts led by industry and government partnerships can have a great impact on attitudes toward disease management. Farmers that are granted access to a government farmland should be trained to avoid unnecessary losses and to set them up for successful businesses. Provincial and national government capacities can also be enhanced through training and resource allocation, such as supplies for outbreak for investigation supplies and petrol for official vehicles. Allocation of official funds towards veterinarians and vaccines can also help to encourage farmers to manage disease and improve production efficiency. Coordination among the individual farmers to buy into the existing sector and industry plans can also be enhanced through advocacy by government, industries, and the independent service-delivery entities.

Emerging farmers can be incentivized to better manage their livestock production and health if the generation of wealth from production and export is more equitable throughout the livestock value chain. The government can take steps to ensure that those farmers that are vulnerable get a fair share of their production value. Farmers can be subsidised to make sure that the feedlot owners and the agro-processors for the meat purchase livestock at a certain cost and then recover that amount from the exports to make sure that the value returns to the primary producers.

While regular incursions of FMD, ASF, and HPAI remain expected, evidence- and risk- based approaches to the regulations and guidance on controlled animal

diseases may be prudent to support sector development. The scientific evidence base for the risks of controlled diseases upon which international and subsequently national regulations and guidance are based could be further strengthened. Further scientific investigations into the pathophysiology, epidemiology including virulence, transmissibility, and the extent of circulation of each disease, strain, and serotype based on surveillance data of each controlled disease in peacetime are needed.

In the case of FMD, designing regulations and guidance so that all cases, regardless of the serotype, are managed; the same can contribute to collaborative control of the disease. Once the disease is under control at the national level, consideration may be given to creating serotype-specific regulations for isolated outbreaks that may occur in future. Furthermore, the protected and infected FMD-zone boundaries during peacetime need to be re-evaluated on a scientific basis, taking into consideration the distances from the risk areas, animal identification and traceability, and control measures including surveillance and vaccination in each zone. A province-based zoning scheme during an outbreak may be effective, considering that each province is managed by its own sub-national veterinary authority (respondent from a private diagnostic company). Sub-national veterinary authorities understand the outbreak situation on the ground better and have stronger relationships with the livestock associations and the farmers than the national-level authorities (respondent from a private diagnostic company). Through their close ties with farmers and livestock associations, sub-national veterinary authorities can better manage the outbreak while reporting results including confirmed positive cases to the national-level authorities. However, sufficient resources in both the public and private sectors would be needed to fulfil the surveillance testing requirements as per WOAHP guidance in order to establish the province-based zones (FMD expert for southern Africa). The capacity of the surveillance strategies and regulations in place to fulfil their objectives for controlled diseases should be regularly assessed. If government resources are not available for such investigations and associated revision of the regulations, then animal health associations and independent entities supported by government and industry funding may be mandated for this task.

With such evidence-based investigations and associated revision of the regulations, producers especially emerging farmers could build resilience in the face of outbreaks of controlled diseases and thereby support sector development.

Recommendations for enhancing exports

Interview respondents offered recommendations for steps that can be taken to enhance the sustainability and

competitiveness of the livestock industries that would enable them to enhance exports. The mitigation of controlled disease burdens through enhanced disease management must be prioritised to support the export markets. Recommendations for enhancing exports include establishing fundamental import requirements, like a national animal identification system and traceability that will also support disease management. Although industries are taking initiatives to implement traceability systems that are allowing them to successfully export, a national traceability is needed to support more enterprises including the emerging ones to enable exports. Such a national animal identification and traceability system should be built based on the guidance provided by the WOAHA for international compatibility (WOAHA, 2022b). A successful national system requires trust between farmers and government and can be built through public-private partnerships between industries and government. Since such a national system requires farmers to provide detailed information on their livestock to the government, trust that farmers will not be penalized for sharing such information with the government is critical (respondent from private diagnostic company). Disease management and exports can be further enhanced through implementation of compartmentalisation in the beef, dairy, and poultry industries, following the swine industry model and according to WOAHA certification guidelines (2022a). Compartments contribute to the overall resilience of the industries through enhance biosecurity and thus minimize losses in the face of disease outbreaks. With compartmentalisation, a system of enterprises can prove disease-freedom through testing and assure trading partners that their livestock products remain disease-free despite outbreaks outside the compartments, allowing daily operations and exports to continue or resume as fast as possible and thereby minimize losses. Minimizing losses and thus enhancing profitability will allow more emerging farmers to enter and remain in the commercial value chain, thus contributing to the development of the entire sector. Emerging farmers can be supported and incentivized to comply with compartment standards through public-private partnerships between government and industries. A compartment-type system can also be established for growth-stimulant usage, especially for the beef industry, and cage-free systems for the poultry industry, in conjunction with the necessary traceability system in place which would allow certain compartments to export commodities to countries that prohibit the use of growth stimulants and poultry cages.

Furthermore, trade deals should be prioritised with those markets that are feasible and sustainable. For example, North America should not be a priority for exports given the expense of exporting such long distances. Although the African Growth and Opportunity Act helps to relieve the costs for exports to the United States, this programme is temporary and therefore not

sustainable. Trade negotiations with the EU and the Middle East can be strengthened, so that the entire country including the primary producers can benefit from trade deals, and not just a few individual enterprises at the interface with trading partners. In this way, those enterprises that are already profiting from exports can continue to do so, while other producers in the value chain including emerging farmers can also benefit and thereby enter and remain in the commercial market.

Limitations and future work

Limitations of the current study that are opportunities for future work include:

- (1) Challenges in national-level livestock data collection due to limited resources and personnel limit the accuracy of the reported data for the outcome variables based on. These limitations could also be reflected in the quantitative results, and therefore the results should not be over-interpreted.
- (2) Most interactive and confounding variables were not accounted for in the analysis, and so correlations and causations between disease outbreaks and outcome variables could not be statistically proven. More advanced studies could be pursued to demonstrate correlation and causation by addressing the interactive and confounding variables.
- (3) As a perception-based study, the qualitative results are subjective and subject to uncertainty and bias. These biases were mitigated through identification of a consensus and consultation with the literature for supportive evidence where possible.
- (4) The high-interest, high-influence stakeholders engaged for this study represent only a subset of all stakeholders of the livestock sector. Future work can engage other stakeholders such as the producers for more information on ground-level challenges.
- (5) The remote nature of the study creates a limitation for understanding challenges in the field. A field study involving participant observation could reveal further insights and a ground-level perspective through engagement with stakeholders in person. Future work can include a closer look at the impact of socioeconomic issues on livestock sector development, like black economic empowerment, land reform, and prioritization of government resources. The poultry meat industry can be engaged to better understand the perspectives of the industry stakeholders on the challenges to poultry meat industry development.

The epidemiology and pathophysiology of controlled diseases including virulence, transmissibility, and extent of circulation should be better studied to evaluate the risk to and impact on livestock production and health and the risk of transmission and thus inform evidence-based regulations and official guidance for veterinary

authorities, producers, and importing countries.

Endemic diseases like brucellosis and Newcastle disease can be assessed for impact on production and exports parameters using more advanced statistical analyses and modelling. An assessment of the impact of brucellosis on human health especially veterinarians in South Africa is needed.

Conclusion

The study achieved its aim of exploring challenges and proposing recommendations to support livestock sector development in South Africa, both at the sector and at the industry levels, using a stakeholder-driven approach. This study provides a better understanding of the challenges, especially with regard to livestock disease management, through the perspectives of the high-influence and high-interest stakeholders. The approach proved to be an effective method for insights that may otherwise not be described in the literature and can encourage stakeholder ownership of the self-identified challenges and interventions to support the development of the sector.

The ability of farmers to meet domestic and international animal health regulations for controlled diseases in the face of increasing disease burden, high input costs, and reduced government support featured as a major challenge to livestock sector development by interview respondents and was confirmed by the literature review and supported by the event study analysis. Other challenges include lack of trust between industry and government as a legacy of apartheid, a poor performing economy due to political challenges beyond the livestock sector that hinders both profitability and consumer spending power, decentralisation which hinders national coordination for livestock disease management, limited government personnel and resources to update and carry out regulations on controlled diseases, and limited access to land and capital for emerging farmers. These challenges are hindering public and private efforts to mitigate disease burden, high input costs, and external shocks like drought, heavy rains, and the COVID-19 pandemic.

The impacts of the implementation of regulations surrounding controlled diseases can have a much greater impact on production and exports than the diseases themselves. The management of controlled diseases especially FMD, ASF, and HPAI is getting more difficult over time because of the implementation of national and international regulations that severely limit operations and exports and thus profitability especially for emerging farmers. This is especially evident where production and export parameters are resilient to drought and COVID-19 pandemic lockdowns but is vulnerable to the outbreak control measures. The event study analysis showed that the FMD-free status suspensions and associated export bans identified by the interview respondents in particular

were linked to major deviations in production and export variables from 2010 to 2021. Industries have successfully reopened trade markets within a few weeks to months of the export bans, demonstrating that producers can ensure continued safe exports in the face of outbreaks occurring elsewhere. However, the limited government resources and personnel available to manage the outbreaks prevent many farmers from resuming operations as soon as possible despite their efforts to achieve and demonstrate disease-freedom. The risks to profitability created by outbreaks of controlled diseases discourage emerging farmers from investing in livestock disease management on their farms that would otherwise allow them to enter and remain in the commercial value chains.

In addition to the challenges affecting development of the entire sector, respondents highlighted specific challenges most critical to each industry. For the beef industry, FMD remains the biggest challenge due to periodic outbreaks outside the infected zones despite the maintenance of the zones as per WOAHA standards. Further challenges critical for the beef industry included the imbalanced earning structure that discourages primary producers from investing in disease management and export restrictions due to FMD outbreaks and to growth-stimulant usage. For the dairy industry, challenges included high input costs, product “dumping” fuelled by international competition in the free-market system, brucellosis as both an animal and public health issue, and restrictions on production and exports imposed by FMD outbreaks. For the swine industry, challenges especially for emerging farmers included profitability due to lack of access to capital and ASF management. For the poultry industry, challenges associated with high input costs that trigger “dumping” of products, with HPAI and Newcastle disease management, and with meeting international import requirements due to the use of poultry cages were highlighted. Respondents recommended inclusive-growth approaches to elevate the entire sector including (1) adaptation of national regulations and official guidance for controlled diseases to be evidence- and risk-based according to existing and further scientific studies, (2) mentorship programmes and committed resources toward livestock health management especially for the emerging sector through private-public partnerships, (3) establishment of independent entities for each of the industries to support the sustainable delivery of livestock services, and (4) establishment of national animal identification and traceability systems and compartment systems to improve disease management and to meet import requirements. The beef, dairy, and poultry industries may consider establishing compartment systems as the swine industry has done to enhance biosecurity and support business continuity in the face of outbreaks of diseases outside the compartment system. A compartment-like system for growth stimulant-free

products and cage-free products with traceability can also be established with the support of the development of government certification standards.

South African livestock producers are remarkably resilient in the face of extraordinary challenges including extreme climate conditions, burden of livestock disease, the COVID-19 pandemic, decentralised government structures, and reduced government resources for the livestock sector. Despite these challenges, there is a strong will from the government and industries to support the emerging livestock farmers to participate in the commercial markets. Through implementing recommendations suggested by the stakeholders, there is great potential for South Africa's livestock sector to prevail over these challenges and thereby support food security and economic growth for the country.

CONFLICT OF INTERESTS

The author declares that there is no conflict of interest regarding this study.

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