TECHNICAL REPORT

Development of Export Opportunities for Beef Products from the Zambezi Region

Project Name

Development of Export Opportunities for Beef Products
from the Zambezi Region

Project ID

Phase 1 - MCAN/LMEF/2010/02 and Phase 2 - MCAN/LMEF/2012/04

Project Sponsor

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Livestock Marketing Efficiency Fund

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Introduction

Zambezi Region is home to a large proportion of Namibia's big game species and it is situated at the heart of the Kavango Zambezi Transfrontier Conservation Area (KAZA TFCA). As a consequence the region was designated a foot and mouth disease (FMD) infected zone mainly due to the presence of free-roaming African buffalo, which are known to be maintenance hosts of the SAT serotypes of FMD viruses (FMDV). FMD infected status means beef from the Zambezi Region is less attractive to high-value export markets due to the possible presence of FMDV in imported meat. Such markets prefer to buy from FMD free countries or zones. The region's livestock sector lost access to the lucrative South African (RSA) market following a prolonged FMD outbreak from 2007 to 2008.

The World Organisation for Animal Health's (OIE) Terrestrial Animal Health Code (TAHC) recommends measures required to ensure safe importation of fresh meat from FMD infected countries or zones, with an official control programme for FMD, which involves compulsory systematic vaccination of cattle. These measures are listed in Article 8.7.25 of the TAHC, 2014.

Clause 1 (d) of Article 8.7.25 requires that meat should be derived from animals which *were kept for the past 30 days in an establishment, and that FMD has not occurred within a 10-kilometre radius of the establishment during this period.* This cannot be fully implemented in the Zambezi Region because the movement of wildlife cannot be controlled or even accurately monitored. This project was commissioned to overcome this problem.

Problem definition

Current international standards set by the World Organisation for Animal Health (OIE) for safe trade in fresh meat make matured de-boned beef less attractive for importers if it is derived from cattle raised in a foot and mouth disease (FMD) infected zone such as the Zambezi Region, due to possible risk of introducing FMDV. Most high-value markets prefer sourcing beef products from countries or zones with an accredited FMD free status.

FMD Free – No Vaccination	• Country or a zone • Favourable conditions for safe trade
FMD Free – With Vaccination	• Country or a zone • Less favourable conditions for safe trade
FMD Infected	• Country or a zone • Least favourable conditions for safe trade

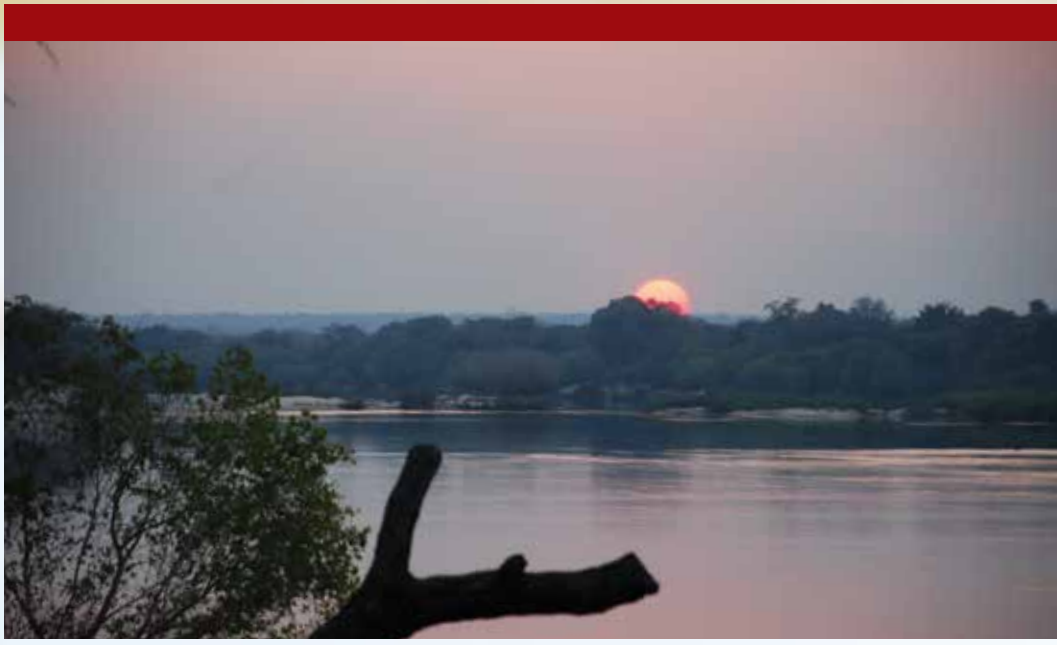
Figure 1

Overall project goal

The purpose of this project was to broaden export opportunities for beef products from the Zambezi Region of Namibia through developing and piloting a science-based integrated value chain risk management system addressing animal disease and food safety risks associated with the production of beef in the Zambezi Region. The system was shown to provide an acceptable level of protection to importing countries.

Phase 1
Specific Objectives

- To conduct market and value chain analysis in order to identify best opportunities for safe and quality beef exports from the Zambezi Region
- To develop a producer protocol for promoting good agricultural practice in animal health and production that will lead to better quality and a safe product
- To develop a pre-slaughter risk management protocol on how best to mitigate the threat posed by FMD
- To conduct experimental infection of cattle with FMDV in a high-security facility in order to confirm the absence of measurable levels of FMDV in skeletal muscle and to determine the distribution of FMDV in carcasses of cattle slaughtered in the acute stage of infection
- To conduct laboratory-based studies to gather adequate scientific evidence proving the safety of deboned beef from the Zambezi Region that has been produced using the proposed approach
- To measure FMD virus antibody responses to FMD vaccination
- To develop an integrated FMD risk and food safety management plan for sanitary risk management along the beef value chain in the Zambezi Region
- To develop protocols and procedures for the prerequisite programme and sanitary risk management programme along the beef value chain
- To develop capacity to implement an HACCP-based food safety management system at the Katima Mulilo abattoir



Phase 2 – Specific Objectives

- To conduct a pilot project based on protocols and procedures established during Phase 1 in order to confirm that the proposed approach renders beef from the Zambezi Region safe
- To conduct laboratory studies to gather adequate scientific evidence to prove the safety of matured deboned beef derived from cattle raised in the region
- To conduct local and SADC regional workshops to present results of the project studies and discuss future steps for practical implementation
- To assess the Directorate of Veterinary Services' (DVS) current approach, procedures and actions related to the management of FMD outbreaks in the Zambezi Region
- To conduct an epidemiological study to determine the role of both African buffalo and livestock movement patterns in the epidemiology of FMD in the Zambezi Region
- To investigate and recommend business continuity models that will ensure minimal disruption to marketing of livestock in the region during FMD outbreaks
- To produce a DVD on FMD in Southern Africa with emphasis on the interaction of wildlife and livestock and the transmission of SAT serotypes
- To build capacity at the Central Veterinary Laboratory (CVL) through providing training in FMD diagnostics
- To conduct a marketing campaign to promote acceptance and adoption of the value chain approach
- To conduct a quantitative risk assessment of the level to which a value-chain approach reduces the risk of FMD virus transmission in beef products derived from the Zambezi Region

Multiple disciplines involved

As evidenced by the activities listed above, the project was implemented using a multidisciplinary approach involving expertise in the following areas:

Animal Production

Food Safety

Epidemiology – both qualitative and quantitative

Animal Disease Management

Ecology

Meat Marketing

Wildlife Conservation

Virology

Phase 1 – Project Activities

Phase 1 – March 2011 to September 2012

- Conducted a market analysis
- Identified and described the existing formal beef value chain
- Developed the prerequisite programme
- Determined the distribution of FMDV in the tissues of cattle during the acute stage of infection with SAT serotypes
- Developed testing protocols for the detection of SAT infection in carcasses
- Conducted laboratory studies to prove the safety of deboned beef
- Developed an integrated FMD and food safety risk management system
- Trained abattoir staff to implement an HACCP-based food safety management system
- Trained selected producers on primary animal healthcare

Phase 1 Key Project Results

The main results of the project were:

Markets analysis

- Trade in beef within the Zambezi Region is possible whenever Meatco chooses to sell, even during FMD outbreaks.
- Access to the beef market elsewhere in Namibia is closed for the Zambezi Region during an FMD outbreak.
- Expansion of trade into the SADC regional market and penetration into the wider African market are the most realistic options to pursue. Within Africa, the most physically accessible markets for the Zambezi Region are those within the SADC region.
- Matured fresh beef export was considered the most profitable value chain.

Food safety management system at Katima Mulilo abattoir

- An HACCP audit conducted to assist with improvement
- Ten Meatco staff members trained in HACCP-based food safety management

Applied experimental research conducted at OVI

- Confirmed that even in acutely infected animals, SAT viruses do not occur in significant amounts in striated muscle (meat) or body fat of slaughtered animals
- Determined the quantity of SAT viruses that occur in lymph nodes of cattle in the acute stages of infection, as measured by polymerase chain reaction (PCR), both conventional and real-time methods
- Identified the pre-scapular, submandibular and popliteal lymph nodes as the most consistently infected organs in acute cases
- Designed an abattoir-based sampling strategy for identification of acutely infected carcasses
- Used PCR and serology to develop a system through which carcasses derived from animals sub-clinically infected with the FMD virus can be identified

Abattoir sampling and testing

- Results showed that 97% of the cattle had developed a strong antibody response to SAT-2 virus and 92% to SAT-1 and -3 virus following vaccination with trivalent SAT vaccine during quarantine.
- All pre-scapular, submandibular and popliteal lymph node samples tested negative for the FMDV.

Producer protocol

Developed a producer protocol to improve beef quality and manage disease and food safety risks. The protocol covers the following areas:

- Record keeping
- Animal identification to achieve traceability
- Cattle vaccination against FMD and other diseases
- Treatment of cattle for internal and external parasites
- Grazing management
- Prevention of cattle/buffalo contact through herding and kraaling
- Prompt disease reporting to Veterinary Services
- Trucking cattle to quarantine stations and the abattoir

Promoting approach through publications

Members of the project team co-authored the following two peer-reviewed papers published in the journal *Transboundary and Emerging Diseases.*

- G. R. Thomson, M. -L. Penrith, M. W. Atkinson, S. Thalwitzer, A. Mancuso, S. J. Atkinson and S. A. Osofsky (2013) *International Trade Standards for Commodities and Products Derived from Animals: The Need for a System that Integrates Food Safety and Animal Disease Risk Management, Transboundary and Emerging Diseases*, Blackwell Verlag GmbH
- G. R. Thomson, M. -L. Penrith, M. W. Atkinson, S. J. Atkinson, D. Cassidy and S. A. Osofsky (2013) *Balancing Livestock Production and Wildlife Conservation in and around Southern Africa's Transfrontier Conservation Areas, Transboundary and Emerging Diseases*, Blackwell Verlag GmbH

Phase 2 Project Activities

December 2012 to July 2014

- Conducted a pilot project on the value chain approach
- Continued with abattoir sampling and laboratory tests
- Assessed DVS' current approach to management of FMD outbreaks in the Zambezi Region
- Conducted epidemiological studies on the role of cattle-buffalo movement patterns in FMD occurrence in cattle
- Investigated business continuity models for ensuring minimal disruption during FMD outbreaks
- Conducted an ecological assessment of quarantine stations to determine their ability to sustain the desired throughput
- Produced a DVD on FMD transmission in Southern Africa
- Trained Central Veterinary Laboratory (CVL) staff in FMD diagnostics
- Prepared marketing campaign tools for promoting acceptance of the value chain approach
- Conducted a quantitative risk analysis on risk reduction achieved for individual cuts of deboned beef produced according to the risk management protocol developed according to the pilot project
- Held local and a SADC regional workshop to present project results

Phase 2 – Key Project Results

The main results of the project were:

Integrated value-chain risk management system

Finalised development of prerequisite programme, including critical control points, for the integrated FMD and food safety risk management system

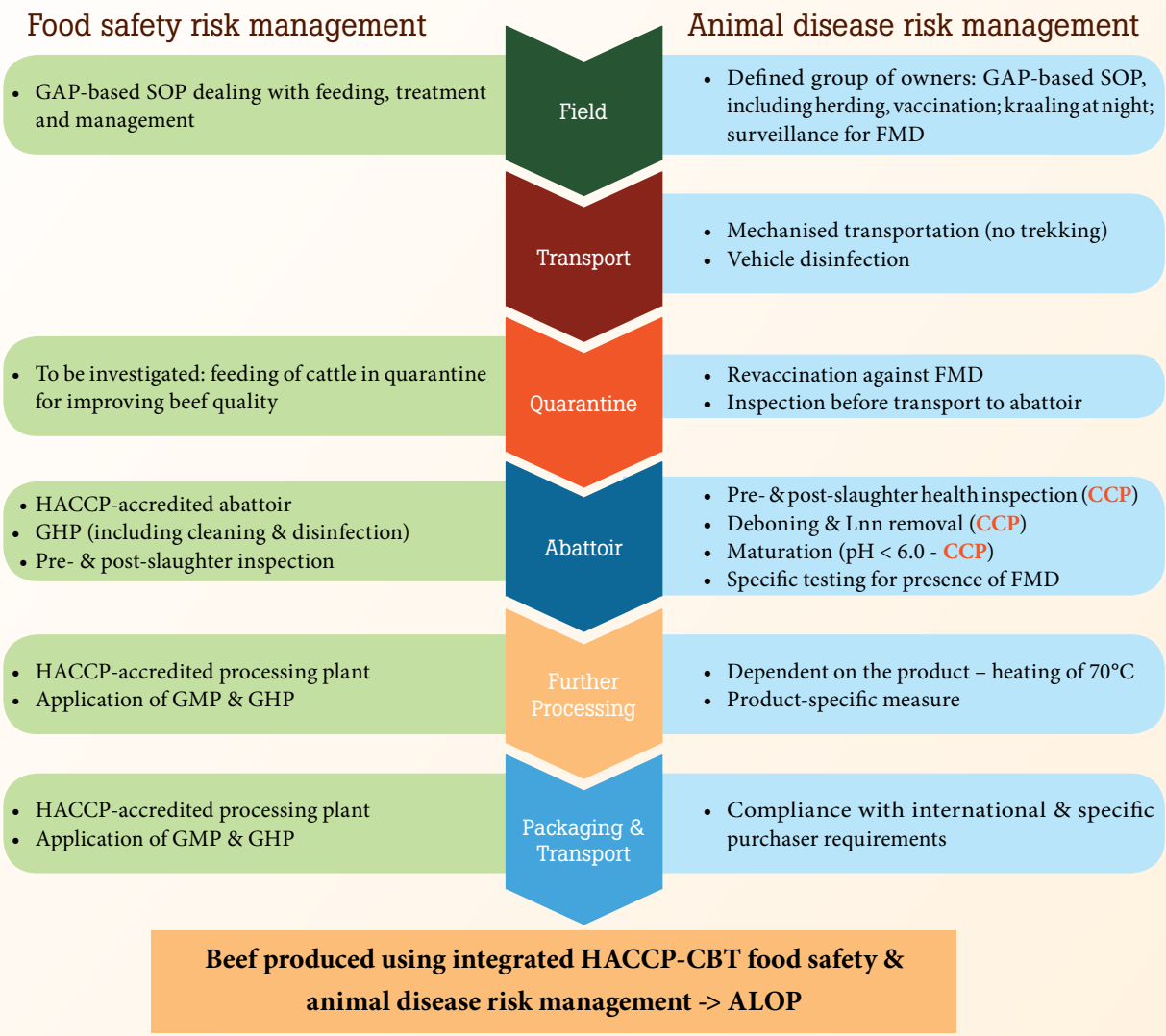


Figure 2

Training of participating farmers

- A total of 35 people were trained in primary animal health care conducted by Afrivet and the University of Pretoria in March 2013, represented as follows: DEES (8), DVS (16), Meat Board (5) and 6 farmers.
- A total of 81 farmers were trained in primary animal health care conducted by Afrivet and the University of Pretoria in September 2013.

Training of Meatco staff on food safety systems

- Conducted training for 11 Meatco staff members on food safety systems including HACCP principles - Plant Manager, Production Manager, Procurement Manager, Technical Manager, 2 x Quality Assurance Officers, Abattoir Superintendent, Dispatch Superintendent, Offal Superintendent and Northern Communal Areas Quality Assurance Manager
- Training covered the following:
  - Main principles of EU Food Safety Strategy
  - Concepts of prerequisites, Good Manufacturing Practices, Good Hygiene Practices and Hazard Analysis Critical Control Point System
  - To present practical examples of prerequisites and HACCP implementation
  - To improve prerequisites and HACCP plan at the Katima Mulilo abattoir
  - The Katima Mulilo abattoir was assisted with updating key documentation – HACCP plan and Quality Manual

Quarantine study recommendations

- To rehabilitate the veld and raise productivity by rotational resting of camps
- Large camps should be sub-divided into smaller grazing units to prevent prolonged grazing at light stocking rates
- Watering points should be strategically positioned to prevent high grazing pressure on areas closer to water points
- Control of invasive bush by a combination of chemical treatment and planned fires
- To revise existing quarantine protocol to include a biosecurity management plan

Risk assessment of the integrated value chain approach

- Conducted quantitative risk analysis of current and proposed new measures to manage FMD risk associated with beef produced in the Zambezi Region, including proving equivalence with Article 8.7.25 of the OIE's Terrestrial Animal Health Code (2014)
- Scenario pathways considered in the risk assessment model were:
  - Scenario A - Current operating procedures within the Zambezi Region
  - Scenario B - Theoretical application of current OIE standard, Article 8.7.25
  - Scenario C - The value chain approach developed by the project
- The risk assessment model predicted that on average, a contaminated product would potentially be released once every 2, 5 or 50 years for scenarios A, B and C respectively.
- Estimated risks associated with deboned beef produced within the Zambezi Region using the value chain approach were less than 1 in a million, a common level used in definition of negligible risk.
- Risks associated with beef produced using the value-chain approach (Scenario C) were estimated to be less than the corresponding risk associated with OIE Article 8.7.25 which demonstrated equivalence with this international standard.

Workshops conducted to present results

- Collaborated with Wildlife Conservation Society – Animal and Human Health for the Environment and Development (WCS-AHEAD) to secure endorsement of the value chain approach by both DVS and the SADC Livestock Technical Committee (SADC LTC) comprised of heads of livestock production and animal health departments of SADC member countries in November 2012
- SADC LTC endorsed the non-geographic approach to FMD control and trade in meat and meat products from FMD endemic areas such as the Zambezi Region through the *Phakalane Declaration* in November 2012.
- SADC LTC specifically endorsed the value chain approach through a resolution passed in June 2014. The resolution called upon member states to accept and adapt the approach in order to promote intra-regional trade in livestock products.

Abattoir sampling and testing

- An additional 149 serum samples and lymph nodes were collected at slaughter.
- Results showed the cattle had developed a strong antibody response to SAT1, 2 and 3 antigens, i.e. 88.6%, 78.5% and 82.6% respectively.
- All pre-scapular, submandibular and popliteal lymph node samples tested negative for FMDV.

Assessment of FMD outbreak management

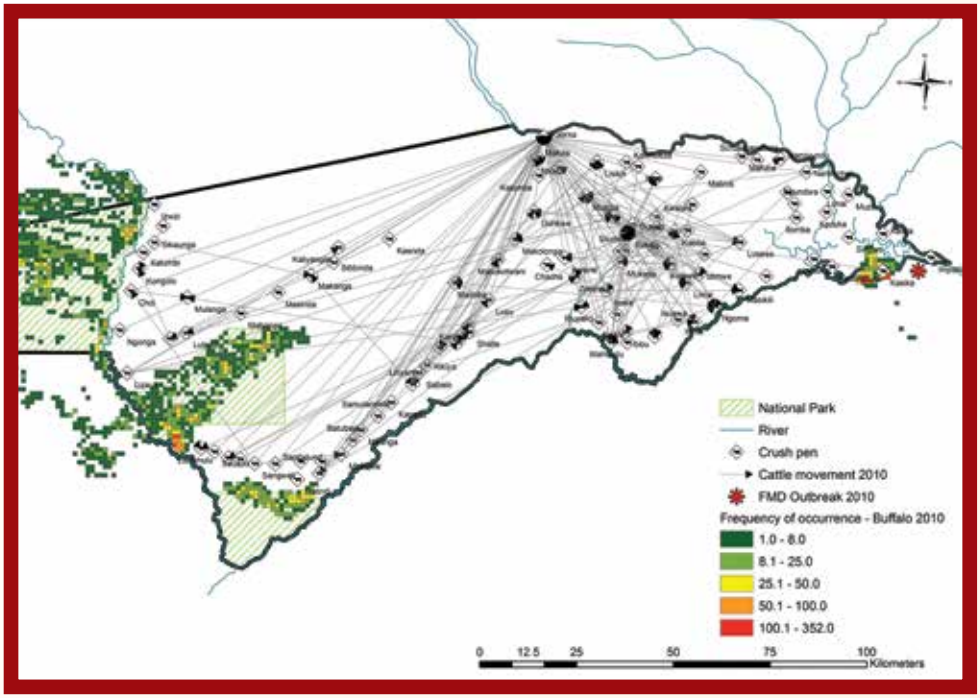
- Recommendations presented in figure 3 were made to decrease the extent in both area and duration.
- A draft FMD outbreak response protocol was prepared for DVS to consider. If implemented, this would reduce most of the disruption to the livestock trade in the Zambezi Region caused by FMD outbreaks and ensure early resumption of exports following an outbreak in the region.

Figure 3

- The caveat is that active surveillance during an outbreak should be adequate to rapidly detect the spread of disease. Farmers must fully comply with the cattle movement restrictions imposed to prevent disease from spreading.

Post-vaccination monitoring and FMD sero-survey

- Tests to monitor the effectiveness of vaccination campaigns were conducted on 1 106 cattle blood samples collected from cattle raised in the Zambezi Region. Results show that cattle will start losing protection from clinical disease or infection by the fourth month after vaccination. The recommendation is to undertake a more comprehensive study to identify all potential causes of the limited duration of immunity conferred by the vaccine currently used in the Zambezi region.
- Tests were conducted on goat blood collected from areas of the Zambezi Region where FMD outbreaks had occurred. The tests served to establish the role of small stock in the occurrence and spread of FMD. All blood samples were negative, showing that goats tested had had no recent exposure to FMD virus.



Epidemiological study of cattle-buffalo movement patterns

- The study improved the understanding of local and cross-border movements, their motivations and the risks they present to the cattle population in the Zambezi Region.
- The study report highlighted the role of buffalo and livestock movements and defined their probable role in the maintenance of FMD viruses in the Zambezi Region.

Capacity building at CVL

- Trained eight (8) CVL staff members in both FMD serology and molecular diagnostics

Production of DVD on FMD in Southern Africa

- Collaborated with WCS-AHEAD and the University of Pretoria to produce a DVD on FMD in Southern Africa, emphasising the peculiarities of SAT serotypes, their maintenance and transmission.
- The DVD is titled *The Manmade Plague* and was released on 30 June 2014.
- The film explains why FMD eradication is currently impossible in Southern Africa and some other regions of sub-Saharan Africa.
- The DVD forms part of efforts to promote the acceptance of non-geographic approaches to FMD risk management.

Project constraints

The key challenges faced in implementing this project were:

- FMD outbreaks in 2012 and 2013 resulted in suspension of export certification for a total period of twelve months. As a consequence some activities had to be rescheduled resulting in some delays and curtailments.
- Gaps in secondary data caused delays in a number of activities such as market analysis, value chain investigation and the study on cattle movement patterns. In some cases primary data collection had to be employed to fill in the gaps in secondary data made available by project partners and other stakeholders.
- Procurement of consultancy services delayed activities due to lack of depth in local expertise. The lack of depth often resulted in the project team having to re-advertise some calls for expression of interest.

Main conclusions

- The project conducted applied research, risk analysis and other studies to demonstrate that deboned beef produced by the application of additional up- and down-stream measures associated with the value chain approach, is an acceptably safe product.
- The additional measures were technically justified and resulted in a level of risk equivalent to (i.e. lower than) that which could be achieved through implementation of a World Organisation for Animal Health's (OIE) trade standard, i.e. Article 8.7.25 of the OIE's Terrestrial Animal Health Code (TAHC).
- Article 8.7.25 cannot be applied fully in locations such as the Zambezi Region for reasons that the project team published in an international peer-reviewed journal.
- The Project therefore provided a blueprint for a value chain system that generates internationally acceptable risk mitigation through application of the principle of equivalence.
- The project developed a scientifically sound and practical alternative for marketing the Zambezi Region's deboned beef regionally and internationally. The proposed system is compatible with the location of the Zambezi Region at the centre of the KAZA TFCA, and therefore, facilitates co-existence of livestock production and wildlife conservation.
- The duration and geographic extent of an area placed under movement restrictions following an FMD outbreak need to be revised. This is a major impediment to livestock marketing in the Zambezi Region. On the other hand, joint efforts from both livestock keepers and DVS are required to ensure that standstill orders, when necessary, are enforced and respected.

The way forward

Since the value chain approach outlined by this study has been shown by an independent, quantified risk assessment to fulfil international requirements for demonstration of equivalence with an existing international standard (Article 8.7.25) for deboned beef, there is nothing to prevent its implementation in the Zambezi Region. Furthermore, the risk assessment provides an ideal marketing tool for Namibia.

The DVS has indicated that it would give favourable consideration to the project's recommendations related to managing FMD outbreaks in order to ensure early resumption of beef exports following an outbreak in any part of the region.

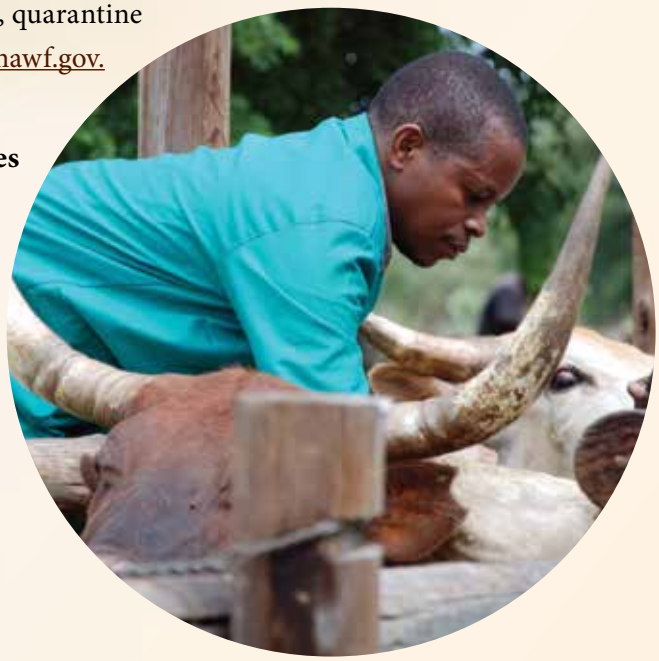
It is expected that the DVS will implement the following recommendations:

- Improving the official animal movement monitoring and control system
- Conducting routine post-vaccination monitoring
- Improving biosecurity measures at quarantine stations
- Rehabilitating and improving management of grazing at quarantine stations

It is expected that the DVS will assist the Food, Agriculture and Natural Resources Directorate of SADC by presenting the results of the project to other Veterinary Authorities within the region to support the development of a common position during the review process of the World Organisation of Animal Health's (OIE – www.oie.int) Chapter 8.7 on FMD in the Terrestrial Animal Health Code. This will hopefully result in the international standards for FMD management becoming more practical in the uniquely complex FMD situation in Southern Africa.

Project implementation partners

- **Meat Board of Namibia** – provided project leadership. Coordinated all activities and responsible for budgeting, budget control and reporting. http://www.nammic.com.na
- **TAD Scientific CC** – main consultant providing scientific and technical support throughout the project. The consultant provided expert advice and operational inputs in animal disease risk management along value chains, developing the integrated CBT/HACCP risk management system, quantitative risk assessment, field and laboratory studies, quarantine biosecurity and epidemiological study on cattle-buffalo movement. http://www.tadscientific.co.za
- **Istituto Zooprofilattico Sperimentale dell'Abruzzo e del Molise "G. Caporale"** – responsible for building capacity at Meatco's Katima Mulilo abattoir to confirm that the implementation of the HACCP-based food safety management system, in accordance with international standards. http://www.izs.it
- **DVS** – provided field support and was responsible for all official controls along the value chain – on-farm, quarantine stations and at the export abattoir. http://www.mawf.gov.na/Services/veterinary.html
- **Department of Veterinary Tropical Diseases (DVTD), Faculty of Veterinary Science, University of Pretoria** – assisted in the development of and monitoring the implementation of the on-farm prerequisite programme. Assessed economic and environmental sustainability of livestock production systems in the Zambezi Region, including compatibility of livestock production with bio-diversity conservation.
- **Department of Production Animal Studies, Faculty of Veterinary Science, University of Pretoria** – designed a risk assessment model and conducted a quantitative risk assessment of the value chain approach.
- **Meatco** – provided logistics and field support in the Zambezi Region, particularly the slaughter of cattle. Meatco provided the infrastructure including assistance with sampling procedures. http://www.meatco.com.na
- **Agricultural Research Council – Onderstepoort Veterinary Institute (ARC-OVI)** – Transboundary Animal Diseases Programme. http://www.arc.agric.za/arc-ovi/Pages/Transboundary-animal-diseases-.aspx



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