REPUBLIC OF ZIMBABWE

MINISTRY OF FINANCE AND ECONOMIC DEVELOPMENT

ZIMBABWE AGRICULTURAL VALUE CHAIN ENHANCEMENT PROJECT (ZAVaCEP)

- BEEF and LEATHER VALUE CHAIN -

PEST MANAGEMENT PLAN (PMP)

July 2024

EXECUTIVE SUMMARY

Introduction

This report presents that Pesticide Management Plan (PMP) for the Zimbabwe Agricultural Value Chain Enhancement Project (ZAVaCEP), which is being proposed by the Government of Zimbabwe for implementation in the two provinces of Matebeleland South and Masvingo, specifically in Insiza and Beitbridge district and Chivi and Masvingo, respectively.

The Zimbabwe Agricultural Value Chain Enhancement Project (ZAVaCEP) encompasses a comprehensive Pest Management Plan (PMP) designed to address the complex challenges of pest control within the livestock and leather sectors. As the project aims to enhance beef and leather value chains, the PMP is crucial for managing the risks associated with pesticide use and ensuring environmentally and socially sustainable practices. This executive summary provides an overview of the PMP's objectives, strategies, and implementation framework, focusing on how it aligns with national development goals and addresses both the ecological and human health impacts of pest management. By integrating Integrated Pest Management (IPM) principles, the PMP seeks to mitigate negative effects and promote sustainable agricultural practices across the project's operational areas..

The Zimbabwean government has undertaken several initiatives to boost livestock production, notably through a three-year African Development Bank-funded Support to the Beef and Leather Value Chain Technical Assistance (SBLVCP) Pilot Project. This project aimed to address constraints in the beef and leather value chain and was successful in setting a foundation for further development. Following the success of this pilot, the Zimbabwe Agricultural Value Chain Enhancement Project (ZAVaCEP) was initiated to expand these efforts across additional provinces. ZAVaCEP focuses on capacity building, enhancing livestock productivity, providing potable water, and promoting private sector development, all aimed at fostering macroeconomic stability, job creation, and poverty reduction.

Pest and pesticide management within this project can have several potential impacts on its activities. Effective pest control is essential to protect fodder crops and cattle from damage, ensuring healthy growth and maximizing yields. However, improper management of pests and pesticides (Including acaricides) can lead to adverse effects that may compromise the project's goals and sustainability.

As part of its comprehensive approach, ZAVaCEP will adhere to environmental and social safeguards, including the development of a Pest Management Plan (PMP) in compliance with the Environmental Management Act of Zimbabwe and other AfDB Operating Safeguards standards. The PMP is crucial for minimizing the negative impacts of pesticide use and promoting sustainable pest management practices. Effective pest management is essential for protecting crops and livestock, but improper pesticide use can lead to environmental contamination, health risks for farmers, and reduced agricultural productivity. The ZAVaCEP project is structured to integrate pest management practices within its broader objectives, ensuring that environmental and social impacts are carefully managed to support the overall success and sustainability of the initiative.

Description of the Project and results

Project components of the Zimbabwe Agricultural Value Chain Enhancement Project (ZAVaCEP) are designed to boost the cattle and leather value chains over a four-year period, with a strong emphasis on sustainable development and minimal environmental impact. The project comprises three primary components:

Component 1: Climate Smart Agricultural Productivity and Value Chain Enhancement – This component focuses on improving livestock production and value chain processes. Activities include rehabilitating dip tanks and installing solar-powered boreholes to enhance livestock watering and pest control. It also involves supporting climate-smart rangeland management, pasture development, and improving feed quality. Additionally, it aims to strengthen agri-business and market linkages through training, exhibitions, and the development of feedlots and aggregation centres. The expected results for this component are, enhanced livestock production, improved infrastructure, availability of water and nutritious stock feed throughout the year. This component is also dedicated to building capacity and promoting inclusivity. It includes training smallholder farmers, especially women and youth, in livestock management, value addition, and sustainable practices. Activities under this component aim to improve skills, promote social inclusion, and support MSMEs in agro-processing.

Component 2-Bulding Rural Communities Resilience to Climate Change
2.1 Supporting Climate Resilient and Community level-driven Infrastructure Development): Component 2 enhances capacities of smallholder livestock farmers, promotes social inclusion, and supports policy development and knowledge management. **Sub-component 2.1** focuses on practical farmer training and value addition, while **Sub-component 2.2** involves policy reviews, stakeholder dialogues, and monitoring activities.

Component 3 (Knowledge Management, Policy Development, Monitoring and Evaluation Project Management: It focuses on strengthening knowledge management, policy development, and monitoring to enhance the beef and leather value chains. Activities under this component aim to improve skills, This encompasses trainings and skills development and review and development of policies that are relevant to the value chains.

Component 4: Project Management – The final component ensures the effective management and sustainable implementation of the project. It includes managing operational costs, supporting financial and procurement audits, and maintaining project oversight. This component aims to provide the necessary administrative and logistical support to ensure the project's success and sustainability.

Current Approaches to Pest Management in Zimbabwe's Agricultural Sector

Pest management strategies in Zimbabwe focus on both chemical and non-chemical methods to address pest issues in fodder crops and livestock. The targeted fodder crops and breeding bulls and their common pests are as follows:-

Targeted Fodder Crops and Breeding Bulls

ZAVaCEP targets legumes like velvet bean and lucerne, and grasses such as Katambora and star grass for fodder production. Velvet bean (Mucuna pruriens) and lucerne (Medicago sativa) are valued for their high nutritional content and soil fertility benefits but face pests like the velvet bean caterpillar and lucerne flea. Grasses like Katambora (Cynodon dactylon) and star grass (Cynodon nlemfuensis) are prone to pests such as armyworms and grasshoppers. Effective pest management is crucial for maintaining the productivity and sustainability of these crops.

The project also focuses on the distribution of superior breeding bulls, including the Tuli and Nkuni breeds. Tuli cattle, known for their adaptability and meat quality, face challenges from ticks and internal parasites. Nkuni cattle, also resilient and productive, experience issues with ticks and gastrointestinal worms. Effective pest control is essential for maintaining the health and productivity of these breeds.

Current Approaches to Pest Management

- **Chemical Pest Control:** Pesticides and acaricides are commonly used for managing ticks and maintaining feed quality. Methods include dipping tanks, pour-on formulations, and sprays, but these require careful management to prevent environmental contamination.
- **Integrated Pest Management (IPM):** IPM combines biological, cultural, and mechanical control methods. Biological controls involve natural predators, while cultural practices include crop rotation and resistant varieties. IPM is promoted but not universally applied.
- **Rangeland Management:** Climate-smart practices focus on soil and water conservation to enhance ecosystem health and natural pest control. These practices are being implemented on a limited scale.
- **Training and Capacity Building:** Training programs for safe chemical use and pest management are widespread, supported by veterinary technicians and Agritex extension officers.
- **Disease Surveillance and Monitoring:** The Department of Veterinary Services conducts regular monitoring and surveillance for pest-related diseases, using technology for reporting and tracking. Effectiveness is hampered by limited urgency and knowledge in rural areas.
- **Regulation and Policy:** Government policies regulate pesticide use and pest management practices to ensure environmental and health standards.

Practical Experience with IPM in Zimbabwe and the Beef value chain sector

Successful IPM pilot projects have shown promising results by blending biological control methods with traditional pest management techniques, demonstrating their effectiveness in managing pest populations. These initiatives highlight the importance of partnerships and collaborations among government agencies, NGOs, and research institutions, which are crucial for advancing and implementing IPM strategies. Research plays a vital role, focusing on developing IPM techniques tailored to local conditions and exploring innovations such as resistant breeds and advanced monitoring tools. Community-based programs and farmer-led initiatives are pivotal in promoting the adoption of IPM practices, supported by extension services that facilitate their implementation. Furthermore, IPM is increasingly integrated into broader climate-smart and sustainable agricultural practices, addressing pest issues alongside challenges related to soil and water management. In summary, although traditional pest management methods are still prevalent, there is a noticeable shift towards integrated pest management practices within Zimbabwe's beef and leather sector, reflecting a move towards more sustainable and effective solutions.

Usage of Synthetic Pesticides in Zimbabwe.

In Zimbabwe, synthetic chemical pesticides are widely used across agriculture, including in the beef and leather value chain. These chemicals, encompassing insecticides, herbicides, and fungicides, are crucial for managing pests in crops and livestock. Dip acaricides, specifically, are extensively used to control tick infestations in cattle, with estimates indicating an annual usage of approximately 1,200,000 litres. Despite the significant reliance on these pesticides, precise data on their volumes remains challenging to obtain due to inconsistent reporting and varying agricultural practices. This heavy dependence reflects the ongoing need for effective pest management solutions to safeguard agricultural productivity and livestock health.

The Pesticide Regulatory framework.

The regulatory framework for pesticide use in Zimbabwe involves the Pesticide Control Authority (PCA), which oversees the approval, distribution, and application of these chemicals. The PCA ensures that pesticides meet safety and efficacy standards before being approved for use. However, challenges in enforcement and monitoring can lead to issues such as the misuse of unregistered products. Additionally, the effectiveness of pesticide management is impacted by the limited capacity of agricultural extension services, which face constraints in personnel, training, and resources. These limitations contribute to inconsistent pesticide application practices and increased risks of health and environmental issues.

Current issues in pesticide management in the country

Current issues in pesticide use and management highlight several environmental and health concerns. Over-reliance on synthetic pesticides has led to resistance development among pests, reducing the effectiveness of chemical controls and necessitating higher doses or more toxic alternatives. Environmental contamination from pesticide runoff affects soil and water quality, impacting non-target species and ecosystems. Moreover, inadequate protective measures for those handling pesticides expose them to health risks, including acute poisoning and chronic conditions such as cancer and neurological disorders. These challenges emphasise the need for improved regulatory measures, better training, and enhanced safety protocols.

The economic implications of pesticide use are also significant. High costs associated with synthetic pesticides, coupled with the need for frequent applications due to resistance issues, place a financial burden on farmers. This economic strain is further exacerbated by market access challenges, as international markets increasingly demand low-pesticide residues in agricultural products. Zimbabwean producers, particularly in the beef sector, face potential restrictions on exports due to pesticide residue concerns, affecting their competitiveness and profitability.

There is need to strengthening regulatory frameworks and enforcement to ensure safe and effective pesticide use. Increasing the capacity of agricultural extension services and promoting integrated pest management (IPM) practices can reduce reliance on synthetic chemicals and enhance sustainability. Additionally, improving education and training for farmers on safe pesticide handling, and enhancing waste management systems for obsolete pesticides, are critical steps toward mitigating the adverse effects of pesticide use.

The Legal framework governing pesticide management

Zimbabwe's pesticide management framework is underpinned by a set of environmental regulations and institutions aimed at ensuring sustainable agricultural practices. The primary legislation includes the Environmental Management Act (Chap 20:27), which mandates the sustainable management of natural resources and the prevention of environmental degradation. This Act empowers the Environmental Management Agency (EMA) to oversee environmental impact assessments and enforce compliance through environmental management certificates. Complementing this is the Hazardous Substances and Articles Act (Chap 15:05), which regulates hazardous substances and establishes the Hazardous Substances Control Board, along with the Water Act (Chap 20:24), which focuses on water resource management and pollution control. The Environmental Management (Control of Hazardous Substances) General Regulations Statutory Instrument SI No 268 of 2018 further details the control measures for hazardous substances, including pesticides.

The Pesticide Regulations, Statutory Instrument 144 of 2012, are specifically tailored to manage pesticide use in Zimbabwe. This legislation mandates that all pesticides must be approved by the Ministry of Lands, Agriculture, Fisheries, Water and Rural Development before use. The Plant Protection Division of the Department of Research and Specialist Services (DRSS) oversees the registration and assessment of these pesticides to ensure they meet safety and efficacy standards. This rigorous approval process is designed to prevent the distribution and use of harmful or ineffective pesticides, thereby protecting public health and the environment.

The African Development Bank (AfDB) also sets standards for pesticide management through its Operational Safeguards, specifically OS1 and OS4. OS1 requires an Environmental and Social Impact Assessment (ESIA) or Environmental and Social Management Plan (ESMP) for projects involving pesticide use, emphasizing the need for a risk management plan and stakeholder engagement. OS4 focuses on pollution prevention and control, advocating for best practices in handling hazardous materials, including safe pesticide use and disposal. It promotes Integrated Pest Management (IPM) as a preferred approach, recommending non-chemical methods and minimal use of harmful pesticides.

Institutional arrangements

Institutionally, Zimbabwe's pest management efforts are supported by both public and private entities. Government bodies like the Ministry of Finance, Economic Development and Investment Promotion (MoFED) and the Ministry of Lands, Agriculture, Fisheries, Water and Rural Development (MLAFWRD) play central roles in managing and overseeing the project. Within MLAFWRD, departments such as the Department of Veterinary Services (DVS) and the Department of Research and Specialist Services (DRSS) are crucial for technical support and pesticide regulation. Additionally, private sector institutions like the Agricultural Chemical Industry Association (ACIA) regulate the distribution of agrochemicals, ensuring compliance with safety standards. Strengthening these frameworks and improving local capacities are essential for advancing Integrated Pest Management (IPM) practices and promoting sustainable agricultural development in Zimbabwe.

ZAVaCEP Integrated Pest Management Measures (IPMM)

The Zimbabwe Agricultural Value Chain Enhancement Project (ZAVaCEP) emphasizes the importance of integrated pest management (IPM) in ensuring the health and productivity of beef cattle and the quality of leather products. Central to this approach is the management of internal parasites and tick-borne diseases, which significantly impact cattle health in Zimbabwe. Internal parasites, particularly during the rainy season, can cause serious health issues such as diarrhoea and emaciation. Regular deworming with broad-spectrum dewormers at key intervals helps manage these infestations. In contrast, tick-borne diseases like Babesiosis, Anaplasmosis, Heartwater, and Theileriosis pose critical threats, with various chemical control methods, including plunge dipping, spray races, and pour-ons, being used to combat ticks and associated diseases.

Pesticide use in pest management poses several environmental risks, including pollution of water sources, soil degradation, and air contamination. Pesticides can harm non-target species, contribute to bioaccumulation in the food chain, and adversely affect both terrestrial and aquatic ecosystems. To mitigate these effects, the ZAVaCEP PMP advocates for a cautious approach, emphasizing the need for Integrated Pest Management (IPM) practices. IPM offers a holistic strategy that combines biological, chemical, cultural, and mechanical methods to manage pests, with chemical pesticides being used as a last resort. The IPM approach promotes environmental health, reduces pesticide resistance, and relies on a thorough understanding of pest life cycles and interactions with the environment.

Effective IPM in fodder production involves several key activities. Crop rotation and diversification help disrupt pest life cycles, while using pest-resistant fodder varieties reduces reliance on chemical controls. Biological control agents, such as natural predators and entomopathogenic fungi, offer eco-friendly pest management solutions. Additionally, cultural practices like removing crop residues and timely planting can prevent pest outbreaks. These strategies contribute to a more sustainable approach to pest management, ensuring healthier crops and improved yields.

In the context of cattle dipping, IPM strategies include scheduled dipping to manage tick populations and integrating chemical with non-chemical control methods. Biological control, such as using entomopathogenic fungi and natural tick predators, complements these efforts. Proper management of dip effluent, including containment and treatment, is essential to prevent environmental contamination. For hide production, maintaining high sanitation standards, using natural repellents, and controlling environmental conditions in storage areas help prevent pest infestations. Training, capacity building, and regular monitoring and evaluation are crucial for the successful implementation of IPM, ensuring that pest management practices are effective and adaptable to changing conditions.

Table i. Potential Impacts of ZAVaCEP Activities that will Use Chemicals

Project Activity	Pesticide Related Impacts
Subcomponent 1.1: Support Sustainable Livestock Production and Productivity	
Rehabilitate 25 dip tanks and supply chemicals (Implying that aprox 1600-2250 litres of acaricide per year will be used)	• Groundwater pollution from dipping solution flowing out of drip-dry pens at the exit from plunge dip • Groundwater pollution from leakages of dipping solution from base of plunge dip if walls and base are not properly sealed • Leakage of dip concentrate solution if not properly stored. • Risk of surface water pollution from flows of dipping solution from drip dry areas out at the exit of the plunge dip. • Risk of ground and surface water pollution and risk to human health from in appropriate disposal of empty pesticide containers. • Approximately 30000 litres of dip effluent are discharged every year per dip- for 25 dip 750000 litre will be discharged
Carry out appropriate conservation practices around rehabilitated dip tanks	• Positive impact on risk of surface water pollution by dip pesticides from the dip and drip-dry areas at the exit from plunge dip. Conservation works stop flow of dip solution into the local streams or dams.
Procure and distribute 14 small scale feed formulation plants	• Some pesticide and rodenticides may need to be used to protect the stored feed and stored grain from pests and rodents . Soil and groundwater pollution may arise from improper storage and handling of these chemicals. • Risk of human and bird poisoning arising from improper storage and handling of pesticides and rodenticides.
Subcomponent 1.2: Support to Agribusiness and Water Value Chain Enhancement	
Support development of 8 Community Level Feedlots	• No pesticide pollution risk associated with the construction of the feedlots • Risk of soil and groundwater pesticide pollution associated leakage from areas of storage of cattle dosing and dipping/spraying/pour-on chemicals at the feedlot • Risk of soil and groundwater pollution during spraying of cattle in feedlot. • Risk to human health from mishandling of chemicals at the feedlot and in storage areas.
Support 5 existing dairy farmers groups to	• Pesticides will be used in animal health management and sanitizing dairy cattle and milk handling facilities. Risks of pesticide pollution

improve quality of their operations	of soil and ground water and risk to human health relate to handling and storage of the veterinary and cleaning chemicals
Subcomponent 2.1: Capacity Building, Social Inclusion and Smallholder livestock farmers empowerment	
Procure 2 sets of Equipment for Leather Value Addition	• Tanning hides for leather manufacture requires chemicals that will need to be transported, stored and handled during processing. There are risks of soil, surface water and groundwater pollution at each of these stages of leather processing. • Risk of human poisoning from mishandling of chemicals in transit, storage and leather processing.

ZAVaCEP IPMM Approach

The IPMM approach for ZAVaCEP emphasizes a shift from reliance on chemical pesticides toward more sustainable practices, including Biological Control Practices (BCP) and Natural-Based Solutions (NBS). The IPMM aims to reduce environmental and health risks while promoting long-term ecological balance. BCP involves using natural enemies such as predators and pathogens to control pest populations, while NBS leverages plant extracts and cultural practices to manage pests in an environmentally friendly manner. Chemical pesticides are used sparingly and only when absolutely necessary, ensuring that their application is both targeted and responsible. The following additional criteria will apply to the selection and use of such pesticides: (i) they have negligible adverse human health effects; (ii) they are shown to be effective against the target species; and (iii) they have minimal effect on non-target species and the natural environment. The methods, timing, and frequency of pesticide application are aimed to minimize damage to natural enemies.

The IPMM strategy presents significant benefits, including enhanced ecological balance and reduced risk of pest resistance. Sole reliance on BCP and NBS promotes biodiversity and soil health, but these methods may be slower and require more extensive knowledge and training. A balanced approach that integrates BCP and NBS with proportionate chemical use can optimize pest control effectiveness while minimizing negative impacts. However, this combined strategy demands careful management to avoid potential drawbacks such as interaction issues between methods and increased complexity for farmers.

IPM opportunities for ZAVaCEP interventions

Fodder production could benefit from IPMM practices by incorporating biological and natural-based controls to reduce chemical use. Cattle dipping requires Integrated Vector Management (IVM) to control ticks, combining acaricides with biological measures. Hide processing involves managing pests without compromising hide quality or worker safety. Effective implementation of these activities hinges on comprehensive training for farmers, extension workers, and other stakeholders to ensure successful adoption and application of IPMM practices.

Monitoring and evaluation are critical for assessing the success of IPMM in ZAVaCEP. The project will employs various methods, including baseline data collection, regular field inspections, and the use of technology to track pest incidences and control measures. Evaluation involves mid-term and end-term assessments to measure the impact of IPMM on pest populations, crop and livestock health, and environmental outcomes. Reporting through regular progress updates, annual reports, and community meetings ensures transparency and accountability, facilitating continuous improvement and stakeholder engagement.

Institutional roles in the ZAVaCEP IPMM include coordination between government agencies, research institutions, and local actors. The Ministry of Lands, Agriculture, Fisheries, Water, and Rural Development, along with the Project Management Unit (PMU), oversees the implementation of IPMM. The Department of Plant Protection, Zimbabwe Agricultural Research Trust (ZART), and Zimbabwe National Vector Control Programme provide technical support and research. Local agricultural extension officers, dip attendants, and farmer groups play crucial roles in executing and monitoring pest management practices. The integration of these roles, coupled with a robust grievance redress mechanism, ensures that IPMM is effectively managed and responsive to stakeholder concerns.

A budget provision of $120000,00 is proposed with other aspects such as salaries and some training already covered by the Government of Zimbabwe. Stakeholder engagements as ell as Grievance Redress mechanisms are budgeted for in other specific plans for the ESMP.

In conclusion, the Pest Management Plan (PMP) for ZAVaCEP focus on integrating Biological Control Practices (BCP), Natural-Based Solutions (NBS), and, minimizing use of chemical pesticides. PMP aims to protect the environment and human health while enhancing productivity. The plan emphasizes comprehensive training, monitoring, and stakeholder engagement to ensure that pest management practices are both effective and adaptive. Through a structured grievance redress mechanism and robust institutional collaboration, ZAVaCEP is poised to achieve its goal of fostering a resilient and environmentally balanced agricultural system.

Table of Contents

ABBREVIATIONS

ACIA	-Agricultural Chemical Industry Association
AfDB	– African Development Bank
BPC	-Biological Pest Control
BVC	-Biological Vector Control
DRSS	- Department of Research and Specialist Services
DVS	- Department of Veterinary and Technical Services
ZEMA	– Zimbabwe Environmental Management Agency
ESIA	- Environmental and Social Impact Assessment
ESMP	- Environmental and Social Management Plan
FAO	-Food and Agricultural Organization
GDP	– Gross Domestic Product
GIFAP	-Group of National Associations of Agrochemical Manufacturers (GIFAP)
GoZ	– Government of Zimbabwe
MLAFWRD	– Ministry of Lands, Agriculture, Fisheries, Water and Rural Development
MoFED	Ministry of Finance and, Economic Development and Investment Promotion
NBS	-Nature Based Solution
PMP	- Pest Management Plan
PRB	-Pesticide Registration Board
PRCA	-Pesticide Registration and Control Authority
SADC –	- Southern Africa Development Community
SBLVCP	- Support to the Beef and Leather Value Chain Project
SME	– Small to Medium Enterprises
TA	- Technical Assistance
WHO	- World Health Organisation of the United Nations
ZART	-Zimbabwe Agricultural Research Trust
ZAVaCEP	– Zimbabwe Agriculture Value Chain Enhancement Project

1. INTRODUCTION

The Zimbabwean economy has experienced wildly varied economic fortunes over the past quarter century, with GDP growth rates varying widely from year to year. In 1999, the country registered a negative economic growth rate of -0.8%, which dipped to -17% in 2003 before rising to -3.7% in 2007, and falling again to -17.7% in 2008, its lowest in over fifty years. Thereafter it rose to a high positive growth rate of 21.5% in 2010 before falling again to a low of -7.8% in 2020. In the midst of these varying economic fortunes, agriculture remains a critical sector of the economy, contributing between 12 and 16% of the GDP, and providing about 60% of the raw materials for the manufacturing sector. Agriculture contributes about 40% of the export earnings of Zimbabwe. Above all, agriculture provides employment and livelihoods to 60-70% of the total population, most of them being rural residents practicing smallholder mixed farming. In rural areas the proportion of the population engaged in agriculture exceeds 85%.

Within the Zimbabwe Agricultural sector, livestock production is an important and integral part with livestock products contributing about 30% of the agricultural Gross Domestic Product (GDP), whose cash flow mainly comes from small-scale communal farmers. The livestock sub-sector is an important source of livelihoods and contributes significantly to inclusive growth of the agriculture sector and the economy. According to the Zimbabwe Livestock Growth Plan (2021-2025), the livestock sub-sector contributes significantly to household and national food and nutrition security, foreign currency earnings, and is a source of livelihood for about 67% of rural households. Thus, the government of Zimbabwe continuously invests in this sector to ensure its growth and as a way of propping other sectors of the economy that depend on it. The main challenges facing livestock sub-sector are:

- low productivity;
- poor animal genetics;
- limited supply of water for existing dip tanks; and
- climate change which has brought about an increase in animal disease outbreaks, poverty deaths, frequent droughts, and floods.

Addressing the animal health situation is a prerequisite for increased livestock productivity and safe trade in animals and animal products. Leather is one of the main products of the livestock sector and it feeds into an important industrial subsector of leather tanning as well as the manufacture of footwear and leather goods manufacturing. In its efforts to revive the leather sub-sector, the Government prepared the Zimbabwe Leather Sector Strategy (2021-2030) with the aim of increasing the competitiveness of the leather value chain. However, since a significant proportion of the cattle production is by small scale farmers, it followed that, to boost production in the livestock sub-sector will require substantive investments to support small scale farmers.

1.2 Project Background

Within the livestock sub-sector, the Government of Zimbabwe has implemented a number of programs to increase production and efficiency. In one of these efforts, the GoZ implemented a 3-year African Development Bank (AfDB/Bank) funded Support to the Beef and Leather Value Chain Technical Assistance (TA) Pilot Project (SBLVCP) in Matabeleland North Province (MNP) and Bulawayo Province with the ultimate aim of replicating successful elements of this project to all the other 8 provinces of Zimbabwe. The Project was financed through Bank's Fund for African Private Sector Assistance (FAPA) to the value of USD 1 million and a Transition Support Facility Pillar III (TSF) to the value of US$ 719,165.76. The project was also in sync with approved national and local development plans. The Project aimed to catalyse economic growth with emphasis on value addition as a driver of employment creation, income growth, poverty reduction and achieving inclusive growth. This Project was designed to resolve some of the constraints/bottlenecks in the beef and leather value chain using a more holistic approach by involving all the stakeholders as opposed to stand alone interventions at various levels of the value chain. This was prescribed to be the foundation for the eventual development of the value chains, with multiplier effect and specifically in the growth and advancement of the beef and leather sub-sectors.

Overall, the SBLVCP achieved its short and mid-term objectives via a robust implementation strategy and stable supportive social-cultural operating environment strengthened by technical backstopping from the Government Ministries. In addition, the project Evaluation report highlighted that the design of the project, with a special focus on key components that are critical for the viability and competitiveness of the beef and leather sectors, enhances replicability and scalability of the project to other regions of Zimbabwe such as Matabeleland South, Masvingo and Bulawayo Provinces since they are adjacent to each other and have a significant stock of cattle. It should also be noted that some of the project components took a national approach hence making it easier and faster to achieve results in other provinces. In February 2022, as a direct outcome of the success of the pilot SBLVCP, the Government of Zimbabwe (GoZ) approached the African Development Bank for financing of a similar successor project. A field mission was sent by the Bank in June 2023 which resulted in the preparation of the Zimbabwe Agricultural Value Chain Enhancement Project (ZAVaCEP).

The ZAVaCEP has been designed to operate through some well-coordinated and basic critical interventions which include:

- capacity building,
- provision of potable water,
- enhancing livestock productivity,
- value addition, and
- promoting private sector development hence contributing to macroeconomic stability,
- job creation, and poverty reduction.

The districts of Insiza and Beitbridge in Matebeleland South province and Chivi and Chiredzi in Masvingo province and Bulawayo Metropolitan Province were selected for the project mainly because they are major producers of cattle in semi-arid ecological zones where they face many production challenges. Bulawayo Metropolitan Province was included not because of any primary cattle production but because it has a significant number of leather and beef processing facilities. Some of the activities to be considered under the proposed Project will cover capacity building of leather product manufacturers including procurement of start-up tools for making leather products, disease control, exhibition of products at trade fairs, training of farmers in animal husbandry to produce good hides and skins, training of hides collectors and tanners, and logistical support of coordinating stakeholders in the platform.

The ZAVaCEP is aligned to the Zimbabwe National Development Strategy 1 (NDS1: 2021-2025), Zimbabwe Vision 2030, and Zimbabwe Leather Sector Strategy (2021-2030).

1.3 Environmental Management Plan and Pest Management Plan for ZAVaCEP

The implementation of any development project in Zimbabwe is supposed to be accompanied by the conduction of an environmental and social impact assessment or in this case an environmental and social management plan (ESMP) to ensure that all potential biophysical and social impacts of the project are identified and that measures are incorporated into the project design and implementation protocols to eliminate or mitigate the impacts of these identified impacts. The Environmental Management Act (Chap 20:27) of 2002 prescribes that any project of significant size that is carried out in Zimbabwe must be subjected to an environmental impact assessment (EIA) to identify all the potential positive and negative environmental impacts associated with it and to devise design features and management protocols for enhancing all positive impacts as well as to minimize, eliminate or mitigate any potential negative impacts. A detailed Environmental Management Plan (ESMP) must be produced out of the EIA report to guide the project implementor in their environmental management. The ESMP will be submitted to the Zimbabwe Environmental Management Authority (EMA) for their assessment after it is approved by the AfDB. An environmental management certificate or letter of approval will be issued by EMA on approval of the ESMP, where, by law, project implementation cannot start before EMA's approval.

An environmental and social impact assessment for the ZAVaCEP is in process. However, one of the key elements of the ZAVaCEP is with respect to pest control for the livestock and in all areas of tanning and leather processing. The development of a Pest Management Plan (PMP) for the ZAVaCEP project is justified under OS4 guidelines, which mandate that projects involving pesticide use must include an assessment of the need for, and if necessary, the planning and implementation of an Integrated Pest Management (IPM) and/or Integrated Vector Management (IVM) program. This approach ensures that pest management activities are effectively managed throughout the entire lifecycle of the project, addressing potential risks and promoting sustainable practices. The overall objective of the PMP for the ZAVaCEP is to develop a pest management plan to prevent or mitigate the negative impacts of pesticide use on the natural and human environment; and to promote the use of Integrated Pest Management methods and approaches under the program. Specifically, the overall objective can be subdivided into the following:

- to identify potential risks of fodder crops pests, beef cattle pests and disease control products on the human and natural resources in relation to the interventions envisaged under the project;
- to propose an action plan for Integrated Pest Management, where appropriate, in order to minimize the use of synthetic chemicals; and
- to define institutional arrangements for the implementation and monitoring of the pest management plan before, during and after the implementation of the project and the implementation of activities to eliminate, or mitigate the negative environmental and social impacts.

The information for this PMP was collected through discussions with dip attendants in Insiza, key interviews with personnel from the Department of Veterinary Services and a review of literature, including reports and publications on pesticide use and management in Zimbabwe.

1.4 Environmental and Social Consequences of Pest Management Practices

Pest management practices in rural communities can have significant environmental and social consequences, both positive and negative. Environmentally, the use of chemical pesticides can lead to contamination of soil and water resources. Pesticides can leach into groundwater or run off into nearby streams and rivers, affecting aquatic ecosystems and potentially entering the food chain. Non-target species, including beneficial insects, birds, and other wildlife, may also be adversely affected by pesticide exposure, leading to a loss of biodiversity and disruption of local ecosystems. Over-reliance on chemical control can result in pest resistance, requiring even higher doses or more toxic chemicals to achieve the same level of control, further exacerbating environmental impacts.

On the social front, pest management practices can influence the health and well-being of rural communities. Pesticide exposure poses significant health risks to farmers and their families, particularly when safety measures and protective equipment are not adequately used. Acute exposure can lead to poisoning, while long-term exposure may result in chronic illnesses, including respiratory issues, cancers, and neurological disorders. The costs associated with medical treatments and loss of productivity can place a considerable financial burden on affected households, exacerbating poverty and reducing overall community well-being.

Moreover, pest management practices can impact agricultural productivity and food security in rural communities. Effective pest control is essential for protecting crops from damage and ensuring good yields. However, improper use of pesticides can damage crops, reduce soil fertility, and lead to pest outbreaks due to the elimination of natural predators. This can result in reduced harvests and food shortages, which in turn affect the nutritional status and economic stability of rural populations. Balancing pest control with sustainable agricultural practices is crucial for maintaining food security and supporting the livelihoods of rural farmers.

Community dynamics and social structures may also be influenced by pest management practices. The introduction of integrated pest management (IPM) techniques, which combine biological, cultural, and mechanical control methods with minimal chemical use, can foster community cooperation and knowledge sharing. IPM can empower farmers by building their capacity to manage pests sustainably, leading to greater resilience against pest outbreaks and climate variability. However, the success of such initiatives often depends on access to resources, education, and extension services, which may be limited in some rural areas. Collaborative efforts between government agencies, NGOs, and local communities are essential to overcome these challenges and promote environmentally and socially sustainable pest management practices.

1.5 Potential Impacts of Pest and Pesticide Management on Project Activities.

The Zimbabwe Agricultural Value Chain Enhancement Project (ZAVaCEP) aims to enhance beef agricultural productivity and profitability in Zimbabwe by focusing on key value chains, including beef and leather. Pest and pesticide management within this project can have several potential impacts on its activities. Effective pest control is essential to protect fodder crops and cattle from damage, ensuring healthy growth and maximizing yields. However, improper management of pests and pesticides (Including acaricides) can lead to adverse effects that may compromise the project's goals and sustainability.

One of the primary concerns with pest and pesticide management in ZAVaCEP is the potential for environmental degradation. The use of chemical pesticides, if not carefully managed, can contaminate soil and water resources, affecting not only the immediate project areas but also downstream ecosystems. This contamination can reduce soil fertility, harm non-target species, and disrupt local biodiversity. Such environmental impacts can hinder the long-term viability of agricultural activities promote in the area, as soil health and ecosystem services are critical for sustainable farming practices.

Additionally, the health and safety of farmers and workers involved in ZAVaCEP are at risk due to pesticide exposure. Without proper training and protective measures, individuals handling pesticides may suffer from acute or chronic health issues, ranging from skin irritations to severe respiratory problems and even cancer. Acaricides can be fatal if accidentally ingested. These health risks can lead to decreased productivity, increased medical costs, and fatalities with potential suffering. Ensuring that farmers and workers are educated on safe pesticide use and provided with necessary protective equipment is crucial to mitigating these risks.

Moreover, pest resistance can develop if chemical pesticides are overused or misused, leading to more persistent and harder-to-control pest populations. This can result in increased costs and labour for farmers as they try to manage resistant pests, potentially reducing the profitability of agricultural activities supported by ZAVaCEP. To address this, the project should promote integrated pest management (IPM) practices, which combine biological, cultural, and mechanical control methods with judicious use of chemicals.

1.5 Structure of the Report

a. This report is structured as follows:
b. Introduction
c. Description of the Project
d. Legislative and Regulatory Framework
e. Current approaches to pest management in the project sector
f. Current issues in the use and management of synthetic chemical pesticides in the Zimbabwe and the beef and leather
g. Policy, Legal and Institutional Framework for Integrated Pest Management (IPM)
h. ZAVaCEP Integrated Pest Management Measures (IPMM)
i. Project Integrated Pest Management Measures (IPMM)
a. Conclusion and Budget for the PMP

2. DESCRIPTION OF THE ZAVACEP- COMPONENTS AND ASSOCIATED ACTIVITIES

2.1 ZAVaCEP Objectives, Components, Activities and Expected Results.

The overall objective of the ZAVaCEP is to improve cattle and leather value chain for the benefit of farmers and the national economy in a sustainable manner where the negative impacts on the biophysical, human and social environment are minimized, mitigated or eliminated. The accent lies with the pursuit of sustainable development.

ZAVaCEP has been designed as a four-year project consisting of four components as:

Component 1: - Climate Smart Agricultural Productivity and Value Chain Enhancement
Component 2: - Building Rural Communities" Climate Resilience to Climate Change
Component 3: - Knowledge Management, Policy Development, Monitoring, Evaluation and Project Management
Component 4: Project Management

The specific activities that will be conducted under ZAVaCEP are itemized in the Table 3 below.

Table 2. ZAVaCEP project components, Activities and Results

Component Name	Sub-Component and Associated Activities	Expected results
Component 1: Climate Smart Agricultural Productivity and Value Chain Enhancement Objective Improved climate-smart agricultural productivity and value chain enhancement so as to increase subsistence farmers' incomes and build resilience	**Sub-component 1.1: Support to Sustainable Livestock Production and Productivity** • Rehabilitate 16 existing seasonal dip tanks/to make them fully functional (including start-up package **acaricides**, initial stock of **medication and supplies**, etc) and drilling of multipurpose solar-powered boreholes (with overhead tanks & reticulation system including water troughs etc). • Facilitate drilling of 17 solar-powered boreholes for supply of water to dip tanks and 4 multi-purpose boreholes (with overhead tanks & reticulation system including water troughs etc). • Facilitate construction of 14 water troughs (livestock-watering points) near existing boreholes. • Facilitate climate smart rangeland management, total 200ha (construction of water and soil conservation works, integrated catchment management, etc). • Carry out appropriate conservation practices around dip tanks and multi-purpose boreholes areas (total 85 ha), to be emphasised during community/beneficiaries training *(community in-kind contribution - labour, locally available materials)*. • Support pasture development and fodder conservation, total 600ha (legumes & grass pastures). • Procure and distribute 16 bulls of superior genetics (managed by traditional leader). • Procure and distribute 14 feed formulation equipment. **Sub-component 1.2: Support to Agri-Business and Value Chain Enhancement**	Enhanced livestock production Improved infrastructure Superior cattle breed Nutritious Feed quality Availability of water for dipping through all seasons

Component Name	Sub-Component and Associated Activities	Expected results
	• Conduct 6 training courses on quality standards and market linkage in the Leather Value Chain (SMEs and Clusters) – MIC • Facilitate 6 product development and design courses/sessions to enhance both quality and competitiveness utilizing both physical and virtual design studios for ToT designers and product developers including follow up mentorship sessions – MIC • GOVT - Establish the value of the fifth quarter for cattle (6 sessions*) (Government in-kind contribution - Stakeholders consultations)* – Agric • Support to 3 local exhibitions (SMEs/clusters) – MIC • Support 5 Regional exhibitions (2 Zambia, 2 South Africa and 1 Tanzania)- MIC • Support total of 2 leather value chain development knowledge-exchange visits (to Ethiopia or Tunisia), participants 4 Govt/MIC and Agric4, 4 clusters & 2 SMEs. • Support development of 8 community-level demand-driven feedlots (including minor construction/ maintenance, training-market linkages & start-up inputs) – Agric • Support to 8 community-level demand-driven feedlots (including minor construction/maintenance labour and locally available materials) - *Beneficiaries/Community in-kind contribution.* • Establish 4 community-managed demand-driven aggregation centres (community centre of excellence, holding pens, water trough, training), close to selected feedlots – Agric. • Establish 1 online market platform for leather finished products (National and International Markets) – MIC. • Support 5 **existing** dairy farmers groups (including women and youth) to sustainably improve quality of associated products.	Strengthened agri-business and value chains Increased market access and competitiveness Improved feedlot infrastructure Employment and income from stock feeds Improved dairy products.
The objective is to build capacity and promote gender and social inclusion in order to reduce gender gaps and ensure women, youth and the disadvantaged also benefit from the project.	**Sub-component 1.3: Support to Women and Youth MSME in Agro – Processing and Market Access (Masvingo District only)** ***(To be managed by the Ministry of Women Affairs, Community, Small and Medium Enterprises Development)*** *Sensitization and Awareness* • Launch of the Project in each of the districts. *Capacity Building of MSMEs in Agro-processing* • Identification of 12 MSME: clusters (beekeeping, peanut butter processing, small grains processing, poultry, horticulture, fish farming etc.), private companies, groups, cooperatives, associations,	Empowered women and youth through targeted training and resource provision, fostering inclusive economic growth. Cluster mapping/private sector, associations mapping

Component Name	Sub-Component and Associated Activities	Expected results
	individuals. (clusters, private companies, groups, cooperatives, associations, individuals). • Engage partners and consultants to capacitate MSMEs with technical skills in production, processing, harvesting, packaging, standardisation and quality assurance. At least 20 training workshops will be conducted for 2000 beneficiaries. • Conduct 16 periodic visits to MSMEs to provide onsite training. *Strengthening of the MSME Agro–processing Value Chain* • Acquisition of at least 40 agro – processing machinery such as stock feed processing plant, peanut butter processing plant, tomato puree, honey processing plant and packaging machinery for each district. • Establish 14 fish farming projects for 100 beneficiaries • Support 20 horticulture projects for 300 beneficiaries • Establish 20 poultry projects for 100 beneficiaries *Market Access* • Certification of 10 MSME products to access local, regional and international markets. • Facilitate participation of 50 MSMEs with quality products at local, regional and international market platforms. • Provision of capacity building to 50 MSMEs to produce products ready to be absorbed by the international market. *Support to the Ministry*. • Procurement of a project vehicle, 2 laptops.	Strengthened SMMEs with most owned by women and Youth Improved skills and knowledge in agro-processing Agro-processing -facilities infrastructure Income from sale of agro-products Availability of High quality agro-products and market demand
Component 2: Building Rural Communities" Resilience to Climate Change	**Sub-component 2.1: Supporting Climate Resilient and Community level-driven Infrastructure Development** • Conduct farmer training (practical/hands-on) on livestock identification and traceability – Agric. • Conduct product development and value addition training (combined), for clusters (beef, horns, hides, skins, footwear, leather crafts, etc), including quality standards and leather designs though leather studios to enhance competitiveness – MIC. • Procure equipment for leather-value addition (clusters/ 2 sets of equipment/tools per cluster), to support the value addition training. – MIC. • Support pass-on scheme for small stock (goats - total 1400 does/female + 70 bucks/male), for women and youth groups -Agric. • Conduct staff training (Training of Trainers/ToT) on low carbon livestock production (husbandry, inputs management for resilience and methane reduction, health management and animal welfare) – Agric.	Knowledge and skills on value chain processes Increase in high quality leather products and earnings from sales of the products. Increase in number of women and youths rearing small livestock

Component Name	Sub-Component and Associated Activities	Expected results
	• Conduct training in eco-friendly sustainable leather tanning especially of goat and sheep skins targeting mainly rural livestock farmers including women and youth – Agric. • Conduct farmer training on low carbon livestock production (husbandry, inputs management for resilience and methane mitigation; health management and animal welfare, feed formulation etc) (4 sessions/year)- Agric. • GOVT - Provide Office Space, including utilities, for PMU & PCU Staff - *Government in-kind contribution.* • GOVT - Provide funds/counterpart contribution for various annual taxes/or waiver value - *Government in-kind contribution.* • GOVT - Provide PMU & PCU Office Furniture Sets - *Government in-kind contribution.* • GOVT - Provide PMU & PCU Office & ICT Equipment Sets (including desktops, laptops, printers) - *Government in-kind contribution.* ***Sub-component 2.2 Reinforcing inclusive and diversified climate resilient livelihoods support***	
	Sub-component 3: Knowledge Management, Policy Development, Monitoring and Evaluation • Facilitate review of legislations/SI/Act (Animal Health Act, SI 182 Live Carcass Classification and Grading, SI 240 of 2001 Pigs) - Agric. • Facilitate review of policies, plans and strategies (Livestock Growth and Recovery Plan, and Gender Strategy in Agriculture) – Agric. • Support production of Policy Briefs on (i) Leather Value Chain, and (ii) Low carbon Beef Value Chain – Agric. • Support or build awareness of the Zimbabwe national standard body/Standard Association of Zimbabwe on best practices of standardization and guideline for climate actions in beef and leather value chain development and access to international markets. • Produce 3 Annual Work Plans and Budgets, and Procurement Plans (Set). • Support the Stakeholders' Platform (lumpsum, 1 per year) to enhance sustained facilitated dialogue at national level of all stakeholders (public and private) along the beef and leather value chain, and to improve the effectiveness of the value chain. • Facilitate 1 Project Technical Launch (PY1). • Facilitate Production of 1 Project Implementation Manual (PIM) - Consultancy (PY1). • Support Tender Advertising and Evaluation (Procurement) Activities (PY1 & PY2). • Support Information Education and Communication (IEC & Visibility) Activities (including promotional wear, airtime, data bundles, billboards, pamphlets etc).	Improved policy and regulatory frameworks supporting the beef and leather value chains.

Component Name	Sub-Component and Associated Activities	Expected results
	• Support 12 monitoring/supervisory field visits (quarterly)/HQ (max 5 people, 5 days/trip). • Support 36 monitoring/supervisory field visits (Provincial/District - monthly). • Conduct 3 quarterly and 3 annual review meetings (& produce Quarterly/Annual Progress Reports). • Facilitate 3 Annual Project Steering Committee (PSC) Meetings. • Facilitate 3 Annual Project Management Committee Meetings. • Procure 2 Sector-MIC and Agric-Livestock PCU Vehicles (twin/double cabs 4x4). • Conduct 1 Mid Term Review (MTR) - recruit consultant (fees & field trip DSA). • Conduct 1 Beneficiary Impact Assessment (BIA) - recruit consultant (fees & field trip DSA). • Conduct End of Project Implementation Report (PCR) - recruit consultant (fees & field trip DSA). • Facilitate E&S Audits, Environmental and Social Safe-guards compliance and Grievance Redress Mechanism (GRM) activities.	
Component 3: Project Management Th primary objective is to ensure effective project management and sustainable implementation	• **Sub-component 4: Project Management** • Contribute to annual MoFED Project Management Unit and Sector Project Coordination Units Operational Costs (Office supplies/consumables/stationery, cartridges, courier services etc). • Support Third Party (AU-African Capacity Building Foundation/ACBF) to manage Project Special Account. • MoFED PMU Annual Staff Costs – Project Officer (1). • Conduct Annual Financial and Procurement Audits (3, combined). • Support Pastel Accounting Software license (2, PY1 and PY3). • Support various Bank Missions, Procurement and Financial Management functions, including fiduciary clinics. • Support 1 PMU-MoFED Vehicle Operation (Fuel) and Maintenance (servicing/repairs).	Sustainable livelihoods and enhanced income generation for smallholder farmers, contributing to overall community resilience and economic stability

2.2 ZAVaCEP Activities Subject to Pest and Vector Control

The ZAVaCEP (Zimbabwe Agricultural Value Chain Enhancement Project) includes several activities that require diligent pest and vector control measures to ensure the project's success and sustainability. These activities are critical in enhancing agricultural productivity and the implementation of Integrated Pest Management (IPM) practices within these activities not only protects crops and livestock from pests and diseases but also promotes environmental sustainability and public health.

i). Cattle Dipping

One of the primary activities in the ZAVaCEP project involves the rehabilitation of 25 plunge pool dip tanks and the installation of 9 solar-powered boreholes with overhead tanks and reticulation systems. Cattle dipping is essential for controlling ectoparasites such as ticks, which are vectors for various bovine diseases, including East Coast fever, caused by the tick parasite *Theileria parva* and anaplasmosis, caused by the tick bacterium *Anaplasma marginale*. Effective pest control in these dipping facilities ensures healthier livestock and reduces the economic burden of pest-related diseases on farmers. According to the Department of Veterinary Services, regular and effective dipping can significantly lower tick infestations and associated disease outbreaks (Department of Veterinary Services, 2023).

ii) Fodder Production Farming of Legumes and Fodder Grasses

The project promotes the development of pasture across 600 hectares through the cultivation of legumes and grasses. The cultivation of legumes and fodder grasses not only supports livestock nutrition but also plays a role in soil fertility and erosion control. However, farming of the grasses and legumes for fodder also poses challenges related to pest management. Insects such as locusts and armyworms, including aphids, beetles, and fungal pathogens can devastate fodder crops, reducing the quality and availability of feed for livestock.

iii) Stock Feed Processing

Stock feed processing hubs are established to enhance feed quality and availability for livestock. However, these facilities can attract pests such as rodents and insects, which can contaminate feed and spread diseases.

v). Introduction of Genetic Breeds

The project supports the distribution of bulls with superior genetics to enhance livestock productivity. While improved breeds can be more resistant to certain diseases, they still require protection from vectors such as ticks and flies.

vii) Hides Processing

The leather value chain includes the processing of hides, which can be adversely affected by pests such as beetles and fungi.

Viii) Agro-Processing and Goat Pass-On Schemes

Agro-processing activities, require pest control measures to prevent infestations and maintain product quality.

3. CURRENT APPROACHES TO PEST MANAGEMENT IN ZIMBABWE AGRICULTURAL SECTOR.

Current approaches to pest management focus on both chemical and non-chemical methods, addressing various pest issues affecting fodder crops and livestock. The Zimbabwe Agricultural Value Chain Enhancement Project (ZAVaCEP) aims to bolster the country's beef and leather industries by implementing a comprehensive Pest Management Plan (PMP). This initiative addresses critical challenges such as pest control in fodder production, cattle dipping to manage tick-borne diseases like East Coast fever and anaplasmosis, and hide processing to improve leather quality. This section describes the approaches used in the country to enhance livestock health, boost productivity, and ensure the economic viability of the beef and leather sectors.

3.1 Overview of Targeted Fodder Crops, and Breeding Bulls and Associated Pest Problems.

For fodder production, ZAVaCEP is targeting the use of legumes, specifically velvet bean and lucerne, as well as grasses like Katambora and star grass. These fodder crops have been selected for their beneficial characteristics, such as high nutritional content, ability to improve soil fertility, and resilience to various environmental conditions.

Legumes play a crucial role in improving soil fertility and providing high-nutrient fodder for livestock within the ZAVaCEP framework. Velvet bean (*Mucuna pruriens*) is particularly valued for its high nutritional content and its ability to fix nitrogen in the soil, enhancing fertility. However, it faces threats from pests such as the velvet bean caterpillar (*Anticarsia gemmatalis*) and various aphid species, which can damage the plants and reduce their effectiveness as fodder. Similarly, lucerne (*Medicago sativa*), a high-protein legume that supports livestock productivity, is commonly affected by the lucerne flea (*Sminthurus viridis*) and various leafhoppers. Managing these pests involves using insecticides and promoting natural predators to maintain pest populations at bay.

In the category of grasses, Katambora grass (*Cynodon dactylon*) is a widely used pasture grass but is susceptible to pests like the armyworm (Spodoptera species) and the stem borer (*Busseola fusca*), which can significantly damage grass stands. Star grass (*Cynodon nlemfuensis),* known for its high drought tolerance and quality forage, faces challenges from grasshoppers (*Caelifera species*) and various beetles that can reduce its forage quality and yield. Effective pest management strategies are essential to preserve the productivity and sustainability of these vital fodder crops.

For distribution of breeding bulls, ZAVaCEP is targeting use of the Tuli and Nkuni breeds. These are Zimbabwe's indigenous cattle breeds, that stand out for their adaptability to local conditions and their significant contributions to the agricultural economy. These breeds, valued for their unique traits, face specific pest-related challenges that affect their health and productivity.

The **Tuli Cattle** originate from the Tuli River area, in Matabeleland, and are renowned for their resilience in harsh environments. Medium-sized with a smooth coat ranging from yellowish to reddish-brown, they are known for high fertility, good mothering abilities, and adaptability to local climates. Tuli cattle produce tender and flavourful meat, making them highly prized for beef quality. However, they are susceptible to pests such as ticks, flies, and internal parasites. Ticks are particularly problematic as they transmit diseases like East Coast fever, anaplasmosis, and babesiosis. Internal parasites like gastrointestinal worms can lead to weight loss, anaemia, and reduced productivity.

Nkuni cattle, also referred to as Nkone or Nguni, are smaller than Tuli cattle and exhibit a variety of coat colours and patterns. They are hardy, adaptable, and resistant to harsh climatic conditions, known for their excellent meat quality and reproductive performance. Despite these strengths, Nkuni cattle face challenges from ticks, flies, and internal parasites. Tick infestations can lead to diseases such as heartwater, anaplasmosis, and babesiosis. Internal parasites, including liver flukes and gastrointestinal worms, pose significant health risks, affecting the overall well-being and productivity of Nkuni cattle.

3.2 Current Approaches to Pest Management in Beef and Leather Sector in Zimbabwe.

In Zimbabwe, the pest management approaches in the beef and leather sector have evolved to address the challenges of pest infestations while promoting sustainability. These approaches encompass various strategies, focusing on reducing the impact of pests on fodder, livestock and hides, improving overall productivity, and ensuring environmental safety.

3.3 Current Approaches to Pest Management

In Zimbabwe's beef value chain sector, pesticide management encompasses several current and commonly employed approaches, each with its unique benefits and challenges.

Chemical Pest Control
The use of chemical pesticides and acaricides remains prevalent, especially for managing ticks that transmit serious diseases like tick-borne fever. These chemical methods, including dipping tanks, pour-on formulations, and sprays, are effective in controlling tick populations. Additionally, synthetic pesticides are often applied to fodder and pasture crops to maintain feed quality.

Cattle Dipping
Regular cattle dipping using plunge pool dip tanks is a widespread practice to manage tick populations and reduce tick-borne disease incidence and has been practiced for a long time in the country. A detailed dipping practice is provided in Annex 3. This method requires diligent maintenance of the dip tanks to prevent environmental contamination from pesticide seepage and runoff. It requires sufficient dip chemicals as well as water.

Integrated Pest Management (IPM)
IPM strategies offer a more sustainable approach by incorporating biological, cultural, and mechanical control methods. Biological control involves using natural predators or parasites to manage pest populations, reducing reliance on chemicals. Cultural practices such as crop rotation, planting resistant varieties, and maintaining proper sanitation help disrupt pest life cycles are being promoted in isolated parts of the country. Cattle road grid barrier have been used to manage pests affecting livestock. Their effectiveness has been severely reduced as a result of poor fence maintenance and fence thefts.

Rangeland Management
Climate-smart rangeland management practices focus on enhancing the health of grazing lands through water and soil conservation techniques. These practices promote healthier ecosystems capable of naturally controlling pest populations, thereby reducing pest prevalence. They are also being practised but on a smaller scale.

Training and Capacity Building
Training programs and extension services are widespread and employed nationwide through deployment of veterinary technicians and Agritex extension officers. These initiatives focus on the safe

use of chemicals, including storage and disposal methods. They provide ongoing support and advice, ensuring that stakeholders are well-informed and capable of implementing best practices.

Disease Surveillance and Monitoring
Regular monitoring and surveillance of livestock for pest-related diseases are done by the Department of Veterinary services and are crucial for early detection and management. This involves field inspections, diagnostic testing, and the use of technology, such as mobile apps, for reporting and tracking pest and disease outbreaks. Their effectiveness in the rural communities is limited by a lack of sense of urgency and limited knowledge.

Regulation and Policy
Government policies and regulations guide the use of pesticides and pest management practices to ensure compliance with environmental and health standards. These regulatory frameworks are essential for promoting sustainable pest management and protecting public and animal health.

3.4 Practical Experience In Integrated Pest Management In Beef And Leather Value Chain in Zimbabwe.

Practical experience with integrated pest management (IPM) in the beef and leather sector is increasingly being incorporated to address the limitations of traditional pest control methods and it includes the following:

i. Pilot Projects and Demonstrations: Several pilot projects have demonstrated the effectiveness of IPM in managing pests in livestock and pasture systems. For example, projects that integrate biological control methods with traditional pest management practices have shown promising results in reducing tick populations and improving livestock health.

ii. **Partnerships and Collaborations:** Collaborative efforts between government agencies, NGOs, and research institutions have facilitated the development and implementation of IPM strategies. These partnerships often involve sharing knowledge, resources, and best practices for managing pests in the beef and leather sector.

iii. **Research and Innovation:** Ongoing research in Zimbabwe focuses on developing and refining IPM techniques tailored to local conditions. Innovations such as the use of resistant livestock breeds, advanced pest monitoring tools, and environmentally friendly pest control methods are being explored and tested.

iv **Farmer-Led Initiatives:** Farmers and local communities are increasingly adopting IPM practices through farmer-led initiatives and community-based programs. These initiatives often involve training and support from extension services, helping farmers implement IPM strategies effectively and sustainably.

v. **Integration with Broader Agricultural Practices:** IPM is being integrated into broader agricultural practices, including climate-smart agriculture and sustainable land management. This holistic approach helps in managing pests while addressing other challenges such as soil health and water conservation.

Overall, while traditional pest management approaches remain prevalent, there is a growing shift towards integrated pest management practices in Zimbabwe's beef and leather sector. These practices aim to provide more sustainable and effective solutions to pest-related challenges, ultimately enhancing productivity and environmental sustainability in the sector.

4. Current Issues in the Use and Management of Synthetic Chemical Pesticides in Zimbabwe and the Beef Value Chain.

4.1 Use of Pesticides in the Country

In Zimbabwe, the agricultural sector relies heavily on synthetic chemical pesticides to manage pests in crops and livestock. The exact volumes of these pesticides can vary annually due to reporting inconsistencies and changing agricultural practices. However, it is known that broad-spectrum insecticides, herbicides, and fungicides are commonly used. For livestock, acaricides are essential in controlling ticks and other parasites. The volumes of dip acaricides and quantities of pesticides used in Zimbabwe can vary annually, but I can provide some general figures based on recent data.

4.1.1. Volumes and Types of Pesticides Used in Zimbabwe:

The use of synthetic chemical pesticides in Zimbabwe has been significant, particularly in agriculture where they are employed to manage pests in crops and livestock. However, precise data on the volumes used can be challenging to obtain due to variations in reporting and recording practices. In Zimbabwe, dip acaricides are commonly used for controlling tick infestations in cattle. The estimated annual usage of dip acaricides is approximately 1,200,000 litres. This figure represents the combined total of different types of dip solutions used across the country. Organization (FAO), about 10 million litres of dip acaricides are used annually in Zimbabwe. Additionally, the Pesticide Action Network (PAN) reports that around 5,000 to 6,000 tons of various pesticides are used annually for agriculture in the country. For broader pesticide usage, which includes various types of chemicals for agriculture, the annual quantities can be around 4,000 to 6,000 metric tons. This range encompasses herbicides, insecticides, fungicides, and other types of pesticides.

For livestock, acaricides are prevalent to control ticks and other parasites. The types of pesticides used vary based on the targeted pests and the crop or livestock involved.

In Zimbabwe, the agricultural sector heavily relies on a range of synthetic pesticides to manage pests in both crops and livestock. For crops, broad-spectrum insecticides, herbicides, and fungicides are commonly used to protect against a variety of pests and diseases that threaten productivity. **Cypermethrin** and **deltamethrin** are widely employed insecticides, effective against chewing insects such as leafhoppers, armyworms, and caterpillars. These insecticides help maintain the health and yield of crucial fodder crops like **star grass and lucerne**. Herbicides like **glyphosate and atrazine** are essential in controlling broadleaf and grassy weeds, ensuring that crops such as **star grass** can thrive without competition. Fungicides like **mancozeb and propiconazole** are used to combat fungal diseases in crops like **lucerne**, preventing issues like downy mildew and rust, which can severely impact forage quality and crop yields.

For livestock, acaricides are a critical component of pest management, particularly for controlling tick infestations in cattle. **Deltamethrin and amitraz** are two commonly used acaricides in Zimbabwe. Deltamethrin, a synthetic pyrethroid, provides effective control against a wide range of ectoparasites, including ticks and lice, and has a residual effect that reduces the need for frequent treatments. Amitraz, on the other hand, disrupts the nervous system of ticks, leading to their death and is effective against various tick species. However, the repeated use of these chemicals can lead to resistance in tick populations, posing challenges for long-term pest management. **Amitick,** a formulation containing amitraz, is specifically designed for tick control and is used in dip tanks and as a pour-on treatment, providing effective control when applied correctly. These pesticides and acaricides are vital for maintaining the health and productivity of Zimbabwe's agricultural and livestock sectors.

The volumes of dip acaricides and quantities of pesticides used in Zimbabwe can vary annually, but I can provide some general figures based on recent data.

4.1.2. Approval and Regulation

The approval of pesticides used in Zimbabwe is given by the Pesticide Control Authority (PCA), which regulates and ensures that products meet safety and efficacy standards. The approval process involves evaluating the safety, efficacy, and environmental impact of the pesticides before they are permitted for use.

Supervision of pesticide use is managed by the PCA, which oversees compliance with regulations and guidelines. Additionally, the PCA oversees the distribution and application of these pesticides, working in collaboration with agricultural extension services to provide farmers with guidance on proper usage, application methods, and safety precautions. However, there can be challenges related to enforcement and monitoring, leading to occasional misuse or illegal use of unregistered products.

4.1.3. Phytopharmaceutical and Agricultural Extension Services Capacity

Zimbabwe's phytopharmaceutical and agricultural extension services play a crucial role in managing pesticide use across the country. The Pesticide Control Authority (PCA) is the primary regulatory body responsible for approving and supervising pesticide products. The PCA ensures that all pesticides meet stringent safety and efficacy standards before they can be used. This approval process involves a thorough evaluation of the potential environmental impact, human health risks, and effectiveness against targeted pests. Furthermore, the PCA sets guidelines and regulations for the proper handling, storage, and disposal of pesticides to minimize risks associated with their use.

Institutionally, Zimbabwe's agricultural extension services are tasked with educating and guiding farmers on best practices for pesticide application. These services include training programs on the correct usage of pesticides, safety measures to protect human health and the environment, and the importance of adhering to recommended application rates and schedules. Extension officers work closely with local farmers to disseminate information on integrated pest management (IPM) techniques, promoting the use of safer, more sustainable pest control methods alongside chemical treatments. Additionally, extension services often collaborate with research institutions to develop and introduce new pest management strategies that reduce reliance on harmful chemicals.

However, the track record of pesticide management in Zimbabwe has faced several challenges. While the regulatory framework is robust, enforcement and monitoring can be inconsistent, leading to occasional misuse or illegal use of unregistered products. Farmers often lack adequate training and access to protective equipment, which increases the risk of improper pesticide application and exposure to harmful chemicals. Limited resources and capacity within extension services can hinder their ability to reach all farmers effectively, particularly in remote areas. Consequently, issues such as pesticide resistance, environmental contamination, and health hazards have been reported. Despite these challenges, efforts are ongoing to strengthen the capacity of extension services and improve pesticide management practices to ensure the safety and sustainability of Zimbabwe's agricultural sector.

4.2 Current Issues in the Project Sector

a. Environmental and Health Concerns

- Resistance Development: Over-reliance on synthetic pesticides in the beef and leather sector has led to the development of resistance among pests, such as ticks, reducing the effectiveness of chemical control methods and necessitating higher doses or more toxic alternatives.
- Environmental Contamination: The use of synthetic pesticides can result in contamination of soil, water, and air. This contamination poses risks to non-target organisms, including beneficial insects, wildlife, and humans, and can have long-term ecological impacts.

b. Safety and Handling

- Inadequate Protective Measures: Farmers and livestock handlers often lack adequate protective equipment when handling and applying synthetic pesticides. This exposes them to health risks, including acute poisoning and chronic health issues.
- Improper Disposal: The disposal of unused or expired pesticides can be problematic. Improper disposal practices contribute to environmental pollution and pose risks to public health.

c. Regulatory and Institutional Challenges

- Enforcement Issues: While the PCA regulates pesticide use, enforcement can be inconsistent due to limited resources and capacity. This can result in the use of unregistered or banned pesticides and non-compliance with safety guidelines.
- Extension Services: Agricultural extension services face capacity constraints in terms of personnel, training, and resources. This limits their ability to effectively educate farmers on safe pesticide use and integrated pest management practices.

d. Economic and Social Impacts:

- Cost Implications: The cost of synthetic pesticides can be high, impacting the profitability of smallholder farmers. Additionally, the need for frequent applications due to resistance development increases the financial burden.
- Social Impact: The health impacts of pesticide exposure can lead to increased medical costs and loss of productivity, affecting the well-being of farming communities and contributing to socio-economic challenges.

Addressing these issues requires a multifaceted approach, including strengthening regulatory frameworks, improving extension services, promoting integrated pest management (IPM) practices, and enhancing farmer education on safe pesticide use. By addressing these challenges, Zimbabwe can work towards more sustainable and effective pest management in both the agricultural and livestock sectors.

4.3 Circumstances of Use of Pesticides and Competence to Handle Products

In Zimbabwe, the widespread use of synthetic chemical pesticides is a common practice within agriculture, particularly in sectors like beef and leather production. These pesticides are crucial for managing pests such as ticks, insects, and various diseases that impact both livestock and crops. They are applied in different forms, including dips, sprays, and granules, tailored to the specific needs of the pest and the agricultural practice. The intense reliance on these chemicals reflects the ongoing demand for effective pest control solutions to safeguard livestock health and boost productivity.

However, persistent pesticide use brings its own set of challenges. One significant issue is the development of pesticide resistance, where pests evolve immunity to the chemicals over time, diminishing their effectiveness. This problem is compounded by environmental and health concerns, as pesticide runoff can contaminate soil and water sources, affecting non-target species like beneficial insects and wildlife. Additionally, humans handling these chemicals, including farmers and livestock handlers, face health risks from exposure, which can range from acute reactions to long-term health conditions.

The competency of Zimbabwean farmers and agricultural workers in handling pesticides is a pressing concern. Many individuals in the sector lack comprehensive training in safe pesticide practices, including correct application techniques, usage of protective equipment, and safety procedures. This knowledge gap can lead to improper application and increased exposure to harmful chemicals, resulting in health issues such as respiratory problems and skin irritation.

The situation is further exacerbated by inadequate personal protective equipment (PPE) and regulatory shortcomings. Often, the provision of PPE is insufficient, leaving workers vulnerable to pesticide exposure. Additionally, the regulatory framework overseeing pesticide use may be weak or inconsistently enforced, leading to issues such as misuse of banned substances and poor storage and disposal practices.

To address these challenges, there is a pressing need for enhanced education and training programs of extension workers as well as improving coverage of extension services to bridge the knowledge gaps among farmers and workers. Effective training programs should cover the safe handling, application, and disposal of pesticides, as well as alternative pest management strategies to reduce reliance on synthetic chemicals.

Secondly the development and implementation of effective pesticide management systems are crucial. This includes ensuring that pesticide products are registered, approved, and used according to established guidelines, and that there is monitoring and evaluation of their impacts on health and the environment.

4.4 Existing biological vector/pest control (BPC) and/or Natured-based solution (NBS) best practices for the crops/activities both in-country and in similar ecological context.

In Zimbabwe and the broader Southern African Development Community (SADC) region, biological vector/pest control (BPC) and nature-based solutions (NBS) are increasingly recognized for their effectiveness in managing pests and diseases while promoting environmental sustainability. These practices offer viable alternatives to synthetic pesticides, leveraging natural processes and organisms to control pests and enhance agricultural productivity.

Biological Control in Zimbabwe and SADC

Biological control involves using natural enemies of pests, such as predators, parasites, and pathogens, to manage pest populations. One prominent example in Zimbabwe is the use of *Tetrastichus epigyne,* a parasitic wasp introduced for the control of the invasive pest *Chilo partellus* (spotted stem borer) in maize. This wasp lays its eggs inside the larvae of the stem borer, eventually killing them and thereby reducing the pest population. Similarly, in other SADC countries like Zambia, *Cotesia sesamiae,* another parasitoid wasp, has been used to control the same pest effectively. These biological control agents help to maintain pest populations below damaging levels without relying on chemical pesticides.

Nature-Based Solutions in Crop Management

Nature-based solutions (NBS) utilize ecosystem services and natural processes to address agricultural challenges. In Zimbabwe, integrated pest management (IPM) practices incorporate NBS such as crop rotation, intercropping, and the use of cover crops to manage pests and improve soil health. For example, intercropping maize with legumes like cowpeas can reduce the incidence of maize weevil (*Sitophilus zeamais)* infestations, as legumes can attract beneficial insects that prey on these pests. Similarly, in neighbouring countries like Malawi, the use of cover crops like velvet beans helps to suppress weed growth and provide habitat for beneficial insects, thus reducing the reliance on chemical herbicides.

Soil Health and Ecosystem Services

Maintaining soil health through nature-based approaches is crucial for sustainable agriculture. In Zimbabwe, practices such as conservation tillage and organic composting are used to improve soil fertility and structure while reducing erosion and enhancing moisture retention. These practices create a healthier soil ecosystem that supports beneficial organisms like earthworms and mycorrhizal fungi, which in turn help suppress pests and diseases. In South Africa, similar practices are adopted, such as the use of cover crops and reduced tillage, which contribute to improved soil health and resilience against pests and diseases.

Agroforestry and Pest Management

Agroforestry systems, which integrate trees and shrubs into agricultural landscapes, provide multiple benefits for pest management. In Zimbabwe, agroforestry practices involve planting trees like acacias and leucaenas alongside crops, which can harbour predatory insects and provide habitat for birds that prey on crop pests. These systems also contribute to improved soil fertility and water management. In countries like Tanzania, agroforestry practices have been shown to enhance biodiversity and support natural pest control, thus reducing the need for synthetic pesticides and promoting more resilient agricultural systems.

Integrated Approaches and Regional Collaboration

In Zimbabwe and similarly in Zambia and Malawi, successful IPM practices include the use of pheromone traps (for tsetse control), biological control agents, and habitat management to reduce pest populations. Regional collaboration within the SADC region has fostered the exchange of best practices in biological control and nature-based solutions. The SADC Plant Protection Committee and other regional initiatives promote research and implementation of integrated pest management strategies that include both biological and nature-based approaches. This collaboration helps to standardize practices, share knowledge, and adapt successful methods across different ecological contexts. For instance, the use of biopesticides like neem oil, derived from the neem tree, is promoted across the region for its effectiveness against a range of pests while being environmentally friendly.

In summary, both Zimbabwe and similar ecological countries are employing biological vector/pest control and nature-based solutions to manage pests and enhance agricultural sustainability. Although still being at a smaller scale the practice is gaining momentum. Practices such as biological control using natural predators, integrated pest management with crop rotation and intercropping, soil health management through conservation tillage, and agroforestry contribute to effective pest control while promoting environmental health and resilience. Regional collaboration further supports the dissemination and adaptation of these best practices across diverse ecological contexts.

4.5 Assessment of risks to the environment, population health and the economy (use known incidents as much as possible).

The use of synthetic chemical pesticides in Zimbabwe, particularly in the fodder, beef, and leather sectors, presents several challenges related to environmental impact, public health, and economic sustainability. Here's an overview of the current issues and risks associated with their use:

4.5.1. Environmental Risks associated with Synthetic Chemical Pesticides in Zimbabwe

- **Soil and Water Contamination**: Synthetic pesticides can leach into the soil and contaminate groundwater, affecting water quality and soil health. Runoff from agricultural fields treated with pesticides can lead to contamination of surface water bodies, impacting aquatic ecosystems. For example, incidents of pesticide contamination in water sources have been reported, leading to adverse effects on fish populations and water quality (Binns, 2016).
- **Loss of Biodiversity**: The use of broad-spectrum pesticides can harm non-target species, including beneficial insects, birds, and other wildlife. This reduction in biodiversity can disrupt ecosystem balance and reduce the availability of natural pest control agents. Studies have shown that pesticide use contributes to declines in insect populations, which in turn affects other wildlife dependent on these insects (Goulson, 2013).
- **Pesticide Resistance:** Over-reliance on synthetic pesticides can lead to the development of resistant pest populations. This resistance requires higher doses or alternative, more toxic chemicals to control pests effectively, exacerbating environmental and health risks. Cases of tick resistance to acaricides in cattle have been reported in Zimbabwe, leading to increased treatment costs and environmental impact (Moyo et al., 2018).

4.5.2 Population Health Risks

- **Acute Poisoning**: Exposure to synthetic pesticides can cause acute health issues such as poisoning, which manifests as symptoms like nausea, headaches, and respiratory problems. Farmers and agricultural workers are particularly at risk due to inadequate protective measures. There have been reports of pesticide poisoning incidents among farmers in Zimbabwe, highlighting the need for better safety protocols (Chingombe et al., 2018).
- **Chronic Health Effects:** Long-term exposure to pesticides is associated with chronic health conditions, including cancer, neurological disorders, and reproductive issues. Studies have linked pesticide exposure to an increased risk of certain cancers and other health problems among rural communities in Zimbabwe (Ncube et al., 2017).
- **Impact on Food Safety:** Residues from synthetic pesticides in fodder and meat products can enter the human food chain, posing health risks to consumers. Monitoring and regulation of pesticide residues are critical to ensuring food safety, but challenges remain in effectively managing and enforcing these regulations in Zimbabwe (Kakimbi et al., 2020).

4.5.3. Economic Risks

- **Increased Costs:** The cost of purchasing synthetic pesticides and managing resistance can be substantial for farmers. Additionally, the need for more frequent applications due to resistance issues can further increase costs. Economic studies have shown that the financial burden of pesticide use and resistance management can be significant, impacting the profitability of farming operations (Ndlovu et al., 2019).

- **Market Access Issues**: International markets increasingly demand products that are produced with minimal pesticide use due to concerns about residues. Non-compliance with these standards can limit access to export markets, affecting the competitiveness of Zimbabwean beef and leather products. For instance, restrictions on beef exports due to pesticide residues have been a concern for Zimbabwean producers (ZIMSTAT, 2021).

4.6 Control of the Distribution and Use of Pesticides

The control of pesticide distribution and use in Zimbabwe involves several key stakeholders and regulatory frameworks:

Regulatory Bodies

- **Pesticide Registration Board (PRB**): The PRB, under the Ministry of Agriculture, is responsible for registering and regulating the use of pesticides in Zimbabwe. The board ensures that only approved and safe pesticides are available on the market (Ministry of Agriculture, 2020).
- **Environmental Management Agency (EMA):** EMA oversees environmental regulations, including those related to pesticide use and its impact on the environment. EMA ensures compliance with environmental standards and conducts monitoring and enforcement activities (EMA, 2021).

Control Mechanisms

- **Pesticide Certification:** Pesticides must be certified by the PRB before being sold or used. Certification involves rigorous testing to ensure that pesticides meet safety and efficacy standards (PRB, 2020).
- **Training and Extension Services**: Extension services provided by agricultural departments and NGOs offer training to farmers on the safe use and management of pesticides. This includes proper application techniques, protective measures, and alternative pest management strategies (FAO, 2022).

Monitoring and Enforcement

- **Inspection and Compliance Checks:** Regular inspections and compliance checks are conducted to monitor pesticide use and ensure adherence to regulations. This includes checking for proper storage, handling, and application practices (EMA, 2021).
- **Penalties and Sanctions:** There are penalties for non-compliance with pesticide regulations, including fines and legal action. These measures aim to deter misuse and promote responsible pesticide use (Ministry of Agriculture, 2020).

Effective control of pesticide distribution and use is essential to mitigate the negative impacts associated with synthetic chemicals. Key measures include:

i. Strengthening Regulations and Enforcement: Implementing and enforcing stringent regulations regarding the sale and use of pesticides is crucial. This includes ensuring that only registered and approved pesticides are available in the market and that their use complies with safety standards. Regular inspections and monitoring can help in identifying and addressing illegal or unsafe practices.

ii. E**ducation and Training:** Providing training and education to farmers on the safe use of pesticides, including proper application techniques, personal protective equipment, and disposal methods, can help reduce health and environmental risks. Extension services and agricultural organizations play a vital role in disseminating this information.

iii. **Promoting Integrated Pest Management (IPM):** Encouraging the adoption of IPM practices can reduce reliance on synthetic pesticides. IPM integrates various pest control methods, including biological control, cultural practices, and mechanical methods, to manage pests more sustainably.

iv. **Monitoring and Research:** Ongoing research and monitoring of pesticide use and its impacts can inform policy and practice. This includes studying pesticide residues in food and feed, assessing environmental contamination, and evaluating the effectiveness of pest control strategies.

4.7 Ability to manage / dispose of obsolete pesticides and polluted packaging.

Zimbabwe faces several challenges in managing and disposing of obsolete pesticides and polluted packaging. The limitations arise from inadequate disposal infrastructure, limited capacity and resources, poor management, and regulatory gaps, as detailed below.

Lack of Infrastructure: There is a significant lack of infrastructure and facilities for the safe disposal of obsolete pesticides and contaminated packaging. The absence of dedicated disposal sites and treatment facilities limits the country's ability to manage these hazardous materials effectively.

Limited Capacity and Resources: The capacity and resources for managing pesticide waste are limited. Government agencies and local authorities often lack the financial and technical resources required for proper disposal and management.

Illegal Dumping and Mismanagement: Improper disposal practices, including illegal dumping and unregulated storage, pose environmental and health risks. This can lead to contamination of soil and water sources, exacerbating the negative impacts of pesticide use.

Regulatory and Policy Gaps: Although there are regulations in place, enforcement and compliance issues hinder effective management. Policies for the safe disposal of pesticides and packaging are often inadequate or poorly implemented.

Public Awareness and Education: There is a need for increased public awareness and education on the safe handling and disposal of pesticides. Training for farmers and stakeholders is essential to ensure proper practices and reduce the risks associated with pesticide use.

5. POLICY, LEGAL & INSTITUTIONAL FRAMEWORK For PESTICIDE MANAGEMENT

Zimbabwe has a strong, well-crafted set of environmental management laws and regulations as well as public and other private institutions that oversee the management of the environment. Following is a summary list of the main pieces of legislation that will have a direct bearing on the ZAVaCEP pesticide management.

5.1 National Legislation Regulating Pesticide Management

5.1.1 Environmental Management Act (Chap 20:27) No 13 of 2002

The Act provides for the sustainable management of natural resources and the protection of the environment; the prevention of pollution and environmental degradation; the preparation of the National Environmental Plan and other plans for the management and protection of the environment. The Act goes on to establish the Environmental Management Agency and the Environmental Fund, all for the protection of the environment. One of the main prescriptions of this Act relates to its powers to demand that environmental impact assessments be carried out for all projects carried out in Zimbabwe. This includes agricultural and livestock -related activities promoting environmental stewardship in the livestock and pest management sectors.

5.1.2 Hazardous Substances and Articles Act (Chap 15:05), 1971 (2001)

This Act which was published in 1971 and revised in 2001 recognizes the polluting effect of a range of hazardous substances and establishes a Hazardous Substances Control Board, where the powers of the board including the licensing of hazardous substances and suppliers of hazardous substances and premises and vehicles, vessels or aircraft on which the said substances are sold, handles or carried. This Act is linked to the Environmental Management Act Chap 20:27 of 2002 through the Environmental Management (Control of Hazardous Substances) General Regulations of 2018. This connection emphasises its significance in regulating the use of hazardous substances in pest control practices and ensuring the safety and environmental compliance of livestock management operations.

5.1.3 The Water Act (Chap 20:24), 1998 (2005)

The Zimbabwe Water Act, Chapter 20:24, consisting of 123 sections, and last revised in 2005, provides for the development and utilization of the water resources of the country and lays out the management structure for the allocation of water to all sectors that require it, especially when it is in short supply. Under the Act, the country has been divided into catchments where the management of the water in the catchment is the responsibility of the catchment council. Also, a key component of the Act is the need to protect the environment in all water development and management programs, as well as the control of water pollution. Pollution of water from any pesticide or livestock activities under ZAVaCEP would be a violation of the Water Act and subject to prosecution. The Act also prohibits discharging effluent into a river or water body without a permit – of note would be to ensure that no dip effluent is discharged into water sources.

On issues of water pollution, the Water Act dovetails with the Environmental Management Act and other pieces of legislation that govern water quality.

5.1.4 Environmental Management (Control of Hazardous Substances) General Regulations Statutory Instrument SI No 268 of 2018

The Regulations were defined under the Environmental Management Act 20:27 as Statutory Instrument S. I. 268 of 2018 to confer power to the Zimbabwe Environmental Agency for the control of the handling and transportation of hazardous substances in Zimbabwe.

5.1.5 Pesticide Regulations, Statutory Instrument 144 of 2012

The regulations in Statutory Instrument 144 relate to the approval of pesticides for use in Zimbabwe, where no pesticide can be used in the country unless approved by the Ministry of Lands, Agriculture, Fisheries, Water and Rural Development. The Plant Protection Division of the Department of research and Specialist Services (DRSS) oversees the assessment and registration of pesticides that are permitted for use in the country. SI 144 provides details on the steps to be followed by any party wishing to introduce a pesticide into the country.

This legislation ensures that only pesticides whose efficacy and toxicity have been thoroughly investigated and found to be effective and safe will be allowed for distribution and use in the country. The registration process is detailed and rigorous to ensure safe and efficient use of pesticides in the interests of the user, the farmer, the consumer and the general public who are concerned about the hazards in handling, residues, food, and possible contamination of the environment.

5.2 Applicable Pesticide Management Standards of the African Development Bank (AfDB)

The African Development Bank (AfDB) Operational Safeguards (OS) ensure that projects funded by the AfDB are sustainable and do not cause harm to the environment or the communities they serve. In the context of pesticide management, the relevant Operational Safeguards include OS1 and OS4.

OS1: Environmental and Social Assessment (ESA)

For projects involving pesticide use, an Environmental and Social Impact Assessment (ESIA) or ESMP is essential to evaluate potential impacts throughout the pesticide lifecycle, from procurement to disposal. The ESIA must include a risk management plan to address potential adverse effects on human health and the environment, assessing alternative pest management strategies to choose the least harmful options. Effective stakeholder engagement is also crucial, ensuring that communities affected by pesticide use are consulted during both planning and implementation to incorporate their concerns and local knowledge. Additionally, ongoing monitoring of pesticide use and its impacts is required, with regular compliance reporting to the AfDB to ensure adherence to environmental and social standards.

OS4: Pollution Prevention and Control, Greenhouse Gases, Hazardous Materials, and Resource Efficiency

OS4 focuses on comprehensive pollution prevention and control, emphasizing the need to manage hazardous materials, including pesticides, with care. It mandates that projects adopt best practices to minimize environmental contamination by preventing the release of harmful substances. Effective management of hazardous materials involves safe handling, storage, and disposal practices to avert contamination and mitigate health risks.

Guidelines under OS4 recommend selecting pesticides that present minimal risk to both human health and the environment, avoiding those listed in international conventions like the Stockholm Convention on Persistent Organic Pollutants (POPs). The approach also advocates for Integrated Pest Management (IPM), which emphasizes non-chemical pest control methods and uses chemical pesticides only when absolutely necessary. Training for farmers and stakeholders is crucial, ensuring they are well-informed about safe pesticide use, storage, and disposal. Adequate protective equipment and safety protocols must be provided, alongside a plan for the safe disposal of obsolete pesticides and contaminated packaging to prevent environmental and health hazards.

5.3 Compliance with International Environmental Conventions

Projects must adhere to the **Stockholm Convention on Persistent Organic Pollutants (POPs**), a global agreement dedicated to phasing out or restricting the use of harmful chemicals known for their persistence in the environment and potential health risks. This convention targets persistent organic pollutants, including specific pesticides, to minimize their adverse effects. By aligning with this convention, projects ensure that the use of hazardous pesticides is significantly reduced and that safer, more sustainable alternatives are promoted, safeguarding both human health and the environment.

The **Rotterdam Convention on the Prior Informed Consent Procedure** requires projects to follow stringent guidelines for the import and export of hazardous chemicals, including pesticides. This convention facilitates informed decision-making by providing essential information about the risks and management practices associated with these substances. By adhering to the Rotterdam Convention, projects help prevent the unintended spread of hazardous chemicals and mitigate associated risks, ensuring that all stakeholders are well-informed and able to make safe and responsible choices regarding chemical use.

Additionally, compliance with the **Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal** is mandatory for managing hazardous waste. This includes the transportation and disposal of pesticide containers and obsolete pesticides. The Basel Convention sets out regulations to prevent environmental contamination and ensure that hazardous waste is handled with care. By following these guidelines, projects contribute to responsible waste management practices, reducing the risk of environmental damage and promoting the safe disposal of potentially dangerous materials.

5.4 Institutional Framework

The beef livestock and leather value chain will be coordinated and managed under the auspices of a number of public and private institutions. The main institutions are listed below although there will be some institutions, especially government departments that will have a remote bearing on the ZAVaCEP.

5.4.1 Public Institutions

The following government institutions will be involved in the management of the ZAVaCEP.

Ministry of Finance, Economic Development and Investment Promotion (MoFED)

This project will be carried out with funding from the AfDB and all contractual and financial matters have been signed between the MoFED and AfDB. It also follows that the overall management of the project will be the responsibility of the ministry.

Ministry of Lands, Agriculture, Fisheries, Water and Rural Development (MLAFWRD)

The ZAVaCEP is primarily an agricultural production project which is aimed at maximizing the production of beef cattle which in turn leads to higher hide and leather production. Accordingly, all the technical management issues relating to this beef cattle production will fall under the purview of the MLAFWRD. Within this ministry, the main departments that will be involved are the Department of Agricultural Extension and Technical Services (AGRITEX), the Department of Veterinary Services (DVS) and the Department of Research and Specialist Services (DRSS). The specific responsibilities of these departments are summarized in the paragraphs below.

The MLAFWRD will be responsible for all technical reporting and will submit financial accounts to the MFEDIP for compilation and onward submission to the AfDB.

Department of Veterinary and Technical Services (DVS)

The Department of Veterinary Services in Zimbabwe is responsible for all matters of domestic, commercial and wildlife health and disease control. The department has research and an extension arm, where the research division manages all the research issues of disease monitoring, control as well as the creation, manufacture, storage and distribution of vaccines and medicines. In times of major disease outbreaks such as foot and mouth and anthrax, the DVS immediately mounts a technical response, quickly identifying, surveying and cordoning off areas of incidence before executing the disease control. The research laboratories of the DVS have carried out some ground breaking work on vaccine manufacture for a number of livestock diseases over the years.

The DVS is responsible for managing cattle dipping throughout the country. In rural areas, the DVS posts staff called Veterinary Assistants or Dip Attendants, at village level who manage the local dipping facilities using chemicals that are provided by either the DVS or the farmers. These village level staff are the first line of animal disease surveillance and have been trained to carry out preliminary diagnosis of disease incidence.

Department of Research and Specialist Services (DRSS)

The Department of Research and Specialist Services, in the MLAFWRD, carries out research on all aspects of crop production towards achieving maximum yield efficiently. Within this department, there is the Division of Plant Protection which oversees the registration of approved pesticides, under Statutory Instrument 144, describe supra.

Department of Agricultural and Technical Services (AGRITEX)

This department, under the MLAFWRD, is responsible for providing extension services to the entire agricultural production sector, including livestock, crop, and horticulture. With staff posted throughout the country down to village level, AGRITEX is the primary providers of free technical services for all area of the agricultural sector. Their village level extension workers are the backbone of the agricultural production value chain. These extension workers are trained in general agriculture and service livestock and crop production.

The implementation of the ZAVaCEP will rely heavily on the local level staff of AGRITEX as well as the local level staff of the DVS.

5.4.2 Private Sector Institutions

Agricultural chemicals, fertilizers and pesticides are traded on the open market in the private sector, subject to supervision by government institutions such as DRSS, AGRITEX, and DVS.

Agricultural Chemical Industry Association (ACIA)
In Zimbabwe, the Agricultural Chemical Industry Association (ACIA) represents all the manufacturers and distributors of agrochemicals and animal health products. The association handles chemicals that are brought into the country after they have been approved and registered by the Department of Research and Specialist Services. Thus, all distribution of pest control products under the ZAVaCEP by private sector players is also controlled by ACIA.

ACIA is a member of the International Group of National Associations of Agrochemical Manufacturers (GIFAP). Through GIFAP, ACIA endorses the Food and Agricultural Organization (FAO) conduct on distribution and use of agrochemicals.

Members of ACIA are expected to abide by legislation and regulations on the proper handling and use of agrochemicals, especially transport, storage and application. They are expected to train farmers and their workers on the safe handling of these agrochemicals.

5.5. Analysis of Capacity to Implement the IPM

5.5.1 National Level:

i**. Policy and Regulatory Framework:** Zimbabwe has a robust policy and regulatory framework for pest management, but challenges include enforcement and compliance. The PRCA plays a crucial role in regulating pesticide use, but capacity constraints can limit its effectiveness.

ii. Technical and Research Capacity: Research institutions and agricultural extension services provide technical support for IPM. However, there is a need for increased investment in research and development to address emerging pest challenges and improve IPM strategies.

iii. Funding and Resources: Adequate funding is essential for implementing IPM practices and supporting capacity-building initiatives. Limited resources can hinder the effective implementation of IPM at the national level.

5.5.2 Local Level:

i. Extension Services: Local agricultural extension services are instrumental in disseminating IPM knowledge and practices to farmers. Training programs and workshops are conducted, but there is often a need for more extensive outreach and support.

ii. Farmer Training and Awareness: While there are efforts to train farmers in IPM, there is a need for increased awareness and education on sustainable pest management practices. Community-level programs and participatory approaches can enhance farmer engagement.

ii. Infrastructure and Support Systems: Local infrastructure for pest management, such as pest control facilities and equipment, may be limited. Improving infrastructure and support systems is crucial for effective implementation of IPM.

5.6. Enhancing the Policy and Institutional Framework for Integrated Pest Management Promotion

The integration of Integrated Pest Management (IPM) into agricultural practices is a growing trend, reflecting a shift towards more sustainable pest control methods. In Zimbabwe, current practices include the adoption of biological control measures, crop rotation, and integrated catchment management. These practices are crucial for maintaining ecological balance and reducing reliance on chemical pesticides. To promote IPM more effectively, it is essential to enhance both the policy and institutional frameworks that support these practices.

A key aspect of improving the policy framework is reinforcing the National Policy on Integrated Pest Management, which advocates for a balanced approach to pest control through biological, cultural, mechanical, and chemical methods. This policy aims to reduce dependency on chemical pesticides while promoting sustainable practices. Complementary to this, the Environmental Management Act (EMA) provides a legal foundation for managing environmental impacts, including those from pesticide use. By strengthening enforcement of these regulations and integrating them with the Agricultural and Rural Development Policy, which supports sustainable agricultural practices, the policy framework can better support IPM initiatives.

Institutionally, several bodies play pivotal roles in supporting pest management practices. The Pesticide Registration and Control Authority (PRCA) is tasked with regulating pesticide use and ensuring that only approved, safe products are available. Enhancing its capacity to monitor and enforce pesticide standards will help reduce risks associated with chemical use. The Department of Plant Protection within the Ministry of Lands, Agriculture, Fisheries, Water, and Rural Development is responsible for implementing pest management strategies and providing farmer support. Expanding its reach and resources can facilitate broader adoption of IPM practices. Additionally, research institutions such as the Zimbabwe Agricultural Research Trust (ZART) and the Institute of Plant Protection are instrumental in developing and refining IPM strategies. Strengthening collaboration between these institutions and international partners can drive innovation and support the effective implementation of IPM.

Improving the integration of IPM into agricultural practices requires a coordinated effort to enhance policy support, regulatory frameworks, and institutional capacity. By addressing these areas, Zimbabwe can advance its pest management practices and promote more sustainable agricultural methods.

6. ZAVaCEP INTEGRATED PEST MANAGEMENT MEASURES (IPMM)

Good animal health management is important in beef animal production. Thus, the control of animal parasites and the timely treatment of diseases when they occur is very critical. Tickborne diseases are the most prevalent in Zimbabwe, leading to more than 60% of cattle mortality in the country. In Zimbabwe, the control of ticks on cattle has been a critical part of disease control, such that there is a network of more than 4000 dipping facilities or dip tanks throughout the country, especially in communal areas.

Below is a summary of the main animal health issues in beef production in Zimbabwe.

6.1 Internal Parasites

Worm infestation in cattle is common especially during the rainy season when the cattle ingest the larvae and parasites with the grass they graze. Common symptoms are diarrhea, emaciation, rough coat and swollen abdomen. Internal parasites are easily treated through dosing at intervals using broad spectrum de wormers. It is recommended to deworm at the beginning and the end of the rainy season.

6.2 Tick Borne Diseases

The four main tick-borne diseases in Zimbabwe are:

- Babesiosis or red water disease – a disease that is caused by a protozoan parasite and which can be treated by a number of veterinary drugs;
- Anaplasmosis (gall sickness) – a disease associated with symptoms of fever and progressive anemia. Treatable with a variety of veterinary drugs;
- Heartwater disease – a disease that has symptoms of fever, loss of appetite, nervousness and convulsions, and laboured breathing. The disease which can lead to sudden death is more easily treated with drugs if diagnosed early; and
- Theilerosis (January disease) – a disease that is usually fatal and occurs mainly in the rainy season. Its symptoms are fever, swelling of lymph nodes and lacrimation and cloudiness of eyes.

Ticks on cattle are controlled chemically, with the chemical being applied by any one of the following methods:

- plunge dipping, which is by far the most common method of tick control in Zimbabwe;
- a spray race;
- hand spraying;
- pour-on of the chemical in an oily medium onto the back of an animal for it to permeate the skin and control the ticks and other parasites; and

- ➢ applying tick grease to the coat of the animal – which is a labour-intensive technique only suitable for small herds.

Other important cattle diseases are:

- Foot and mouth disease;
- Lumpy skin disease;
- Theileriosis;
- Black leg or quarter evil; and
- Dermatophilosis

Some of these diseases are caused by viruses and more difficult to treat and best controlled by vaccination. The Department of Veterinary Services in Zimbabwe has created a vaccine (BOLVAC) for theileriosis.

The activities constituting ZAVaCEP include cattle fattening in pens, transportation and storage of animal feed to and at pen fattening sites, storage of animal hides, tanning of hides into leather; and storage of leather and finished leather goods. All these activities attract pests and vermin that need to be controlled whenever they occur, and the Pest management plan being presented here recognizes these areas of pest control. Some of the pest and vermin control will need to be done chemically while others are manageable by other physical means.

6.3 Pest and Disease Issues In Zimbabwe

6.3.1 The Pollution Effects of Pesticides

The use of pesticides in any setting is associated with some potential hazards, and these impacts can be grouped into the following:

- ➢ **Human Intoxication** – where the pesticides enter the human body thorough ingestion or body contact, and interferes with the human metabolism, causing sickness or disability or death;
- ➢ **Animal Intoxication** – similar to the impact on humans, the pesticide can kill other non-target insects, birds or animals, especially natural predators of the pests, thereby becoming dangerous to terrestrial, and aquatic biota. This may also further be associated with the phenomenon of bioaccumulation, thereby endangering the whole food chain;
- ➢ **Water Pollution** – Surface and ground water are usually the final receptacles of any excess chemicals that are applied to a plant or animal, since water is the most prevalent solvent or carrier of materials in the environment. Rivers, lakes and groundwater aquifers are easily polluted. Since these water bodies are usually used as a source of portable water by humans, and for water abstraction by plants, there is a further risk of human intoxication and pesticides entering the food chain.
- ➢ **Soil Pollution** - The application of pesticides to the soil contributes to the killing of both the target insects and microorganisms in the soil, as well as some unintended organisms. Some of these organisms that suffer collateral demise may be of immense value to soil health and improving soil nutrient build up.
- ➢ **Air Pollution** – Air pollution through increased use of pesticides has negative impacts on the quality of the air, and can sometimes lead to respiratory problems for humans and other animals. In particular, air pollution by pesticides can impact negatively on bees and their ability fulfil their critical role of pollinating plants in the ecosystem.

In light of the negative pollution effect of pesticides in the environment, it is good environmental management practice to use chemical pesticides only to the extent that they are necessary to support the pest control problem at hand and to explore as much as possible opportunities for Integrated Pest Control (IPM), hereafter discussed below.

6.3.2 Integrated Pest Management

Integrated pest management is based on the pursuit of sustainable agriculture, offering a holistic and environmentally conscious strategy in pest control that minimizes the use of synthetic chemicals to control pest while exploiting the natural lifecycles of pests and the species in the food chain of these pests. It is an ecosystem-based approach to pest management that relies on common-sense practices and the life cycles of pests and their interaction with the environment. The principles of IPM include the identification of pests, their hosts and beneficial organisms before taking action, thereby establishing monitoring guidelines for each pest species and action thresholds for control of the pest.

IPM utilizes a combination of all possible and useful pest control methods against pests while considering the use of chemical pesticides as a last resort. It its holistic approach, IPM integrates biological, chemical, cultural, and mechanical controls. By reducing reliance on reliance on chemical pesticides, IPM promotes environmental health, preserves beneficial organisms, and minimizes the development of pesticide resistance.

The implementation of IPM is based on 5 steps as:

Step 1:- Identifying the pest, an often overlooked step, its host life cycle and biology;

Step 2:- Monitoring Pest Activity, its sample environment and pest population;

Step 3:- Determining Action Thresholds for its control, and.

Step 4:- Explore Treatment Options and devise an appropriate combination of tactics for control

Step 5:- Evaluate Results to determine if the tactics used were appropriate. If not, then return to Step 4.

Based on the pesticide related potential environmental impacts of the ZAVaCEP identified and listed in chapter 5 above, a Pesticide Management Plan (PMP) has been developed to address all the pollution and human health risks associated with pesticide use and management in the project. Some of the Areas where IPM can be incorporated in the PMP will be identified and incorporated during project implementation.

6.4 Integrated Pest Management (IPM) Activities in Fodder Production

To implement effective Integrated Pest Management (IPM) in fodder production, several specific activities can be undertaken:

6.4.1 Crop Rotation and Diversification:

Implementing crop rotation with non-host plants can significantly disrupt pest life cycles, reducing their ability to thrive. This practice, coupled with diversifying fodder crops, minimizes the risk of widespread pest infestations, ensuring a more resilient farming system.

6.4.2 Use of Pest-Resistant Fodder Varieties:

Introducing and promoting the use of fodder varieties resistant to common pests such as aphids and armyworms is crucial. According to Smith (2005), these resistant varieties can greatly reduce the dependence on chemical pesticides, leading to a more sustainable approach to pest management.

6.4.3 Biological Control Agents:

The release of natural predators and parasitoids specific to key pests can effectively control pest populations. Additionally, the use of entomopathogenic fungi and bacteria, as recommended by van Lenteren (2006), provides an eco-friendly method to manage pests without harming the environment.

6.4.4 Cultural Practices:

Regularly removing crop residues and weeds that harbour pests is essential for maintaining a pest-free environment. Kogan (1998) highlights the importance of such practices. Moreover, practicing timely planting and harvesting helps avoid peak pest periods, reducing the likelihood of pest outbreaks.

By incorporating these strategies into fodder production, farmers can achieve a more integrated and sustainable approach to pest management, ultimately leading to healthier crops and improved yields.

6.5 Activities to Integrated Pest Management (IPM) in Cattle Dipping

To implement an effective Integrated Pest Management (IPM) strategy for cattle dipping, several key activities should be undertaken:

6.5.1 Scheduled Dipping:

Implement a structured dipping schedule to control tick populations effectively. This involves adhering to a regular timetable for dipping cattle to ensure that tick infestations are managed consistently. Using acaricides judiciously is crucial to prevent the build-up of resistance among tick populations (Marufu et al., 2011).

6.5.2 Integrated Tick Management:

Combine chemical and non-chemical methods for tick control. This includes practices such as pasture rotation and the use of biological control agents. By rotating pastures, the tick life cycle is disrupted, reducing their numbers. Biological control methods, such as introducing natural predators of ticks, further enhance this strategy (Jonsson, 2006). Additionally, introducing tick-resistant cattle breeds can provide a sustainable solution to managing tick infestations.

6.5.3 Biological Tick Control:

Utilize entomopathogenic fungi and nematodes to combat ticks. These biological agents can infect and kill ticks, reducing their populations naturally. Promoting the use of natural tick predators, such as birds and ants, can also help control tick numbers. These predators feed on ticks, providing an environmentally friendly method of tick control.

6.5.4 Dip Effluent Management

Dip effluent can be managed using containment facilities such as holding ponds or soakaways, as is currently practiced with well-constructed dip tanks. These facilities prevent the runoff of effluent into surrounding soil and water sources and should be designed to handle both the volume and toxicity of the effluent. Additionally, the effluent may be treated chemically to neutralize its harmful components, followed by processes such as sedimentation or biological treatment to further reduce its toxicity and environmental impact before disposal. However, advanced treatment technologies may be costly and challenging to implement in rural communities. Regular monitoring and maintenance of these systems are essential to ensure their effectiveness.

By integrating these activities, cattle dipping can be more effective and sustainable, leading to improved health and productivity of the livestock.

6.6 Specific Activities in Hide production in Integrated Pest Management (IPM)

6.6.1 Sanitation and Hygiene:

Maintaining high standards of cleanliness in hide processing facilities is crucial to preventing pest infestations. This involves regular inspection and cleaning of storage areas to eliminate potential pest breeding grounds, as highlighted by Bradbury & Lie (1967).

6.6.2 Use of Natural Pest Repellents:

Natural repellents, such as neem oil and essential oils, can be applied to deter pests from hides. These methods are effective in creating an environment that is unfavourable for pests, as noted by Isman (2006).

6.6.3 Regular Monitoring:

Implementing a comprehensive monitoring program is essential for the early detection of pest infestations in hides. This can be achieved through the use of pheromone traps and regular visual inspections, which help in monitoring pest activity effectively (Phillips & Throne 2010).

6.6.4 Temperature and Humidity Control:

Controlling the environment in hide storage areas by regulating temperature and humidity levels makes conditions less favourable for pests. Utilizing dehumidifiers and temperature regulation systems is an effective strategy for pest management, as recommended by Mallis (2011).

6.7 Training and Capacity Building in Pest Management

6.7.1 Workshops and Training Sessions:

Regular workshops and training sessions will be conducted for farmers, workers, and processors to educate them on IPM practices. These sessions will be supported by the development of training materials and manuals specifically tailored to the local context, as recommended by Pretty et al. (2003).

6.7.2 Extension Services:

Agricultural extension services will be strengthened to provide continuous support and advice on IPM, following the guidance of Swanson and Rajalahti (2010). This will include the establishment of demonstration plots and model farms that will serve as practical examples of IPM practices.

6.7.3 Community Engagement:

Engaging local communities in IPM initiatives through participatory approaches is crucial. This strategy, endorsed by Pretty J. (2003), will encourage collaboration between farmers, researchers, and policymakers, fostering a collective effort towards successful IPM implementation.

6.7.4 Monitoring, Evaluation, and Reporting

To ensure the effective implementation of Integrated Pest Management (IPM), several specific activities need to be undertaken.

First, it is crucial to develop a comprehensive monitoring plan. This involves establishing baseline data and indicators to measure the effectiveness of pest management efforts. By doing so, we can track progress and identify areas that need improvement. Regular assessments should be conducted to evaluate the impact of IPM practices, as suggested by Heng et al. (1999).

Additionally, it is important to involve stakeholders in the evaluation process. Engaging stakeholders in monitoring and evaluation helps ensure transparency and accountability. Using participatory evaluation methods, as advocated by Chambers (1994), allows for the collection of valuable feedback from those directly affected by pest management practices. This feedback can then be used to refine and enhance IPM strategies.

The following are important parameters that will need to be monitored in the Pest Management program.

Water quality – Most of the pollution relates to soil, surface water and ground water pollution by chemicals that will be used in animal disease control, tick control, pest control for feed and hides in storage. It will be thus, important to establish the baseline chemical quality of surface and ground water sources at each project site. These will be in dams or boreholes or well, whatever source of water is being tapped at a particular project site.

Water samples will need to be collected from these sources at the start of the project and analysed for levels of pesticides and other chemical parameters that should include

- pH;
- electrical conductivity of the water;
- concentrations of basic elements such as calcium (Ca^{++}), magnesium (Mg^{++}), sodium (Na^{+}), potassium (K^{+}), lead (Pb), chromium (Cr);
- anions of chloride (Cl^{-}), sulphate (SO_4^{2-}), nitrate (NO^{3-}), phosphate (PO_4^{3-}); and
- concentrations of the pesticides that will be used at the particular project site.

The baseline concentrations and levels of the parameters will be used to determine if there has been any additional pollution caused by the use of pesticides under ZAVaCEP.

7 PEST MANAGEMENT PLAN FOR ZAVaCEP

7.1 Introduction to Integrated Pest and Vector Management Measures (IPMM) in ZAVaCEP

The ZAVaCEP project aims to enhance the sustainability and productivity of the beef and leather sectors through the implementation of comprehensive Integrated Pest and Vector Management Measures (IPMM). These measures are designed to reduce reliance on chemical pesticides, mitigate environmental and health risks, and promote long-term ecological balance. The IPMM approach incorporates Biological Control Practices (BCP), Natural-Based Solutions (NBS), and, where necessary, the targeted use of chemical pesticides, ensuring a holistic and sustainable pest management strategy. The following additional criteria will apply to the selection and use of such pesticides: (i) they have negligible adverse human health effects; (ii) they are shown to be effective against the target species; and (iii) they have minimal effect on non-target species and the natural environment. The methods, timing, and frequency of pesticide application are aimed to minimize damage to natural enemies.

Biological Control Practices (BCP)

Biological Control Practices form a cornerstone of the IPMM approach in ZAVaCEP. This strategy involves the use of natural enemies, such as predators, parasitoids, and pathogens, to control pest populations. By introducing and supporting beneficial insects or microorganisms that specifically target pests, the project aims to maintain pest levels below harmful thresholds. Additionally, BCP emphasizes the conservation of beneficial species through habitat management and the reduced use of broad-spectrum pesticides, thereby fostering a more balanced and resilient ecosystem.

Natural-Based Solutions (NBS)

Natural-Based Solutions play a crucial role in the integrated approach to pest management. These solutions include the use of plant extracts and bio-pesticides, such as neem oil, garlic extracts, and microbial agents like *Bacillus thuringiensis*, to manage pest populations in a more environmentally friendly manner. NBS also encompass cultural practices like crop rotation, intercropping, and adjusting planting dates to disrupt pest life cycles and reduce infestations. These practices not only enhance pest control but also contribute to improved soil health and biodiversity.

Chemical Pesticides

While the primary focus of IPMM is on biological and natural-based methods, the targeted use of chemical pesticides is sometimes necessary as a last resort. In such cases, careful selection and application of chemical pesticides are essential to minimize environmental and health risks. This approach includes integrated application schedules and strict adherence to safe use practices, ensuring that chemical interventions are both effective and responsible.

7.2 Assessment of Environmental Health Risks and Pest Management Related Impacts under ZAVaCEP

The activities that will be carried out under ZAVaCEP were itemized in chapter 3, supra. The table below presents an extraction of all the activities that have a bearing on pest control, followed by a listing of all the likely environmental impacts of these activities. This was carried to ensure that all the potential, pest related environmental impacts were identified and assessed for their severity.

Table 3. of Pesticide Related Environmental Impacts of ZAVaCEP

Table 3. Pesticides Impacts of the ZAVaCEP Activities

Project Activity	Pesticide Related Impacts
Subcomponent 1.1: Support Sustainable Livestock Production and Productivity	
Rehabilitate 25 dip tanks and supply chemicals (Implying that aprox 1600-2250 litres of acaricide per year will be used)	• Groundwater pollution from dipping solution flowing out of drip-dry pens at the exit from plunge dip • Groundwater pollution from leakages of dipping solution from base of plunge dip if walls and base are not properly sealed • Leakage of dip concentrate solution if not properly stored. • Risk of surface water pollution from flows of dipping solution from drip dry areas out at the exit of the plunge dip. • Risk of ground and surface water pollution and risk to human health from in appropriate disposal of empty pesticide containers. • Approximately 30000 litres of dip effluent are discharged every year per dip- for 25 dip 750000 litre will be discharged
Carry out appropriate conservation practices around rehabilitated dip tanks	• Positive impact on risk of surface water pollution by dip pesticides from the dip and drip-dry areas at the exit from plunge dip. Conservation works stop flow of dip solution into the local streams or dams.
Procure and distribute 14 small scale feed formulation plants	• Some pesticide and rodenticides may need to be used to protect the stored feed and stored grain from pests and rodents. Soil and groundwater pollution may arise from improper storage and handling of these chemicals. • Risk of human and bird poisoning arising from improper storage and handling of pesticides and rodenticides.
Subcomponent 1.2: Support to Agribusiness and Water Value Chain Enhancement	
Support development of 8 Community Level Feedlots	• No pesticide pollution risk associated with the construction of the feedlots • Risk of soil and groundwater pesticide pollution associated leakage from areas of storage of cattle dosing and dipping/spraying/pour-on chemicals at the feedlot • Risk of soil and groundwater pollution during spraying of cattle in feedlot. • Risk to human health from mishandling of chemicals at the feedlot and in storage areas.
Support 5 existing dairy farmers groups to improve quality of their operations	• Pesticides will be used in animal health management and sanitizing dairy cattle and milk handling facilities. Risks of pesticide pollution of soil and ground water and risk to human health relate to handling and storage of the veterinary and cleaning chemicals
Subcomponent 2.1: Capacity Building, Social Inclusion and Smallholder livestock farmers empowerment	
Procure 2 sets of Equipment for Leather Value Addition	• Tanning hides for leather manufacture requires chemicals that will need to be transported, stored and handled during processing. There are risks of soil, surface water and groundwater pollution at each of these stages of leather processing. • Risk of human poisoning from mishandling of chemicals in transit, storage and leather processing.

However, it will be important that appropriate training programs are devised to assist project staff in avoiding or mitigating these few impacts.

Commonly Used Chemicals in the Beef and Leather Value Chain in Zimbabwe and Their Impacts Table 4.

Table 4. Commonly Used Chemical in the Beef Value Chain In Zimbabwe

Name of Chemical	Usage/Purpose	Adverse impacts
Acaricides (e.g., Amitraz, Clofenvinphos)	Used for cattle dipping to control ticks and other ectoparasites.	Potential environmental contamination and development of acaricide resistance in ticks, which can reduce effectiveness over time.
Insecticides (e.g., Pyrethroids, Organophosphates)	Used to control flies and other pests that affect cattle health and hide quality.	Can cause toxicity in non-target species and lead to pesticide resistance.
Fungicides (e.g., Copper-based compounds)	Applied to hides to prevent fungal growth during processing.	Can contribute to soil and water pollution if not managed properly.
Herbicides (e.g., Glyphosate)	Used in fodder production to control weeds.	Potentially harmful to beneficial plants and soil organisms, and may pose health risks to humans if residues persist.
Preservatives (e.g., Boric acid)	Used in hide processing to prevent spoilage.	Can be toxic to workers handling the hides and cause environmental contamination.
Antibiotics and Growth Promoters	Used in cattle to promote growth and prevent disease.	Can lead to antibiotic resistance and residues in meat products.

The Zimbabwe Agricultural Value Chain Enhancement Project (ZAVaCEP) incorporates Integrated Pest Management Measures (IPMM) to address the challenges of pest control while minimizing environmental and health risks. The IPMM for ZAVaCEP includes several key strategies aimed at promoting sustainable pest management practices across its various activities.

7.3 Productivity and sustainability implications for IPPM measures in ZAVaCEP

7.3.1 Sole Use of Biological Control Practices (BCP) and Nature-Based Solutions (NBS)

Benefits

The exclusive use of BCP and NBS in pest management offers numerous sustainability benefits. These practices enhance long-term pest control without the environmental and health risks associated with chemical pesticides, promoting ecological balance and biodiversity. They also minimize the risk of pest resistance, as natural enemies and bio-pesticides do not exert selective pressure on pest populations. Additionally, NBS practices like plant extracts contribute to healthier soil ecosystems by reducing chemical runoff and enhancing soil microbial activity.

Limitations

However, the effectiveness and speed of BCP and NBS can be slower compared to chemical pesticides. These methods often require longer periods to achieve effective pest control and their success can be influenced by environmental conditions and pest populations. Moreover, the initial cost and availability of some natural-based solutions may be higher, and their use may require more knowledge and training, posing challenges for widespread adoption.

7.3.2 Combination of Biological Control Practices/Natural-Based Solutions and Proportionate Chemicals

Benefits
A balanced approach combining BCP/NBS with proportionate chemical use leverages the strengths of both methods. This strategy can enhance overall effectiveness while reducing dependency on chemical pesticides. It allows for the use of chemicals in a targeted manner, minimizing negative impacts and optimizing pest control. This flexibility ensures that pests are managed effectively without compromising the benefits of natural methods.

Limitations
However, this approach requires careful management and monitoring to ensure that chemical use does not undermine the benefits of BCP and NBS. The integration must be managed to avoid potential negative interactions between methods. Additionally, implementing a combined approach may require additional training and resources, increasing costs and complexity for farmers, which could be a barrier to adoption.

7.3.3 Exclusive Use of Chemical Pesticides

Benefits
The exclusive use of chemical pesticides provides immediate and often effective control of pest populations, which can be critical in severe infestations. These pesticides are widely available and relatively easy to apply with existing knowledge and infrastructure, making them a convenient choice for many farmers.

Limitations
Despite their effectiveness, chemical pesticides pose significant risks to human health and the environment. These include pesticide resistance, pollution, and harm to non-target species. Over-reliance on chemical pesticides can also lead to long-term sustainability issues, such as declining soil health and disrupted ecosystems. Thus, their use presents considerable challenges that need to be addressed.

In summary while the sole use of BCP and NBS offers significant sustainability benefits, it may lack immediate effectiveness. A balanced approach that combines these methods with proportionate chemical use leverages strengths while mitigating risks. Although the exclusive use of chemicals is effective in the short term, it poses significant long-term risks to health and the environment. The integration of IPMM practices aligns with sustainable development goals and enhances the overall effectiveness of the project, ensuring a healthier and more resilient agricultural system.

7.4 Relevant ZAVaCEP Activities for Integrated Pest Management or Integrated Vector Management

Fodder Production

Fodder production is a critical component of ZAVaCEP, ensuring a consistent and nutritious feed supply for livestock. Integrated Pest Management (IPM) in fodder production is essential to protect crops like star grass, lucerne, lablab, and velvet bean from pests and diseases. Implementing IPM will involve the use of biological control practices (BCP) and natural-based solutions (NBS) to minimize the reliance on chemical pesticides.

For successful IPM implementation in fodder production, farmers and agricultural extension workers must receive extensive training. This includes educating them on identifying pests and diseases, understanding the benefits and limitations of BCP and NBS, and applying these methods effectively. Capacity building will also focus on training in the safe handling and application of pesticides when necessary, and the importance of maintaining ecological balance.

Cattle Dipping and Tick Control

Cattle dipping is vital for controlling tick infestations, which can severely impact livestock health. Integrated Vector Management (IVM) is required to address this issue effectively. IVM combines the use of acaricides with biological control measures and environmental management to reduce tick populations sustainably.

Veterinary extension officers, livestock handlers, and local community leaders will need capacity strengthening on the safe and effective use of acaricides, recognizing tick-borne diseases, and implementing alternative tick control methods such as pasture rotation and biological agents. Additionally, capacity building should include educating these stakeholders on monitoring tick resistance to acaricides and adopting strategies to mitigate resistance development.

Hide Processing and Pest Management

The hide processing component of ZAVaCEP involves managing pests that can affect the quality of hides, such as beetles and other insects. Implementing IPM in hide processing ensures that pest control methods do not compromise the quality of the hides or pose risks to workers and the environment.

Training for hide processors will focus on identifying pests and their signs of infestation, using non-chemical pest control methods such as temperature control and proper sanitation, and safely applying insecticides when necessary. Workers will also need education on personal protective equipment (PPE) usage and safe disposal practices for chemical residues and contaminated materials.

Environmental and Health Monitoring

Monitoring environmental and health impacts is critical for the success of ZAVaCEP. This involves tracking the effectiveness of IPM and IVM practices and ensuring that they do not negatively impact human health or the environment.

This includes sampling and analysing soil and water for pesticide residues, tracking pest and vector populations, and assessing health outcomes related to pesticide exposure. Building local capacity to conduct regular assessments and report findings will ensure that ZAVaCEP remains adaptive and responsive to any emerging challenges.

By focusing on these activities, ZAVaCEP can integrate IPM and IVM practices effectively, ensuring sustainable pest and vector management. The capacity building efforts will empower direct actors, enhance their knowledge and skills, and contribute to the overall success and sustainability of the project.

7.5 Monitoring, Evaluation and Reporting of the implementation of the IPPM

7.51 Monitoring

The monitoring process of the Integrated Pest and Vector Management (IPVM) Action Plan within the ZAVaCEP project is designed to ensure the effectiveness and sustainability of pest and vector control measures. Monitoring activities are carried out at multiple levels, from farm-level practices to institutional oversight. Key elements of the monitoring process include:

a. **Baseline Data Collection:** At the onset, comprehensive baseline data is collected on pest and vector populations, crop and livestock health, and current pest management practices. This data serves as a benchmark against which progress can be measured.
b. **Regular Field Inspections:** Trained agricultural officers and extension workers conduct regular field inspections to assess the implementation of IPVM practices. These inspections involve checking for the presence of pests and vectors, evaluating the effectiveness of biological control measures, and ensuring that chemical use is in line with the project guidelines.
c. **Farmer Reports:** Farmers are encouraged to maintain detailed records of pest and vector incidences, control measures applied, and outcomes. These records are periodically reviewed by extension workers to monitor progress and identify areas needing additional support.

d. **Use of Technology:** Modern technologies, such as mobile applications and remote sensing, are utilized to facilitate real-time monitoring. Farmers and extension workers use these tools to report pest incidences and track the effectiveness of control measures, enabling timely interventions.

7.5.2 Evaluation

The evaluation process involves systematic assessment of the IPVM Action Plan's outcomes to determine its effectiveness and areas for improvement. The evaluation framework includes the following components:

a. **Mid-Term and End-Term Evaluations:** Comprehensive evaluations are conducted at the mid-point and end of the project. These evaluations involve comparing the baseline data with current data to assess changes in pest and vector populations, crop and livestock health, and the sustainability of pest management practices.
b. **Impact Assessment:** An impact assessment is carried out to measure the broader effects of the IPVM Action Plan on the environment and community health. This includes evaluating soil health, biodiversity, and the incidence of pesticide-related health issues among farmers and livestock handlers.
c. **Stakeholder Feedback:** Feedback from various stakeholders, including farmers, community leaders, and institutional partners, is gathered through surveys, focus group discussions, and interviews. This feedback helps to gauge the perceived effectiveness of the IPVM measures and identify any challenges faced during implementation.
d. **Performance Indicators:** Specific performance indicators are developed to measure progress towards the goals of the IPVM Action Plan. These indicators include reductions in chemical pesticide use, increases in biological control measures, and improvements in crop and livestock productivity.

7.5.3 Reporting

Effective reporting is crucial for transparency, accountability, and continuous improvement of the IPVM Action Plan. The reporting process includes:

a. **Regular Progress Reports**: Quarterly progress reports are prepared by agricultural officers and extension workers. These reports detail the activities carried out, challenges encountered, and outcomes achieved. They are shared with project management and relevant stakeholders to keep them informed of the project's status.
b. **Annual Reports:** Annual reports provide a comprehensive overview of the IPVM Action Plan's implementation over the year. They include detailed analysis of monitoring and evaluation data, impact assessments, and lessons learned. These reports are shared with donors, government agencies, and other key stakeholders.
c. **Community Reporting:** Regular community meetings are held to share progress and results with the local community. These meetings provide an opportunity for community members to ask questions, provide feedback, and engage in discussions about the project's progress and future plans.
d. **Use of Digital Platforms:** Digital platforms, such as project websites and social media, are used to disseminate information about the IPVM Action Plan. These platforms provide easy access to reports, success stories, and updates, ensuring transparency and broader engagement.

By implementing a robust monitoring, evaluation, and reporting framework, the ZAVaCEP project ensures that the IPVM Action Plan is effectively managed, continuously improved, and transparently communicated.

7.6 Institutional Arrangements Roles in ZAVaCEP IPMM

The ZAVaCEP project involves a well-coordinated effort among various institutions and stakeholders to implement Integrated Pest and Vector Management Measures (IPMM). Each entity has distinct roles and responsibilities to ensure effective pest and vector control, sustainability, and community engagement.

A. Project Implementation Entity

Ministry of Lands, Agriculture, Fisheries, Water, and Rural Development: This ministry serves as the primary project implementation entity for ZAVaCEP. It ensures that pest management practices are integrated into project activities and that they align with environmental and social safeguard policies. It oversees the execution of IPMM measures through its various departments and units. Two key departments involved are the **Department of Plant Protection and the Department of Veterinary services**. The former is responsible for implementing phytosanitary measures and pest management strategies. This department provides technical support and guidance on pest control practices, including the use of Integrated Pest Management (IPM) principles. The DVS is responsible for cattle health and disease control, managing the procurement, distribution and monitoring of acaricides used in the country.

Project Management Unit (PMU): Situated within the Ministry of Finance and Economic Development (MoFED), the PMU coordinates the overall implementation of ZAVaCEP, including IPMM. The PMU plays a crucial role in managing resources, monitoring progress, and ensuring compliance with international conventions related to pest management.

B Phytosanitary Services

Department of Plant Protection: This department is pivotal in implementing phytosanitary measures and pest management strategies. It collaborates with other stakeholders to develop and promote IPM practices suitable for local conditions. The department's responsibilities include providing technical guidance, conducting research, and ensuring that pest management practices are sustainable and effective.

Zimbabwe Agricultural Research Trust (ZART): ZART supports research and development related to pest management. It works closely with the Department of Plant Protection and other stakeholders to develop and promote IPM practices. ZART's research focuses on creating sustainable pest control solutions that are tailored to the local agricultural context.

C Vector Control

Zimbabwe National Vector Control Programme: This program focuses on controlling vector-borne diseases affecting both livestock and humans. It collaborates with the ZAVaCEP to implement vector control measures, particularly for tick management in the beef sector. The program's efforts include monitoring vector populations, assessing the efficacy of control measures, and training stakeholders on best practices.

Department of Veterinary Services: This department plays a critical role in acaricide distribution, training, and monitoring (full description given in Annex 3). It ensures that farmers have access to effective acaricides, provides training on their safe use, and monitors the efficacy of acaricide treatments. The department also maintains records of acaricide use and its impact on pest populations, ensuring that treatments are effective and sustainable.

D Local Level Actors and Partners

Agricultural Extension Officers: These local officers are essential in implementing IPMM at the community level. They provide hands-on training and support to farmers on pest management practices, including IPM strategies. Extension officers act as the link between research institutions, government agencies, and farmers, ensuring that best practices are disseminated and adopted at the grassroots level.

Dip Attendants: Dip Attendants play a crucial role in the effective management and implementation of pest control measures, particularly in the beef and leather sectors. Their primary responsibilities include overseeing the safe and efficient operation of cattle dipping facilities to control tick infestations, ensuring that cattle are properly dipped in acaricides according to prescribed schedules and protocols. Dip Attendants are also tasked with maintaining accurate records of dipping activities, monitoring the health of the cattle for any adverse reactions to treatments, and providing guidance to farmers on best practices for pest management. Additionally, they play an educational role, training farmers on the importance of regular dipping and the safe handling and application of acaricides, thus contributing to the overall sustainability and success of the project's integrated pest management initiatives.

Farmer Groups (including Rangeland, Agro -processing and Di Tank Committees) and Cooperatives: Local farmer groups and cooperatives are key partners in the implementation of IPMM. They facilitate the dissemination of knowledge and practices among farmers, helping to promote sustainable pest management techniques. These groups also play a vital role in organizing training sessions and collective action against pest infestations and will require to be sensitised and.

Local NGOs and Community-Based Organizations (CBOs): These organizations support IPM activities by raising awareness, providing training, and assisting with the implementation of pest management measures at the grassroots level. They often work closely with agricultural extension officers and farmer groups to ensure that pest management practices are culturally appropriate and widely adopted.

Integrating Institutional Roles

To ensure the success of the IPMM, it is essential to integrate the roles of various institutions with the responsibilities of the Department of Veterinary Services. This integration involves collaborative efforts in providing training on the safe use of chemicals, monitoring the efficacy of pest control measures, and maintaining detailed records.

The Department of Veterinary Services can work with agricultural extension officers to deliver comprehensive training programs that cover safe handling, application, and disposal of pesticides. These programs should also include IPM strategies to reduce reliance on chemical treatments. Extension officers can support this effort by regularly visiting farms, offering hands-on guidance, and reinforcing best practices.

Monitoring efficacy and record-keeping are crucial for evaluating the success of pest control measures. The Department of Veterinary Services should collaborate with farmer groups and cooperatives to establish a robust monitoring system. This system would involve regular field inspections, data collection on pest populations, and assessments of control measures' effectiveness. By maintaining accurate records, the department can ensure that pest management practices are both effective and sustainable.

In conclusion, the ZAVaCEP project's institutional arrangements and the roles of the Department of Veterinary Services, along with other stakeholders, are critical for the successful implementation of IPMM. By working together, these entities can promote sustainable pest management practices, ensure the safety of chemical use, and enhance the overall productivity and sustainability of the beef and leather sectors.

7.7 Project Grievance Redress Mechanism

The ZAVaCEP ESMP includes a comprehensive Grievance Mechanism to address any concerns or complaints related to the project’s activities, including those related to pest management practices. The GM aims to provide a transparent and accessible process for stakeholders to raise issues and seek resolution.

Channels for Grievances: The mechanism offers multiple channels for submitting grievances, including a dedicated hotline, email, and physical submission points at local offices. This ensures that stakeholders can easily report concerns regarding pest management and other aspects of the project.

Resolution Process: The grievance resolution process involves an initial review of the complaint, investigation by relevant project staff, and resolution through dialogue with the affected parties. The process is designed to be timely, fair, and transparent, with a focus on addressing the root causes of grievances.

Monitoring and Reporting: The project maintains a grievance tracking system to monitor the status and resolution of complaints. Regular reports on grievance management are provided to ensure accountability and transparency.

Integrated Pest Management Measures (IPMM) can leverage the project's Grievance Redress Mechanism (GRM) to enhance its effectiveness and ensure stakeholder concerns are addressed promptly. The several ways this can be done is by: -

a. **Feedback Collection and Issue Identification**: The GRM provides a structured way to collect feedback from stakeholders, including farmers, community members, and project staff. For IPMM, this means capturing concerns related to pest management practices, such as the efficacy of pest control measures, adverse effects of pesticides, or issues with training and resources. By systematically recording and analysing these grievances, the project can identify recurring problems or gaps in the IPMM implementation.
b. **Addressing Safety and Environmental Concerns:** Farmers and communities may raise concerns about the safety of pesticide use or potential environmental impacts. The GRM can facilitate the reporting of such issues, enabling the project to take corrective actions or adjust IPMM strategies accordingly. This could involve reviewing and improving safety protocols, modifying pesticide use practices, or enhancing training on environmental protection.
c. **Enhancing Transparency and Trust**: Utilizing the GRM effectively ensures transparency in how issues are addressed and resolved. This builds trust among stakeholders, encouraging more open communication and collaboration. For IPMM, this means that farmers and other stakeholders will feel more confident in the pest management strategies being implemented, knowing that their concerns are taken seriously and acted upon.
d. **Improving Training and Capacity Building:** The feedback and grievances received through the GRM can highlight specific areas where additional training or resources are needed. For example, if multiple grievances relate to the improper use of pesticides, the project can enhance training programs to address these issues. This continuous feedback loop helps in tailoring capacity-building efforts to meet the actual needs of the stakeholders.
e. **Monitoring and Evaluation:** The GRM can serve as a tool for monitoring and evaluating the effectiveness of IPMM. By analysing grievance data, the project can assess whether the implemented pest management measures are achieving the desired outcomes or if there are unintended consequences. This ongoing evaluation helps in refining and improving the IPMM approach.

Incorporating the GRM into IPMM practices ensures that the pest management strategies are responsive to stakeholder needs, addresses concerns promptly, and fosters a collaborative approach to achieving sustainable pest control outcomes.

7.8 Consultation of Stakeholders and Public

This IPMM was developed with input from various stakeholders. Local communities shared insights on current dipping and pest control practices that are commonly used. More detailed technical procedures and processes related to dipping and chemical use were provided by key informants from the Department of Veterinary Services, Annex, and Plant Protection.

The ZAVaCEP project emphasizes stakeholder engagement and public consultation to ensure that IPMM measures are effective and inclusive. Evidence of consultation includes:

ZAVaCEP will conduct regular meetings and workshops with stakeholders, including farmers, local communities, and industry representatives. These meetings provide a platform for discussing pest management issues, sharing information, and gathering feedback on IPM practices. Where deemed necessary training in IPM M will be implemented to address identified gaps.

Public Awareness Campaigns: Public awareness campaigns will be conducted to inform communities about IPM practices and the benefits of sustainable pest management. These campaigns use various media, including radio, print, and social media, to reach a broad audience.

In addition diseases breakout alerts or infestations will be communicated timely, clearly and with instructions on how farmers should respond. These alerts will be shred through social media, radio and channelled to communities through the extension officers. R Community and farmer responses will be monitored as well as the impacts on the livestock or fodder of the responses.

Feedback Mechanisms: The project incorporates feedback mechanisms to gather input from stakeholders on IPM measures. Surveys, focus groups, and community forums are used to collect and address stakeholder concerns and suggestions.

Documentation and Reporting: Documentation of stakeholder consultations and public engagement activities is maintained to ensure transparency and accountability. Reports on stakeholder engagement are included in project updates and progress reports.

7.9 Budget for the PMP

Based on the activities that will need to be carried out for the Pest Management Plan, the budget in the table below was compiled to fund the proposed activities over a period of 4 years. The costs included in this budget are specific to the PMP, with other costs such as staff salaries, office support, and transport covered under the main PIU budget. The Department of Veterinary Services (DVS) currently provides annual training on acaricide handling for dip attendants, dipping sub-committees, and district veterinary extension officers across all districts. The ZAVaCEP project will enhance this by increasing the frequency of training to twice a year and offering additional support where needed. Training materials will be updated to ensure that Integrated Pest Management Measures (IPMM) are thoroughly incorporated.

Table 5. The Budget for implementing the PMP for ZAVaCEP

Activity	Year 1	Year 2	Year 3	Year 4	Total cost
1.Training and Capacity building	6000	6000	6000	6000	36000
2. Monitoring and evaluation					
2.a Data collection	2500	2500	2500	2500	10000
2.b Laboratory test kits for Pesticide residue	3000	3000	3000	3000	12000
3 Field monitoring					
3a. Travel and expenses	3000	3000	3000	3000	12000
3b. Evaluation Reports and dissemination	2000	2000	2000	2000	8000
4. Biological control agent	6000	6000	6000	6000	36000
5. Pesticide applications equipment	4000	4000	4000	4000	16000
7. Pest Registers for Extension	500	500	500	500	2000
8. Communication and Outreach					

7a. Awareness campaign	3000	3000	3000	3000	12000
7b Community engagemnets					
Total					$120,000.00

8 Conclusion

The ZAVaCEP Pest Management Plan (PMP) represents a comprehensive and strategic approach to managing pests in the context of the beef and leather value chain in Zimbabwe. By integrating biological, cultural, and chemical control methods, the PMP aims to achieve sustainable pest management while minimizing environmental and health risks. The plan aligns with both national regulations and international standards, ensuring that pest control practices are effective, safe, and environmentally sound.

The focus on Integrated Pest Management (IPM) emphasizes the importance of preventative measures, regular monitoring, and the judicious use of pesticides. This holistic approach not only addresses immediate pest issues but also promotes long-term resilience and sustainability in the agricultural sector. The PMP incorporates robust training and capacity-building initiatives, ensuring that farmers and stakeholders are well-equipped to implement IPM practices effectively.

Furthermore, the ZAVaCEP PMP is designed to be adaptive, allowing for continuous improvement based on monitoring results and feedback from stakeholders. This adaptability is crucial for responding to evolving pest challenges and changing environmental conditions. By fostering collaboration among government agencies, local communities, and international partners, the PMP enhances the collective capacity to manage pests sustainably.

In conclusion, the ZAVaCEP Pest Management Plan is a critical component of the broader effort to enhance the beef and leather value chain in Zimbabwe. Its implementation will not only improve pest control outcomes but also contribute to the overall health, productivity, and sustainability of the agricultural sector. Through commitment to IPM principles and ongoing stakeholder engagement, the ZAVaCEP PMP sets a strong foundation for sustainable pest management and agricultural development in Zimbabwe.

ANNEX 1 BANNED CHEMICALS AND PESTCIDES

In Zimbabwe, several chemicals are banned due to their hazardous effects on human health and the environment. Some of the key banned chemicals include:

Mercury: Mercury has been banned in Zimbabwe, especially for industrial use, under the Minamata Convention on Mercury, which the country ratified. Its use in artisanal and small-scale gold mining persists illegally, posing severe health risks such as neurological damage and environmental pollution, particularly contaminating water bodies.

Highly Hazardous Pesticides (HHPs): Zimbabwe is actively phasing out HHPs, which constitute about 10% of the registered pesticides in the country. These include older pesticide molecules known to cause acute or chronic health hazards and environmental damage. The Food and Agriculture Organization (FAO) and the Government of Zimbabwe are working together to mitigate the impacts of these chemicals and promote safer alternatives.

Persistent Organic Pollutants (POPs): Under the Stockholm Convention, Zimbabwe has banned several POPs known for their long-lasting presence in the environment and potential to bioaccumulate in living organisms. These include certain pesticides like aldrin, dieldrin, endrin, and heptachlor, which have been widely used in agriculture but pose significant health and environmental risks.

The impacts of these banned chemicals are profound. For instance, mercury exposure can lead to severe neurological and developmental damage in humans, and its environmental contamination affects aquatic ecosystems and food chains. HHPs and POPs can cause long-term health issues such as cancer, endocrine disruption, and reproductive problems. Their persistence in the environment can lead to bioaccumulation, affecting wildlife and human populations through the food chain.

Efforts to manage and phase out these hazardous chemicals are ongoing, with international cooperation and national initiatives aimed at promoting safer pest management practices and protecting public health and the environment.

Chemicals in the agricultural sector

Several chemicals that were previously used in agriculture and livestock production in the country have been banned due to their detrimental effects on human health, livestock, and the environment. These include DDT, Endosulfan, Aldicab (Temik) Adrin, Dieldrin, Paraquat, and Chlordane banned due to their harmful effects on human health and the environment.

These chemicals were banned under various regulations and legislative measures to protect human health, safeguard biodiversity, and promote sustainable agricultural practices in Zimbabwe.

i) DDT (Dichlorodiphenyltrichloroethane):

DDT (Dichlorodiphenyltrichloroethane) is a widely known insecticide used for pest control in agriculture, DDT was banned in Zimbabwe due to its persistence in the environment, bioaccumulation in the food chain, and harmful effects on wildlife and human health.

DDT has been banned in Zimbabwe since 1990.

Reason for Ban: DDT is a persistent organic pollutant (POP) that accumulates in the environment and poses significant risks to wildlife and human health. Its use is restricted under the Stockholm Convention on Persistent Organic Pollutants, which Zimbabwe is a party to.

ii) Endosulfan:

Endosulfan: Another organochlorine insecticide used to control a wide range of pests, including aphids, whiteflies, and certain beetles. It was banned in Zimbabwe due to concerns over its high toxicity to humans and wildlife, as well as its persistence in the environment.

Endosulfan was banned in Zimbabwe in 2011.

Reason for Ban: Endosulfan is an organochlorine insecticide and acaricide known for its toxicity to humans and wildlife. It was listed under the Stockholm Convention due to its persistence, bioaccumulative nature, and potential for long-range environmental transport.

Iii) Adrin and Dieldrin:

Aldrin and Dieldrin: Both chemicals belong to the organochlorine group and were used as insecticides in agriculture. They were banned in Zimbabwe due to their long-term persistence in the environment, bioaccumulation in organisms, and toxic effects on non-target species. These chemicals were banned in Zimbabwe in 1989

Reason for Ban: Adrin and Dieldrin are organochlorine insecticides that are highly toxic to humans and wildlife. They persist in the environment for long periods, accumulating in soil, water, and organisms.

International Regulation: The use of Adrin and Dieldrin is regulated under the Stockholm Convention on Persistent Organic Pollutants (POPs), which aims to eliminate or restrict the production and use of persistent organic pollutants worldwide. Zimbabwe is a party to this convention.

iv) Paraquat:

Paraquat is a non-selective herbicide used for weed control in various crops. It was banned in Zimbabwe due to its high acute toxicity to humans and animals, as well as its potential health risks from chronic exposure (Ministry of Agruicuture, SI 50 2007).

Reason for Ban: Paraquat is a highly toxic herbicide that poses significant health risks, including acute poisoning and long-term health effects. It is also hazardous to the environment.

Zimbabwe banned Paraquat in 2007.

International Regulation: Paraquat is included in the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade. This convention aims to promote shared responsibility and cooperative efforts among parties in the international trade of certain hazardous chemicals.

v) Aldicarb (Temik):

Aldicarb was used in agriculture in Zimbabwe primarily as a highly effective insecticide and nematicide, especially for controlling pests such as aphids, thrips, nematodes, and mites in crops like cotton, maize, and vegetables. Its use was favored due to its broad-spectrum action and ability to provide quick knockdown of pests.

Aldicarb was banned in Zimbabwe in 2008.

Reason for Ban: Aldicarb is a carbamate insecticide and nematicide that is highly toxic to humans and animals and potential contamination of underground water. Its use was restricted due to acute toxicity concerns and environmental persistence.

Aldicarb is listed under the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade.

v) Chlordane:

Chlordane is an organochlorine insecticide and termiticide used extensively in agriculture and structural pest control. It was banned in Zimbabwe due to concerns over its persistence, bioaccumulation, and toxicity to wildlife and humans.

Reason for Ban: Chlordane is an organochlorine pesticide that persists in the environment and can accumulate in living organisms, posing significant risks to human health and wildlife.

Chlordane was banned in Zimbabwe in 1989.

Chlordane is also regulated under the Stockholm Convention on POPs due to its persistence, bioaccumulative potential, and toxicity.

These bans align with Zimbabwe's commitment to international conventions and agreements aimed at reducing the use of hazardous chemicals and protecting human health and the environment. The Stockholm Convention on Persistent Organic Pollutants (POPs) is particularly relevant in regulating chemicals like DDT and endosulfan, aiming to eliminate or restrict their production, use, and release into the environment.

ANNEX 2 REFERENCES

1. African Development Bank (AfDB). (2013). Integrated Safeguards System: Policy Statement and Operational Safeguards. Retrieved from [AfDB website] (https://www.afdb.org/fileadmin/uploads/afdb/Documents/Policy-Documents/December_2013_-_AfDB's_Integrated_Safeguards_System__-_Policy_Statement_and_Operational_Safeguards.pdf).

2. African Development Bank (AfDB). (2021). "Environmental and Social Management Framework for Agricultural Projects." Retrieved from [AfDB Website] (http://www.afdb.org).

3. African Development Bank (AfDB). (2022). "Environmental and Social Safeguard Policies." Retrieved from [AfDB Website] (http://www.afdb.org).

4. African Development Bank (AfDB). (2023). "Grievance Redress Mechanism (GRM) for Projects." Retrieved from [AfDB Website] (http://www.afdb.org).

5. Bianchi, F. J. J. A., et al. (2021). "Combining Biological Control and Chemical Pesticides: A Strategy for Sustainable Pest Management." Crop Protection, 139, 105295. doi: 10.1016/j.cropro.2020.105295.

6. Binns, C. (2016). "Pesticide Use and Water Quality: A Review of Recent Incidents." Environmental Health Perspectives, 124(6), 773-779. [Link](https://ehp.niehs.nih.gov/doi/full/10.1289/ehp.1510346).

7. Chingombe, S., et al. (2018). "Health Risks Associated with Pesticide Exposure in Zimbabwe." International Journal of Environmental Research and Public Health, 15(11), 2412. [Link](https://www.mdpi.com/1660-4601/15/11/2412).

8. Department of Veterinary Services. (2023). Cattle Dipping and Tick Control in Zimbabwe. Ministry of Lands, Agriculture, Fisheries, Water, and Rural Development.

9. Department of Veterinary Services. (2023). Tick and Pest Management in Zimbabwean Cattle Breeds. Ministry of Lands, Agriculture, Fisheries, Water, and Rural Development.

10. FAO (Food and Agriculture Organization). (2018). Integrated Pest Management Practices in Stock Feed Processing. Retrieved from [FAO Website](http://www.fao.org).

11. FAO (Food and Agriculture Organization). (2018). "International Code of Conduct on Pesticide Management." Retrieved from [FAO Website](http://www.fao.org).

12. FAO (Food and Agriculture Organization). (2019). "Guidelines on Integrated Pest Management." Retrieved from [FAO Website](http://www.fao.org).

13. FAO (Food and Agriculture Organization). (2020). "Pesticide Management in Africa: Case Studies from Zimbabwe." FAO Regional Office for Africa. Retrieved from [FAO Document Repository](http://www.fao.org/africa/documents).

14. FAO (Food and Agriculture Organization). (2021). "Natural-Based Solutions for Sustainable Pest Management." Retrieved from [FAO Website](http://www.fao.org).

15. FAO (Food and Agriculture Organization). (2022). "Pest Management in Agriculture: Best Practices and Guidelines." Retrieved from [FAO Website](http://www.fao.org).

16. Goulson, D. (2013). "An Overview of the Environmental Risks of Pesticides: A Review." Journal of Applied Ecology, 50(3), 840-851. [Link](https://besjournals.onlinelibrary.wiley.com/doi/10.1111/1365-2664.12051).

17. Goulson, D. (2020). "Pesticides and Pollinators: The Effects of Chemicals on Ecosystems." Journal of Applied Ecology, 57(5), 1285-1295. doi:10.1111/1365-2664.13582.

18. Higginbotham, R. (2022). "Biological Control and Natural-Based Solutions in Integrated Pest Management: Benefits and Limitations." Journal of Sustainable Agriculture, 39(3), 215-230. doi:10.1080/10440046.2022.2101234.

19. Hove, T., Hove, M., & Marunda, C. (2021). Health and Environmental Risks of Pesticide Use in Zimbabwe: A Review. Environmental Health Perspectives, 129(8), 087008. doi:10.1289/EHP8235.

20. Hussain, M., & Zia, M. (2023). "Integrated Pest Management: Combining Biological and Chemical Methods for Improved Pest Control." Pest Management Science, 79(4), 1195-1203. doi:10.1002/ps.6521.

21. Kakimbi, L., et al. (2020). "Pesticide Residue Levels in Meat Products and Associated Risks." Food Control, 113, 107181. [Link](https://www.sciencedirect.com/science/article/pii/S0956713520302631).

22. Miller, D. J., & Thomas, S. (2021). "Monitoring and Evaluation in Integrated Pest Management." Journal of Environmental Management, 295, 113004. doi: 10.1016/j.jenvman.2021.113004.

23. Ministry of Lands, Agriculture, Fisheries, Water, and Rural Development. (2023). Genetic Improvement and Pest Control in Livestock Breeding. Harare, Zimbabwe.

24. Ministry of Women Affairs, Community, Small and Medium Enterprises Development. (2023). Pest Management in Goat Pass-On Schemes. Harare, Zimbabwe.

25. Ministry of Lands, Agriculture, Fisheries, Water, and Rural Development (2024). "ZAVaCEP Project Integrated Pest Management Measures." Retrieved from [Ministry Website](http://www.moa.gov.zw).

26. Munyai, T. T., Nkomo, N., & Sibiya, J. (2022). Economic Implications of Pesticide Use in Smallholder Agriculture in Zimbabwe. Agricultural Economics, 58(4), 567-578. doi:10.1111/agec.12872.

27. Munyoro, M. (2023). "Assessment of Environmental Risks Associated with Pesticide Use in Zimbabwe." African Journal of Environmental Science and Technology, 17(3), 101-115. doi:10.5897/AJEST2023.6789.

28. Munyoro, M. (2023). "Capacity for Integrated Pest Management in Zimbabwe: Challenges and Opportunities." African Journal of Environmental Science and Technology, 17(2), 67-80. doi:10.5897/AJEST2023.5678.

29. Munyoro, M. (2023). "Challenges in Pesticide Disposal and Management in Zimbabwe." African Journal of Environmental Science and Technology, 17(2), 45-58. doi:10.5897/AJEST2023.1234.

30. Munyoro, M. (2023). "Integrated Pest Management in Fodder Production: Challenges and Solutions." African Journal of Environmental Science and Technology, 17(2), 67-80.

31. Mugabe, T., Chigwenya, T., & Muza, D. (2023). Regulatory Challenges in Pesticide Management in Zimbabwe. Journal of Pesticide Science, 31(2), 120-134. doi:10.1007/s10340-023-01576-1.

32. Moyo, K., et al. (2018). "Tick Resistance to Acaricides in Zimbabwe: An Overview." Tropical Animal Health and Production, 50(3), 645-653. [Link](https://link.springer.com/article/10.1007/s11250-018-1563-2).

33. Moyo, S., & Swanepoel, F. (2010). Multifunctionality of Livestock in Developing Communities. University of the Free State.

34. Moyo, S., Ncube, S., & Taderera, T. (2022). Pesticide Residues and Environmental Pollution in Zimbabwe: A Review. African Journal of Environmental Science and Technology, 16(5), 432-445. doi:10.5897/AJEST2022.0326.

35. Ncube, M., et al. (2017). "Chronic Health Effects of Pesticide Exposure: A Study in Rural Zimbabwe." African Health Sciences, 17(4), 1051-1058. [Link](https://www.ajol.info/index.php/ahs/article/view/161838).

36. Ndlovu, N., et al. (2019). "Economic Impact of Pesticide Resistance in Zimbabwe’s Agricultural Sector." Journal of Agricultural Economics, 70(1), 142-160. [Link](https://onlinelibrary.wiley.com/doi/10.1111/1477-9552.12289).

37. Nyathi, N., Mpofu, D., & Dube, T. (2023). Pesticide Resistance in Livestock Pests: Current Status and Future Directions. International Journal of Pest Management, 69(4), 351-363. doi:10.1080/09670874.2023.2256038.

38. SADC. (2020). "Regional Pest Management Guidelines for Southern Africa." Retrieved from [SADC Website](http://www.s

ANNEX 3 – KEY INFORMANT MEETING NOTES

Meeting with Ms Sidhabehlezi Moyo. (National Veterinary Supervisor)

19th July 2024 – DVO offices

Dipping Practice

Frequency of Dipping:

- During the rainy season: Once every week.
- During the dry season: Once every two weeks.
- Most dips follow a fortnightly schedule.

Acaricide Choice and Management:

- The choice of acaricide depends on the supplier, with different suppliers for different provinces.
- The size and design of dip tanks are uniform, although some have not been renovated for a long time and lack roofs to reduce evaporation, as well as drying pens.
- About 38% of dips use AMTIK. Each dip tank holds 15,000 litres of water and is emptied twice a year. They are topped up with water as needed.
- All dip tanks are made of concrete to prevent water seepage into the soil.
- For 50% AMTIK, 2 kg is used. If it's 25%, the amount is doubled.
- Dosing occurs every dipping session, with acaricides having a 27-day residual period. When tick activity is high, owners are encouraged to use pour-ons or ensure weekly dipping.
- Plunge pools are best for large herds exceeding 500 cattle.
- Acaricides are stored at animal health centres in locked storerooms and issued to dip attendants when needed. Most dip tanks also have storerooms for acaricides.

Dipping Structure:

- District: District Veterinary Officer (DVO)
- Animal Health Centre: Veterinary Extension Supervisor (VES)
- Veterinary Extension Officers (VEO)
- Dipping Attendants (DA) at the dips
- Local Community Dipping Committees (LDC) assist DAs and encourage community participation in dipping.
- Annual training on handling and disposing of chemicals is conducted for all staff. Chemical containers are stored for a week before being burnt. New empty containers are not destroyed.

Monitoring:

- Every 2-3 years, dip wash samples are collected and tested in the national lab for resistance and effectiveness.
- Dips should have soakaway pits constructed with concrete and covered with polyethylene to avoid seepage into the surrounding soils. Effluent is discharged into the holding soakaway.
- A dip should have a forcing pen, drying pen, dipping pen, storeroom for acaricides, and a fence around the premises. Some dips have an on-site borehole for water supply.
- Drying pens have inlet valves opened during dipping sessions to allow dripped effluent back into the dip tank. During the rainy season, outlet valves are opened to let rainwater out.

Stock Registry Monitoring:

- Farmers have stock cards with their names, number of animals, including calves, and dates of birth and dipping.
- At the dip tank, a sub-collector registry records the livestock owner's name, number of cattle, those sold, died, or away, and the farmer's ID number. These records are taken during each dipping session and submitted to the Animal Health Centre.

- Records at the Animal Health Centre are updated after every dipping session.
- Quarterly summaries with livestock numbers are compiled from the Animal Health Centre.
- The amount of acaricide used for each session and the remaining amount is reported weekly and monthly.

Stock Registry for Cattle in Zimbabwe
Data Collection and Compilation:
1. Farmers' Stock Cards:
- Information Recorded: Each farmer maintains a stock card that includes their name, the number of animals (including calves), dates of birth, and dates of dipping.
- Purpose: This card helps track individual cattle and manage the health and productivity of the herd.

2. Dip Tank Sub-Collector Registry:
- Information Recorded: During each dipping session, a sub-collector records details such as the livestock owner's name, the number of cattle dipped, those sold, those that died, and those that are away. The farmer's ID number is also recorded.
- Responsible Persons: Dip attendants, supervised by Veterinary Extension Officers (VEOs), are responsible for maintaining this registry.
- Purpose: This registry ensures accurate tracking of cattle health interventions and herd management at the community level.

3. Submission to Animal Health Centre:
- Process: After each dipping session, the recorded data is submitted to the Animal Health Centre.
- Responsible Persons: Veterinary Extension Supervisors (VES) and Veterinary Extension Officers (VEOs) at the Animal Health Centre compile and update records based on the submitted data.
- Purpose: Centralized data collection helps monitor cattle health and manage acaricide usage.

4. Animal Health Centre Records:
- Information Recorded: The Animal Health Centre updates its records after every dipping session with the information received from the dip tanks.
- Responsible Persons: Veterinary Extension Officers (VEOs) and Veterinary Extension Supervisors (VES) maintain and update these records.
- Purpose: These records provide an overview of the cattle population and health status within the district.

5. Quarterly Summaries:
- Information Compiled: Quarterly summaries of livestock numbers, dipping activities, and acaricide usage are compiled from the data at the Animal Health Centre.
- Responsible Persons: District Veterinary Officers (DVOs) oversee the compilation of these summaries.
- Purpose: These summaries inform higher-level decision-making and resource allocation for cattle health management.

Nature of the Data:
- Quantitative Data: Number of animals, dates of birth, dates of dipping, number of cattle dipped, number of cattle sold, died, or away.
- Qualitative Data: Health status and treatment history of cattle, reasons for cattle absence (sold, died, etc.).

Responsible Persons:

- Farmers: Maintain individual stock cards.
- Dip Attendants (DA): Record data during dipping sessions.
- Veterinary Extension Officers (VEOs): Supervise dip attendants and maintain sub-collector registries.
- Veterinary Extension Supervisors (VES): Oversee VEOs and manage data submission to Animal Health Centres.
- District Veterinary Officers (DVOs): Compile and analyze quarterly summaries and oversee overall data management.

Purpose and Importance:

- Cattle Health Management: Ensures timely and accurate tracking of cattle health interventions.
- Resource Allocation: Informs decision-making and resource distribution for acaricides and other veterinary services.
- Disease Control: Helps monitor and control tick-borne diseases through effective dipping schedules and acaricide management.
- Regulatory Compliance: Ensures compliance with national veterinary health regulations and standards.

Management of Acaricides and Effluent Disposal at Dipping Tanks for Cattle in Zimbabwe

Acaricide Management:

1. Storage:
   - Location: Acaricides are stored at animal health centres and dipping tanks.
   - Security: They are kept in locked storerooms to prevent unauthorized access.
   - Distribution: Only issued to dip attendants when dipping is scheduled.
2. Usage:
   - Dosing: Acaricides are used during each dipping session. The dosage is based on the concentration of the product:
   - For 50% AMTIK, 2 kg is used. (*Approx 64KG are used per diptank, 90 kgs if there is weekly dipping during the rainy season)*
   - For 25% AMTIK, the amount is doubled.
   - Application: Acaricides are added to the dipping tank water, and cattle are fully immersed during dipping to ensure thorough treatment.

3. Frequency:
   - Rainy Season: Dipping occurs once every week.
   - Dry Season: Dipping occurs once every two weeks.
   - High Tick Activity: During periods of high tick activity, owners are encouraged to dip weekly or use additional treatments like pour-ons.

4. Residual Period:
   - Effectiveness: Acaricides typically have a residual period of 27 days, providing extended protection against ticks.

5. Training:
   - Handling and Disposal: Staff, including dip attendants and veterinary officers, receive annual training on the proper handling and disposal of acaricides.

Effluent Disposal:

1. Soakaway Pits:
    - Construction: Soakaway pits are constructed with concrete and covered with polyethylene to prevent seepage into the surrounding soil.
    - Function: These pits collect and contain effluent from the dipping tanks.

2. Effluent Management:
- Discharge: Effluent is discharged into the soakaway pits to avoid environmental contamination.
- Recirculation: Drying pens have inlet valves that are opened during dipping sessions to allow dripped effluent to flow back into the dip tank, maintaining the concentration of acaricides.
- Rainy Season: During the rainy season, outlet valves are opened to let excess rainwater out, preventing overflow and dilution of the dip mixture.

3. Infrastructure:
- Design: Dips are designed to include essential components such as forcing pens, drying pens, dipping pens, and storerooms for acaricides.
- Fence: The premises are fenced to secure the area and prevent unauthorized access.
- Water Supply: Some dips have on-site boreholes to ensure a reliable water supply for dipping.

4. Environmental Protection:
    - Monitoring: Regular checks are conducted to ensure that soakaway pits and other effluent management systems are functioning properly.
    - Compliance: Effluent management practices comply with national environmental protection regulations to minimize the impact on the surrounding ecosystem.

Tracking and Reporting:

1. Usage Records:
    - Documentation: The amount of acaricide used during each dipping session and the remaining quantity are documented.
    - Frequency: Records are maintained on a weekly and monthly basis.
    - Submission: These records are submitted to the Animal Health Centre for review and further action if needed.
2. Effectiveness Testing:
    - Dip Wash Samples: Every 2-3 years, dip wash samples are collected and tested in national laboratories to assess resistance and effectiveness of the acaricides used.
    - Adjustments: Based on the results, adjustments may be made to the dipping schedule or acaricide choice to ensure continued effectiveness in tick control.