Ethiopian Veterinary Association
Golden Jubilee Special Edition Magazine

October 2024
Addis Ababa, Ethiopia

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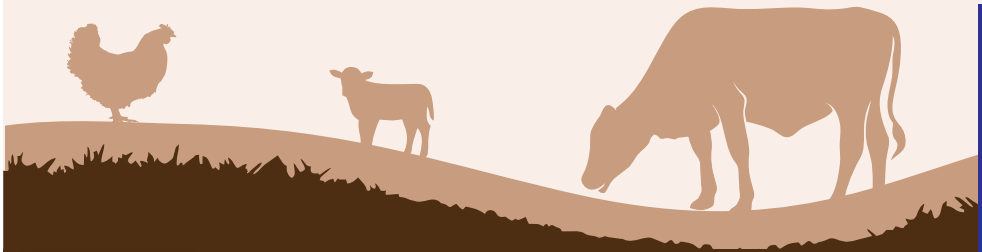

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In this special edition

VÉTÉRINAIRES SANS FRONTIÈRES SUISSE
member of VSF International

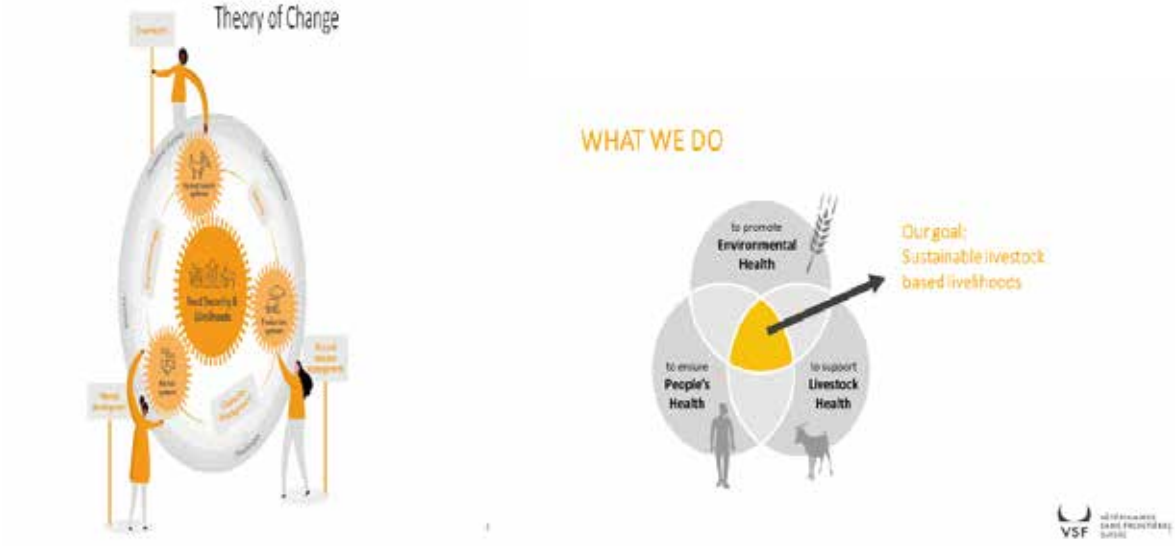
Vétérinaires Sans Frontières – Switzerland (VSF-Suisse) is a development-oriented, politically and religiously neutral non-profit international non-governmental organization (INGO) headquartered in Berne, Switzerland. It has Country Offices in Togo, Mali, South Sudan, Kenya, Somalia, and Ethiopia. VSF-Suisse began its work in Ethiopia in 2010 as a Foreign Charity, implementing resilience-building, disaster-risk reduction, animal health, and nutrition-sensitive humanitarian interventions.

In addition to its action in the range of livestock-based livelihoods and animal health services, it has strong recognition for its expertise in linking agricultural and livestock interventions to community-based nutrition and One Health, which has remained its flagship program since it has been operational in the Somali Region of Ethiopia. In this regard, results from shorter-term emergency interventions have demonstrated longer-term nutritional impacts, and many of the organization's projects have consequently been extended and scaled up. VSF-Suisse has always been on the front line of emergency response, recovery, and rehabilitation of pastoral and agro-pastoral communities in the Somali and Oromia regional states. It has successfully partnered with several donors and UN agencies to implement projects of similar scope and objectives.

VSF-Suisse has maintained a high-caliber staff at all levels of the organization. It prides itself on having a strong, locally based team that is well embedded in the heart of our beneficiary communities and well-networked with all our key partners and stakeholders locally and internationally.

VISION: Healthy people derive their livelihoods from healthy livestock in a healthy environment.

MISSION: To improve vulnerable populations' well-being and resilience by promoting their livestock's health and productivity within a healthy environment.



Rural development, resilience building, health, and capacity building are the four major areas at the center of VSF-Suisse's implementation strategy.

1. VSF-Suisse works to enhance rural development and improve food sovereignty, nutrition security, and livelihoods by improving agricultural and livestock production, product value chains, and livelihood diversification.
2. Through its work with communities on disaster risk reduction, conflict resolution, natural resource management, and the integration of emergency response activities when required, VSF-Suisse strengthens community resilience to shocks and disasters.
3. VSF-Suisse works to improve animal and human health by improving accessibility, availability, and affordability of public and private service delivery, strengthening awareness and control of endemic and emerging diseases and zoonosis, and improving linkages between environmental, human, and animal health via the *One Health* approach.
4. Capacity building is the central theme of all VSF-Suisse's activities, as informed and empowered communities are key to resilience and independence.

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Office Address of Ethiopia Country Office

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Addis Abeba, Ethiopia

Background

Vétérinaires Sans Frontières Germany (VSF-Germany) established in 1991 at Veterinary School of Hannover, Germany and registered in Ethiopia as a foreign organization since 2010 and providing humanitarian aid and development assistance to pastoralists, agro-pastoralists, and vulnerable communities whose livelihoods depend on livestock. VSF- Germany has been working in the Greater Horn of Africa since 1998 and currently operates in six countries: Ethiopia, Kenya, Somalia, South Sudan, Sudan and Uganda. VSF Germany in Ethiopia is operational in 2024 in 37 Woredas in four regions (16 in Afar, 8 in Borana Zone of Oromia; 12 in Konso, Gamo, Gofa and South Omo Zones of South Ethiopia; and 1 in Dawuro Zone of South West Ethiopia Regional States) implementing developmental/resilience and emergency response projects/programs to achieve the following strategic goals set for 2021 to 2025

- Strengthen community resilience and emergency response to manage and use natural resource sustainably, absorb shocks and respond to cope with and recover from disaster and conflicts
- Enhance local economies development by improving food sovereignty, nutrition and income security, and livelihoods diversifications
- Improve the health and wellbeing of animals, humans and the environment in line with one Health Approach
- Strength individual and institutional capacities, systems, and structures to achieve long-term sustainability
- Create job opportunities for youth (boys and girls) that will enhance and contribute to pastoral economy

VSF Germany program portfolios in 2024 meant to achieve the above goals are:

- Drought Emergency Response and Recovery in Borana, Afar, South Ethiopia and Somali Region (DERR-BOASS)-funded by USAID/BHA
- Bridging fund for Integrated Life-saving and DRR Initiatives in Afar and SNNP Regions, Ethiopia (ILDRR)-funded by GFFO
- Emergency Livelihood support through provision of animal health services to drought affected communities in South Ethiopia and South West Ethiopia Regions- funded by FAO
- Support to the Implementation of Emergency Response Interventions in the Afar Region of Ethiopia- funded by FAO
- Multisector and Integrated Life Saving Support (MILSS) for vulnerable communities in drought affected District of Karat Zuria, Konso Zone in SNNPR- funded by EHF
- Rabies Vaccination Campaign Project in four sub-cities of Addis Ababa -funded by VSF Germany HQ through Private Donations / Core Funds
- Piloting the private sector engagement in the Prevention and Control of Transboundary Diseases (PC-TAD); PPR Control in selected woredas of Afar Region, Ethiopia- funded by WOAH

Major Donors of VSF Germany:

President's Message

Celebrating 50 Years of Veterinary Excellence

Dear distinguished EVA members, founding fathers, partners and stakeholders,

As we commemorate the 50th anniversary of the Ethiopian Veterinary Association (EVA), it is an honor to reflect on our journey. From its inception to this Golden Jubilee, EVA has witnessed remarkable growth and achievement. We now look forward to a future full of opportunities and progress.

The contributions of our founding members, who have witnessed both the Bronze and Golden Jubilees, have been instrumental in shaping the organization. Their legacy continues to inspire us as we move towards future milestones, including the Diamond and Platinum Jubilees.

EVA is a professional association that unites policymakers, researchers, academicians, and service providers from across Ethiopia. As a founding member of the World Veterinary Association (WVA), EVA has also forged strong partnerships with Government institutions and international organizations such as MoA, EU, USAID, FAO, AUIBAR, IGAD, and ILRI. This 50-year celebration belongs to all our members and partners, whose collaborative efforts have significantly advanced veterinary services, education, research, and governance.

Our service providers form the largest body within EVA, representing the face of the veterinary profession in our communities. These dedicated professionals have worked in challenging environments, often traveling on foot, horseback, or lorry to deliver healthcare and contain disease outbreaks. Despite limited resources, their commitment to serving livestock owners has earned them respect and admiration across the country.

One of EVA's proudest achievements is the eradication of Rinderpest, a deadly disease that posed a major threat to livestock and food security in Ethiopia. We have also made progress in controlling other infectious diseases, and we are now on track to eliminate PPR and Rabies by 2030, further solidifying our role in public health and disease control.

While we have made great strides, we have also faced challenges. The absence of a veterinary statutory body resulted in the proliferation of veterinary colleges, which compromised the quality of veterinary training and left many young professionals struggling to find meaningful career opportunities. This also left the training modalities shapeless, resulting in a challenging governance structure. Additionally, veterinary research has not been fully institutionalized, limiting our ability to innovate and address emerging challenges.

Despite these obstacles, we remain optimistic about the future. The government's recent legislative efforts, endorsing the animal health and welfare proclamation, combined with the growing demand for veterinary services under the One Health platform, signal increased recognition of the veterinary profession's critical role in global health. The "Lemat Tirufat" initiative, aimed at transforming the livestock sector, also holds great promise for opening new dimensions for veterinarians in Ethiopia.

As we celebrate this Golden Jubilee, EVA is embracing the theme of One Health, One Welfare, and One Planet. These concepts highlight the interconnectedness of human, animal, and environmental health and will guide our profession in the years ahead.

- One Health emphasizes the role of veterinary professionals in managing zoonotic diseases, which continue to pose significant global health threats. EVA encourages members to integrate the One Health approach into education, research, services, and policy.
- One Welfare expands on this by including animal welfare and ecosystem health, recognizing that human well-being, animal welfare, and environmental health are deeply interconnected. By promoting animal welfare, we contribute to sustainable livestock systems and positive social change.
- One Planet draws attention to the urgent need to address global environmental challenges, such as climate change and biodiversity loss. Veterinarians have a key role in promoting sustainable food systems, conserving biodiversity, and combating antimicrobial resistance.

Looking forward, EVA is committed to leading efforts to promote global health security, environmental sustainability, and animal welfare. The veterinary profession will be vital in addressing challenges posed by climate change, zoonotic diseases, and food security. Together, we can build a more resilient and sustainable future for humans, animals, and the planet.

Finally, I'd like to express my heartfelt gratitude to the professionals who worked hard to compile this special edition commemorating our Golden Jubilee.

TONGO
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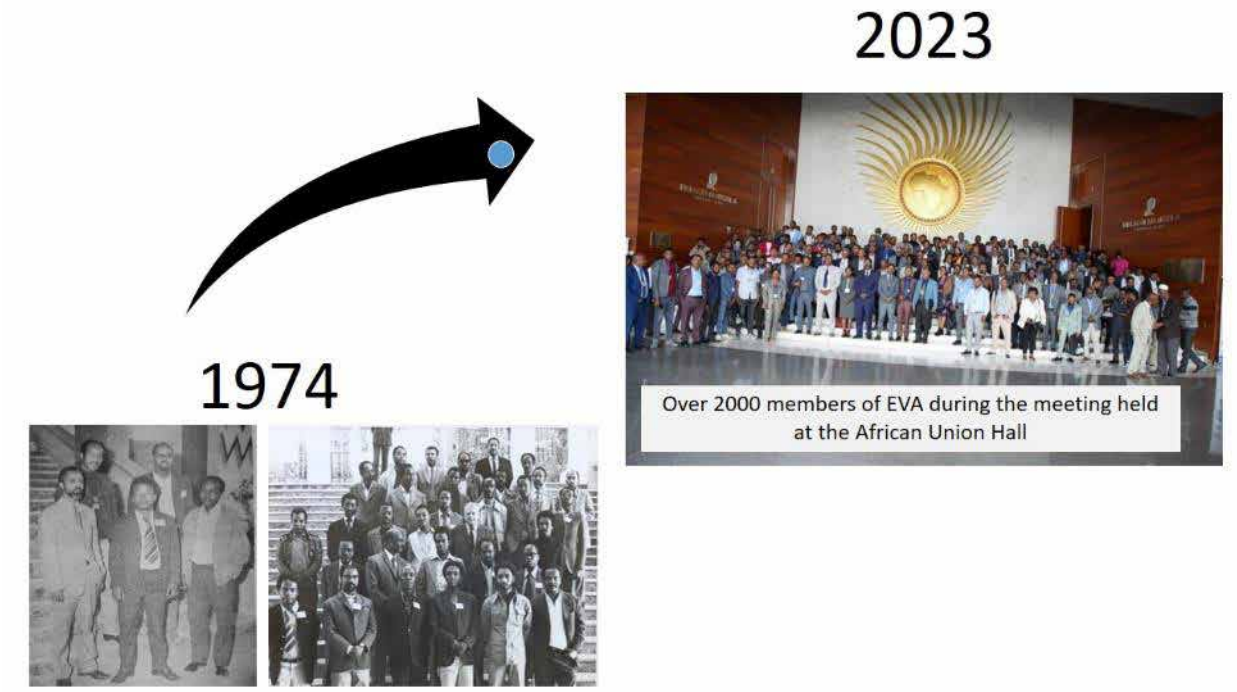
Part One: A 50-years Journey of the Ethiopian Veterinary Association

Endrias Zewdu[1, 2], Gewado Ayledo[1], Yimesgen Tarekegn[3]

[1]EVA, [2]Ambo University, [3]Blue Vet Talk,



Background

The Ethiopian Veterinary Association (EVA) is a pioneer membership-based local organization operating in Ethiopia, with registry number 0495. With a steadfast commitment to its members, EVA is dedicated to advancing the veterinary profession and driving the growth of a robust and competitive livestock industry in Ethiopia.

Over the past five decades, EVA has significantly influenced the evolution of veterinary practices in Ethiopia, navigating through various historical milestones marked by successes, challenges, and opportunities.

This year, EVA celebrates its golden jubilee, honoring five decades of unwavering dedication to the advancement of veterinary medicine and global health security. This document chronicles the rich history of the Association, spanning fifty distinguished years, aiming to inspire the new generation of veterinary professionals and preserve EVA's storied legacy for years to come.

Historic Foundation

The year 1974 stands as a landmark in the history of the Ethiopian Veterinary Association (EVA), marking its birth through the bold vision of 13 pioneering veterinarians. From that moment, EVA emerged as a dynamic, autonomous, non-profit, and non-political organization. This legacy was solidified when EVA was formally registered and granted legal status under Proclamation No. 1113/2019 by the Authority for Civil Society Organizations.

Figure 1: Among the Founders of the Ethiopian Veterinary Association in 1974.

Figure 2 Veterinarians who were present during the foundation or first assembly at African Union Hall in 1974(Dr. Solomon Haile Mariam, Dr. Belay G Micael, Dr. Adamu Waqjira, Dr. Kinfe Getaneh, Dr. Bisrat G/Egziabihaer, Dr. Hailu Bekele, Dr. Mekonen Jote, Dr. Fisiha Gebre Ab, Dr. Girma Tadege, Dr. Samuael Atnafu, Dr. Tamirat HaileYesus, Dr. Yonas Tsige, Dr. Kassa Bayu, Dr. Worku Tesfa Mariam, Dr. Abebe Asnake, Dr. Kobalinko, Dr. Geremew Debele, Dr. Wario Godana, Dr. Girma Bekele, Dr. Zelalem Gobeze, Dr. Beyene Kidane, Dr. Abakano Kereyu, Dr. Birhanu Nigatu, Dr. Fiseha Meketa, Dr. Gualu Endegnanew, Dr. Tekle Lemecha, Dr. Alemu Abebe, Dr. Ayalew Ketsela, Dr. Zelleke Dagnachew, Dr. Ephraem Mamo, Dr. Fikre Yoseph, Dr. Asefa Tigneh)

The following is a list of pioneering veterinarians who were explicitly recognized for their contributions to the establishment of the EVA. It also includes details about the roles assigned to the five pioneers during the initial meeting, which involved nearly 32 members. It is worth noting that there may be unidentified pioneer veterinarians or instances where evidence is lacking, so the list might not be complete.

Table 1: Founding Members

No	Members	Roles given during the first general assembly	Remarks
1	Dr. Alemu Abebe	Chair	
2	Dr. Tamirat Haileyesus	Member	
3	Dr. Fikrie Yosef	Member	
4	Dr. Efrem Mamo	Member	
5	**Dr. Solomon Hailemariam**	Co-chair	
6	Dr. Mekonnen Jotie		
7	Dr. Fiseha Gebreab		
8	Dr. Adamu Wakjira		
9	Dr. Ayalew Ketsela		
10	Others		

Membership

Requirements

Article 6 of EVA's Bylaw stipulates the membership requirements. The founding members and those admitted by the General Assembly constitute regular members of the Association. Candidates who wish to apply for regular membership are required to fulfill a range of eligibility criteria as stated in Article 6 (2) of the Bylaw.

Beyond regular membership, EVA welcomes veterinary professionals and organizations to join through cooperative, honorary, and lifetime memberships. Associate membership invites apprentices, veterinarian candidates, and entities engaged in veterinary and related activities that align with EVA's mission, all with the Management Board's approval.

Honorary membership is available to individuals and organizations that, despite not having voting rights in the General Assembly, significantly contribute to EVA's success and serve as exemplary figures in the veterinary field.

Lifetime membership is granted to regular EVA members who make an advance payment of two years' membership fees. This allows them to enjoy lifetime membership benefits without the need to pay annual fees.

Developments

From its humble beginnings with few members in 1974, EVA now boasts a membership base of over 2,000 members serving across various sectors of veterinary service provision and governance, including government offices, research organizations, academia, international agencies, and the private sector. As number of veterinary colleges in Ethiopia continues to grow, EVA's membership is expected to expand in the years to come.

Membership with International Associations

Since its mid-seventies, EVA has proudly held membership in the prestigious World Veterinary Association (WVA), demonstrating its global presence. Further, EVA boasts affiliations with renowned international bodies, including the World Association for Buiatrics (WAB). Recently, EVA has become a founding member of the Ethiopian Agricultural Professional Association Alliance (EAPSA)

Mandates

EVA's foundational goals are diverse and comprehensive. The Association strives to promote and advance the veterinary discipline, ensuring continuous development by embracing the latest advancements, technologies, and research. Additionally, EVA safeguards the rights and interests of veterinarians, fostering a thriving community united by a shared purpose to address evolving challenges and opportunities in the field. EVA also emphasizes professional networking and collaboration within veterinary and related fields, creating vibrant platforms for knowledge exchange and fostering synergistic partnerships. By engaging in policy dialogues, EVA plays a pivotal role in shaping effective policies, research, education, and extension activities within Ethiopia's livestock sector.

Mission Statement

EVA is highly committed to maintaining members' rights and benefits, delivering quality service, promoting the public interest through ensuring animal and human health, and creating strong partnerships with government, NGOs, and other professional associations.

Vision Statement

EVA aspires to become one of the top five professional associations in Ethiopia and ten in Africa by 2026.

Strategic objectives

The overall objective of the Association is to advance the science and art of veterinary medicine, including its relationship with public health, biological science, and agriculture. Specifically, it aims to achieve objectives such as:

- To strive to protect the interests and rights of veterinarians;
- To enable members to develop their veterinary and human biological medicine and agricultural profession;
- To serve as a bridge for the veterinary medicine and other related professions networking platform;
- To conduct discussions and research/consultancies in collaboration with governmental and non-governmental organizations;
- To cooperate and operate closely with the concerned government bodies and play its roles in the veterinary health sector, thereby directing the rules and regulations of the development activities;
- To ensure that professional ethics and standards are respected and utilized, complying with the rules and regulations;
- To support the veterinary and related educational activities' quality and standards; To operate freedom and patent rights;
- To develop a veterinary career, thereby becoming professional, developing their expertise, and operating their own governmental and non-governmental organizations.

Governance

The Association has clear institutional policies, strategies, and guidelines to pursue its mandates. The Bylaw is the overarching legal framework enabling EVA to discharge its duties. It was drafted, passed through various debates, and finally endorsed by the General Assembly in 2009.

Recently, EVA has revamped its governance structure to align with emerging global developments and seize future opportunities. The new structure features four key functional departments, enhancing its

operational effectiveness (Figure 3).

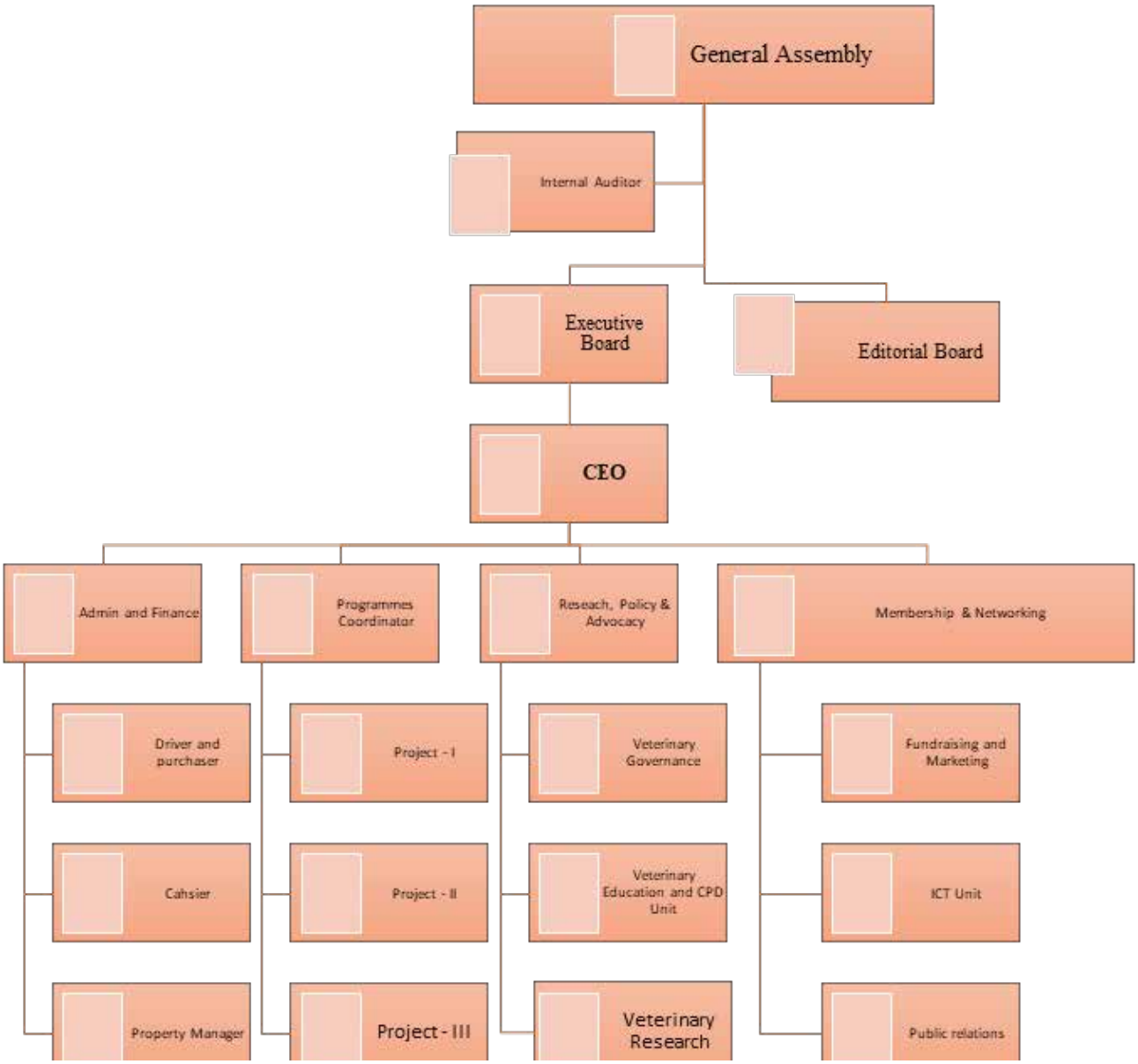


Figure 3: Organizational structure of EVA

Strategy and operational documents

The Association developed a 10-year strategic plan (2018-2027) that sets out a clear vision, mission, and ambitious goal to excel in EVA's operational areas, including global networking and visibility. Further, EVA has developed operational guidelines. The human resource, finance/budget management, and property administration guidelines are central to the effective and efficient administration of EVA's staff, property, logistics, and finance resources.

Key Milestones and Achievements

Policy Support and Advocacy

EVA offers robust technical support and evidence-based recommendations, aiding in the development of policies and strategies that create a supportive environment for Ethiopia's livestock sector. Key areas of focus include Agricultural Policy, Strategies, Proclamations, Regulations, and Guidelines. EVA's advocacy efforts have been instrumental in shaping policies and strategies within the veterinary community and the broader public, contributing to a significant understanding of livestock policies. Accordingly, EVA has made meticulous efforts to offer technical support and advice in realizing the following policy instruments:

- Revised Animal Health and Welfare Proclamation (2023): Draft proclamation submitted to Council of Ministers for review and approval
- Regulations on Animal Health and Welfare (2023): Seven (7) draft regulations were developed with MoA and are awaiting the promulgation of the proclamation.
- Proclamation No. 728/2011: A proclamation establishing the Veterinary Drug and Feed Administration and Control Authority (VDFACA).
- Proclamation No 315/2003: Fisheries Development and Utilization Proclamation;
- Proclamation No 267/2002: Animal Diseases Prevention and Control Proclamation.
- Strategy for Animal Health Human Resource Development (2022): This strategy was developed in close consultation with MoA and with logistical support from FAO.
- National Rabies Control and Elimination Strategy (2021-2030)
- National Strategy for progressive PPR eradication
- National Framework for Continuing Professional Development (CPD-2021): Developed by EVA and partners with the support of the HEARD project, this framework introduces formal CPD education/training in Ethiopia's veterinary domain to enhance the professional careers of veterinary practitioners.
- Veterinary Rationalization Roadmap (VRRM-2015): This national document outlining the roadmaps for rationalizing animal healthcare and governance in Ethiopia was developed in partnership with the MoA, ILRI, and development partners.
- Evaluation of the Performance of Veterinary Services (PVS-2011): In collaboration with the MoA, EVA facilitated an independent team commissioned by the World Organization for Animal Health (OIE/WOAH) to evaluate the veterinary service system in Ethiopia. The evaluation identified critical gaps in animal health delivery and underscored the importance of establishing a regulatory system for the vet profession in Ethiopia.
- In collaboration with Brooke Ethiopia, EVA produced and validated a book on the List of Essential Veterinary Medicine
- EVA has been actively engaged in persistent advocacy and lobbying efforts to eliminate Value-Added Tax (VAT) from imported veterinary drugs and premixes, aiming to reduce financial burdens on the veterinary sector, improve access to essential medications for animal health, and foster sustainable practices within the industry.
- The EVA has made significant efforts, utilizing effective communication strategies and active lobbying

with relevant government agencies, to advocate for the adjustment of externship students' salaries. This initiative aims to align the students' remuneration with the evolving living conditions, ensuring their financial stability during their training period.

In doing the aforementioned, EVA collaborates closely with a diverse range of stakeholders, including the Ministry of Revenue, the Ministry of Federal Civil Service, the Drug Administration and Control Authority (DACA), the Ministry of Health, the Ministry of Agriculture, veterinary education colleges and schools, non-governmental organizations (NGOs), and development partners such as Brooke Ethiopia.

Safeguarding Members' Rights and Interests

To safeguard its members' interests, EVA conducted a national career structure study to enhance salary and benefits packages for the veterinary workforce in Ethiopia. The findings, approved by the Federal Civil Service Ministry, overcame numerous administrative and political challenges. Additionally, EVA played a crucial role in the approval and enforcement of the current Job Evaluation and Grading (JEG) system.

Conferences and Events

Since its inception in 1974, EVA has organized significant conferences, seminars, and events focusing on various aspects of veterinary services, livestock development, One Health, and other crucial agendas. EVA has organized 36 annual conferences with different themes in the realm of the livestock industry and animal healthcare. The list of the events is presented in the table below:

Table 2: Annual conferences of EVA, their themes, and venues

Year	Conference theme	Venue
2003	17th Annual Conference: Animal Health Challenges During Drought: Implications, Opportunities and Management,	held in Addis Ababa, June 5-6, 2003
2004	18th Annual Conference: Capacity Strengthening/Building and Partnership for Enhanced Animal Health Services Provision and Development in Ethiopia,	held in Addis Ababa, June 9-10, 2004
2005	19th Annual Conference: Strategic and Innovative Approaches to Enhance Livestock Export Trade in Ethiopia: Animal Health, Markets and Institutions,	held in Addis Ababa, June 8-, 2005
2006	20th Animal Health Challenges during Draught Implication, Opportunities, and Management.	
2007		
2008		
2009		
2010	24th Annual Conference: Climate Change and Livestock Vulnerability: Its Veterinary Dimensions and Public Health Concerns,	Conference hall of the African Union, Addis Ababa, July 21-22, 2010
2011	25th Annual Conference: Enhancing Veterinary Education and International Partnership towards One Health	United Nations Conference Centre (ECA), Addis Ababa, July 27-28, 2011
2012	26th Annual Conference: Enhancing Veterinary Governance for Sustainable Livestock Development in Ethiopia,	United Nations Conference Centre (UNCC), Addis Ababa, September 20-21, 2012
2013	27th Annual Conference: Strengthening the Capacities of Veterinary Services in view of expanding livestock and livestock products trade and enhancement of producer's livelihoods and resilience,	Addis Ababa, September 6-7, 2013
2014	28th Annual Conference Rationalization and Public-Private Partnership for Effective Delivery of Livestock Services	United Nationals Conference Centre (ECA) Addis Ababa, September 5-6, 2014

Year	Conference theme	Venue
2016	30th Annual Conference: One Health Approach for Combating Emerging/ Re-emerging Pandemic Threats,	Ababa, 2- 3 September 2016
2017	31 Annual Conference: Status of Veterinary Professionals, Pharmaceuticals, and Animal Health Research and Skill Gaps in Ethiopia, 2017	
2018	32th Annual Conference: Systems approach to Veterinary Service Delivery: a framework for transforming the veterinary Service strategy into action	Economic Commission for Africa (UN ECA), Addis Ababa, September 5-6 2018
2019	33rd Annual Conference: Livestock Development: Key in Ensuring Food and Nutritional Security and Enhancing Export Earnings in Ethiopia,	Conference Center of the Commission for Africa (UN - ECA), Addis Ababa, Ethiopia September 18 - 19, 2019
2020	34th Annual Conference: Current Natural Shocks and Their Implications in Livestock Development and Animal Health in Ethiopia	Held Through Virtual Platform, Addis Ababa, Ethiopia November 26, 2020
2022	35th Annual Conference: Veterinary Education, Research and Extension in Ethiopia: Challenges, Opportunities, and the Way Forward	Held in Hotel De Lepol Addis Ababa, Ethiopia
2023	36th Annual Conference: Unlocking the livestock potential of Ethiopia: the role of animal health and welfare	Held in African Union Hall, Addis Ababa, Ethiopia

Project Design and Implementation

In the past five decades, EVA has designed and implemented various projects in the areas of veterinary research, education, and development. The most notable ones are listed below:

CAH-NET Project (Community Animal Health Network): Funded by FARM AFRICA, the project (March-May 2012) targeted the pastoral lowlands to establish sustainable vaccination programs for diseases of livestock and public health significance, including Rabies, Anthrax, Newcastle Disease (NCD), etc.

USAID/Agribusiness and Trade Expansion (Hide and Skin Quality Improvement in Ethiopia): This project, which is worth **$120,000,** was funded by USAID and implemented (August 2009 to December 2010) in different districts of Ethiopia. Through the project, EVA conducted studies aimed at identifying key challenges to the production and marketing of Hide/Skin, along with actionable recommendations to address these gaps.

LVC-PPD Project (Improving and integrating animal health services in the livestock value chain through public-private dialogue in Ethiopia): Funded by the European Union (10th EDF) and worth **€509,596.06**, this initiative was implemented from 2013-2013 and integrated animal healthcare into the livestock value chain through public-private partnerships, achieving significant health improvements in pastoral areas. Among the primary outputs, the project successfully implemented a sanitary mandate contracting scheme (SMC) in the pastoral areas, where the initiative helped combat significant livestock diseases.

HEARD Project (Health of Ethiopian Animals for Rural Development):
Jointly executed from 2019-2023, this EU-funded project improved livestock health and productivity in 70 districts across three regional states (Amhara, Oromia, and Somali). The EVA component, worth **€1,750.033,** has immensely contributed to the improvement of livestock health and productivity while fostering the marketing of livestock products. It also enhanced the knowledge and skills of the private sector for quality service delivery at affordable prices. The technical capacities of veterinary institutions were built through training, guidelines/operating procures, and upgrading veterinary infrastructure, among others.




RESTORE Project (Restoration of Veterinary Services damaged by drought and conflict): This is a forthcoming EU-funded project designed to aid in the restoration of animal health services and infrastructure in drought and conflict-affected districts of 8 regions of Ethiopia. in addition to building the health facilities, particular emphasis is placed on fostering public-private partnership platforms to in combating prioritized diseases, which pose threats to both livestock and public health. The EVA component, worth **€ 1,012,435,** will focus on operationalizing continuing professional development (CPD) programs in the veterinary domain and piloting innovative approaches involving public-private partnership (PPP) arrangements. The latter is part of the veterinary rationalization roadmap (VRRM) developed by the Ministry of Agriculture some ten years back, creating the most suitable enabling environment for the holistic transformation of veterinary services in Ethiopia.

The SPANA Global Animal Welfare Accelerator Program 2024. Also state "The project, worth £42,685, is funded by SPANA (Society for the Protection of Animals Abroad)

UNIDO (Project ID: 170180UNIDO). "The project aims to improve the competitiveness of meat value chains and the livestock industry through targeted capacity-building interventions, ultimately improving livelihoods and income generation for smallholder farmers. The EVA was selected through competitive bid to provide event facilitation services for training and workshops organized by the livestock value chain project.

WTS (Germany-funded): a pilot project supported by Germany focused on advocating animal welfare in Ethiopia (2024 to 2025).

Capacity development

The Ethiopian Veterinary Association (EVA) is committed to bolstering the proficiency of veterinary professionals, private veterinary service providers, and pertinent stakeholders through the implementation of comprehensive training programs and workshops. These endeavors are crafted to augment competencies in alignment with One Health principles and methodologies. The following are the prominent capacity-building initiatives facilitated by the EVA:

Business Skills and Entrepreneurship (BSE) Training: Tailored for private veterinary service providers within project intervention zones, benefiting hundreds of veterinary professionals.

Workshops on Innovative Animal Health Delivery Models: Engaging 124 attendees across sessions conducted in the Amhara, Oromia, and Somali regions, fostering innovative approaches to animal healthcare.

Continuing Professional Development (CPD): In collaboration with veterinary colleges, the EVA has developed 20 training modules concentrating on contemporary and emerging livestock health problems, along with prioritized zoonotic diseases.

Veterinary rationalization roadmap (VRRM): where EVA offered familiarization workshops to the veterinary community, providing vital insights into contemporary frameworks and methodologies.

In-Service Applied Veterinary Epidemiology Training (ISAVET): This training was designed to enhance the capabilities of Ministries overseeing animal health affairs by providing hands-on field training to veterinary epidemiologists. The training aimed to fortify surveillance mechanisms, outbreak investigation techniques, and swift response protocols during emergent situations.

Research and Education
Research activities

In collaboration with its members and partners, EVA has conducted and published numerous research activities, generating critical evidence for policy input. The main ones include:

- Needs assessment to identify critical gaps in veterinary professionals and veterinary paraprofessionals in Ethiopia
- Major causes for downgrading and marketing of Skin/Hide in Ethiopia;
- National Indicators to Measure the Coverage of Veterinary Services coverage in Ethiopia
- The willingness of livestock keepers to pay for vaccination services;
- Assessment of key challenges in the quality of Veterinary Education in Ethiopia;
- Assessing the employment trends and veterinary Workforce forecast of veterinary graduates;
- Developing the national framework for the CPD program in Ethiopia

Qualify Education

In collaboration with veterinary colleges, EVA established the Deans' Forum (termed Veterinary Education forum-VEF) aimed at enhancing the quality of veterinary education, including day-one competence in compliance with OIE/WOAH standards.

Publications/Journals

EVA has produced major publications and journals, contributing significantly to veterinary literature and knowledge. There is an editorial board dedicated to the prudent review of scientific papers for publication

in the Ethiopian Veterinary Journal (EVJ). Recently, the EVJ has been accredited as one of the reputable scientific journals in Ethiopia, offering helpful knowledge and information exchange on varying agendas. As of now, EVA has published 28 volumes, each volume consisting of two issues biannually, boasting hundreds of articles with multifaceted impact, including knowledge dissemination and advancement of the field of veterinary science, enhancing the academic recognition and credibility of researchers, authors, and institutions, fostering a culture of academic excellence, enhancing professional development and visibility within the veterinary community. In addition, EVA journals can influence policy decisions, best practices, and regulations in the veterinary sector, driving positive change and improvements in animal health and welfare. EVA journal publications also serve as valuable educational resources for students, professionals, and researchers, contributing to the continuous learning and development within the veterinary field.

EVA also produces proceedings highlighting the deliberations that took place during each of the last 36 annual conferences.

The upcoming EVA journal will be dedicated to special edition papers celebrating the organization's 50th anniversary.

Partnership, networking, and sponsors (National, International)

UN agencies: Food and Agricultural Organization (FAO), European Union (EU), USAID, World Health Organization (WHO), International Livestock Research Institute (ILRI), Tuft University, Palladium,

NGOs: Farm Africa, VSF-G, VSF-S, Mercy Corps, BOAZ, Animal Welfare Charities (The Brooke Ethiopia (BE), The Donkey Sanctuary (DSE), Society of Animals Abroad (SPANA)), BACLEAN, ALS, World Veterinary Association (WVA), World Organization for Animal Health (OIE), SNV, Civil Society Organizations Agency, Ethiopian Civil Society Organizations Forum, Professional Associations (ESAP, EAHPA, ESE, EPPPA). IGAD ICPALD,

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Government bodies: Ministry of Agriculture, Regional Public Veterinary Services, Academic Institutions, Research Institutes (Ethiopian Institute of Agricultural Research), National Veterinary Institute, National and Regional Animal Health Diagnostic Laboratories, Ministry of Innovation and Technology, Ministry of Irrigation and Pastoral Development, Ministry of Health- one health working group, Ethiopian Wildlife Conservation Authority,

Academia: AAU, ADI, Ethiopian Public Health Institute, Ethiopian Biodiversity Institute, Municipalities, Ethiopian Biotechnology Institute, AHI, NVI, EAA, MoA LFSD Project, MoA DRIVE Project. Etc.,

Future Plans

Implementing strategic initiatives to fortify EVA as an institution involves fostering robust connections with its constituent entities, such as ministries, regional bodies, private organizations, development partners, and affiliated members. This effort extends to active engagement with the Veterinary Education Forum, the Veterinary Research Forum, and Continuous Professional Development (CPD) programs, enhancing EVA's impact across various spheres of influence. Moreover, EVA's future aspirations also include expanding its membership base, establishing regional chapters, maximizing income and asset base to construct its own conference and knowledge center, fostering networking and partnerships, and executing impactful projects.

Projects: In partnership with stakeholders, EVA has already initiated participating in developing new projects such as Global Health Security (GHS), Ethio-Pandemic Multi-sectoral Prevention, Preparedness

and Response (EPPR), capacity-building funds, etc.

We will continue to hunt for different project funds and engage with partners to win more projects and enhance our efforts to benefit the livestock-owning communities.

Land for office construction: The Ethiopian Veterinary Association (EVA) has not yet secured land for the construction of its office, but the process was not without its challenges. Over the years, under various executive board members, the organization faced several trials and obstacles in realizing this goal. Nevertheless, the attempt to secure land for EVA office construction would be one of the tasks awaiting.

Communication platform: EVA's website serves as a vibrant communication platform showcasing a range of activities, including newsletters, bulletin publications, projects, and documents. Recently enhanced, it now features an integrated membership database and is tailored to capture and highlight golden jubilee-related events such as the photo competition.

Appendices

Appendix 1: List of Executive and Editorial Board members

Year	Executive Committee	Position	Editorial Board	Position
1974-1975	Dr. Alemu Abebe	President		
	Dr. Tamirat Haileyesus	Vice President		
	Dr. Mekonnen Jote	Secretary		
	Dr. Fikre Yoseph	Cashier		
	Dr. Teklemariam Zegu	Member		
	Dr. Efrem Mamo	Member		
1976 – 1977	Dr. Mekonnen Jotie	President	Dr. Fiseha Gebreab	Editor -in-Chief
	Dr. Solomon Hailemariam	Vice President	Dr. Wario Godana	Deputy Editor-in-Chief
	Dr. Efrem Mamo	Secretary	Dr. Tamirat Haileyesus	Associate Editor
	Dr. Hailu Bekele	Cashier		
	Dr. Ayalem Ketsela	Member		
1977- 1978	Dr. Fikrie Yosef	President	Dr. Fiseha Gebreab	Editor -in-Chief
	Dr. Dawit Zekiros	Vice President	Dr. Kassa Bayou	Deputy Editor-in-Chief
	Dr. Tekliye Bekele	Secretary	Dr. Antonio de Maria	Assistant Editor
	Dr. Eden Birhanu	Cashier	Dr. Samuel Atnafu	Member
	Dr. Zeleke Dagnachew	Member		
1979-1980	Dr. Gualu Endegnanew	President	Dr. Zeleke Dagnachew	Editor-in-Chief
	Dr. Ketema Shafo	Vice President	Dr. Getachew Weldemichael	Associate Editor
	Dr. Fisehea Tareke	Secretary	Dr. Kinfe Getaneh	Assistant Editor
	Dr. Eden Birhanu	Cashier	Dr. Getachew Bekele	Business Manager
	Dr. Tekle Lemecha	Member		
1980- 1984	Dr. Ayalew Ketsela	President		
	Dr. Samuel Atnafu	Vice President		
	Dr. Girma Bekele	Secretary		
	Dr. Belay Gebremichael	Cashier		

Year	Executive Committee	Position	Editorial Board	Position
	Dr. Hailu Bekele	Member		
	Dr. Abebe Wendimu	Member		
1984 – 1986	Dr. Solomon Hailemariam	President		
	Dr. Gualu Endegnanew	Vice President		
	Dr. Yemiwedew Simegn	Secretary		
	Dr. Mekonnen Fanta	Accountant		
	Dr. Tirushet Teshager	Cashier		
1986 - 1991	Dr. Yemiwedew Simegn	President		
(Ethiopian Animal Health Professionals United Association)	W/ro Hiwot Terefe	Secretary		
	Dr. Tamirat Haileyesus	Member		
	Dr. Merid Mekonnen	Member		
	Dr. Abebe Demissie	Member		
	Mr. Male Weyessa	Member		
	Mr. Dima Jilo	Member		
	Newly replaced later (Dr. Tadese H/mariam and Dr. Hailu Kebede			
1991 - 1996	Dr. Ibrahim Hussein	President	Dr. Wendwosen Asfaw	Editor-in-Chief
	Dr. Sintayehu Abdicho	Vice President	Dr. Mulualem Adam	Assistant Editor
	Dr. Solomon Mekonnen	Secretary	Dr. Taye Efrem	Assistant Editor
	Dr. Emiru Zewdie	Accountant	Dr. Girma Zewdie (two years later)	
	Dr. Tsegaye Shiferaw	Cashier		
	Dr. Eden Birhanu	Member		
1996 - 2000	Dr Getachew Abebe	President	Dr Sintayehu Abdicho	Editor-In-Chief
	Dr Berhanu Bedane	Secretary	Dr. Mulualem Adam	Assistant Editor
	Dr Hailu Kebede	Treasurer	Dr. Taye Efrem	Assistant Editor
	Dr Abrham Gopilo	Vice President	Dr. Eshetu Yimer	Assistant Editor
	Dr Sileshi Mekonnen	Member	Dr. Sileshi Mekonnen	Assistant Editor
	Dr Temesgen Alemu	Member	Dr. Gutema Sultesa	
	Dr. Mebratu Gebreyesus	Vice Chairman	Dr. Ademe Zerihun	
2001	Dr Berhanu Admasu	President	Dr Kassa Bayu	Editor-In-Chief
	Dr Bayeleyegn Molla	Vice Chair	Dr Tesfu Kassa	Associate Editor
	Dr Tariku Sintaro	Secretary	Dr Solomon Nega	Assistant Editor

Year	Executive Committee	Position	Editorial Board	Position
	Dr Yrgalem G/Meskel	Treasurer	Dr Mohammed Abdella	Assistant Editor
	Dr Eshetu Mengistu	Finance	Dr Kassaye Hadgo	Assistant Editor
2003	Dr Berhanu Admasu	President	Dr Yilma Jobre	Editor in Chief
	Dr Bayeleyegn Molla	Vice Chair	Dr Tesfu Kassa	Associate Editor
	Dr Tariku Sintaro	Secretary	Dr Eshetu Yimer	Secretary
	Dr. Tsega Alemayehu	Finance	Dr Getachew Tilahun	Assistant Editor
	Dr. Eshetu Mengistu	Treasure	Dr Kassa Bayu	Assistant Editor
			Dr Moges W/Meskel	Assistant Editor
			Dr Lake Mariam Yogezu	Assistant Editor
			Dr Markos Tibo	Assistant Editor
2004-2005	Dr Eshetu Yimer	President	Dr Yilma Jobre	Editor-In-Chief
	Dr Mulualem Tarekgn	Vice President	Prof Tesfu Kassa	Associate Editor
	Dr Awoke Kidane Mariam	Secretary	Dr Brehanu Admassu	Secretary
	Dr Tsega Alemayehu	Finance	Dr Moges Wolde Meskel	Assistant Editor
	Dr Zerihun Nigatu	Treasure	Dr Tadele Desie	Assistant Editor
	Dr Taye Yirgu	Public Relation	Dr Abayehe Dagne	Assistant Editor
	Dr Sileshi Mekonnen	Public Relation	Dr Laikemariam Yigezu	Assistant Editor
			Dr Markos Tibo	Assistant Editor
2009 - 2012	Dr Brehanu Admassu	President	Prof Getachew Abebe	Editor-In-Chief
	Dr Thomas Cherinet	Vice president	Dr Yilma Jobre	Associate Editor
	Dr Yoseph Shiferaw	Secretary	Dr Markos Tibo	Assistant Editor
	Dr Assegedech Sirak	Member	Dr Tarekegn Tola	Secretary
	Dr Laikemariam Yigezu	Member	Dr Abebe Wossene	Assistant Editor
	Dr Tarekegn Tola	Member	Dr Hassen Chaka	Assistant Editor
	Dr Melese G/Tsadik	Member	Dr Moges Woldemeskel	Assistant Editor
			Dr Tadesse Enguale	Assistant Editor
			Dr Wodwosen Asfaw	Assistant Editor
2013-2016	Dr Wondwoswn Asfaw	President	Dr Eshetu Yimer	Editor-In-Chief
	Dr Nega Tewolde	Vice President	Dr Melaku Tefera	Associate Editor
	Dr Yohannes Getenet	Secretary	Dr Abebe Wossiene	Associate Editor
	Dr Roman Yilma	Treasurer	Dr Gobena Ameni	Editor-In-Chief(2014-2015)
	Dr Alehegn Wubete	Member	Dr Hagos Ashenafi	Assistant Editor
	Dr Deriba Faji	Member	Dr Hassen Chaka	Assistant Editor
	Dr Tesfaye Alemu	Member	Dr Tadesse Enguale	Assistant Editor
			Dr Tesfaye Sisay	Assistant Editor
2016-2017			Dr. Tadese Equale	Editor-In-Chief

Year	Executive Committee	Position	Editorial Board	Position
			Dr. Endrias Zewdu	Associate Editor
			Dr. Hassen Chaka	Associate Editor
			Prof. Gobena Ameni	Associate Editor
			Dr. Abebe Wessenie	Assistant Editor
			Dr. Kassahun Asmare	Assistant Editor
			Dr. Hagos Ashenafi	Assistant Editor
			Dr. Tesfaye Sisay	Assistant Editor
			Dr. Eshetu Yimer	Assistant Editor
2018 - 2022	Dr. Bewket Siraw	President		
	Dr Edmealem Shitaye	Vice President, andPresident (2021-2022)	Prof Kassahun Asmare	Editor-In-Chief
	Dr Kelay Belihu	Secretary	Prof Hagos Ashenafi	Associate Editor
	Dr Yohannes Girma	Member	Prof Alemayehu Lemma	Associate Editor
	Dr Estegenet Tekle	Member	Prof Tadele Tolosa	Assistant Editor
	Dr Mohammed Aliy	Member	Prof Asefa Asmare	Assistant Editor
	Dr Seble Hailemariam	Member	Dr Balako Gumi	Assistant Editor
	Dr Fisum Alemayehu	Member	Prof Wudu Temesgen	Assistant Editor
			Dr Asefa Deresa	Assistant Editor
			Dr Birhanu Hadush	Assistant Editor
			Dr Tewodros Tesfaye	Assistant Editor
			Prof Endrias Zewdu	Assistant Editor
2023 -	Dr Bojia Endebo	President	Prof Kassahun Asmare	Editor-In-Chief
	Dr Feseha Abinet	Vice President	Prof. Alemayehu Lemma	Associate Editor
	Dr. Fasika Belete	Secretary	Prof. Wudu Temesgen	Associate Editor
	Dr. Fitsum Alemayehu	Member	Prof. Tadele Tolosa	Assistant Editor
	Dr. Hayat Kelifa	Member	Prof. Balako Gumi	Assistant Editor
	Dr. Bedaso Mamo	Member	Prof. Tesfahewot Zerihun	Assistant Editor
	Dr. Kalkidan Wondimu	Member	Prof. Hunduma Dinka	Assistant Editor
			Prof.Gezahegne Mamo	Assistant Editor
			Dr. Birhanu Hadush	Assistant Editor

Appendix2 List of EVA Secretariat offices at various levels

Year	Full Name	Position
2004-2009	Mr.Mulushewa Beshah	General Manager
	W/t Kalkidan Negash	Finance admin
	W/t Sifnedengel Tadesse	Assistant Editorial Manager (2009-2010
2010-2013	Dr.Fisseha Abinet	General Manager
	Mrs.Sihine Demeke	Finance admin
	Mrs.Sifinedengel Tefera	Assistant Editorial Manager
2013	Dr.Darsema Gulema	General Manager
	Mrs.Sifinedengel Tefera	Assistant Editorial Manager
2014-2015	Dr. Legesse Garedew	General Manager
	Dr Darsema Gulema	Project Coordinator
	Mrs.Sifinedengel Tefera	Assistant Editorial Manager
	Mrs.Sihine Demeke	Finance Officer
2016-2017	Dr. Darsema Gulema	General Manager
	Mrs.Sihine Demeke	Finance Officer
	Mrs.Sifinedengel Tefera	Office Assistant/Secretary/Cashier
2018	Dr. Fasil Awol	General Manager
	Dr. Yitagele Terefe	Editorial Assistant
	Mrs.Sifinedengel Tefera	Office Assistant/Secretary/Cashier
	Mrs.Sihine Demeke	Finance Officer
2019-2022	Dr.Tewodros Tesfaye	General Manager
	Dr. Yitagele Terefe	Editorial Assistant
	Dr. Fasil Awol	Project Coordinator
	Dr. Gewado Ayledo	Senior Veterinary Expert
	Mrs.Sihine Demeke	Finance Officer
	Mrs. Meron Solomon	Secretary cashier
	Prof Endrias Zewdu	Editorial Assistant (as of 2022
	Mr. Dinku Hamda	Webmaster (2022-2023)
2023-2023	Dr.Yilkal Kebede	General Manager
	Dr.Fasil Awol	Project coordinator
	Dr.Gewado Ayledo	Senior Veterinary Expert
	Mrs.Sihine Demeke	Finance Officer
	Mrs. Meron Solomon	Secretary-Cashier
	Mr. Dinku Hamda	Webmaster
	Prof Endrias Zewdu	Editorial Assistant
Dec. 2023- June, 2024	Professor Endrias Zewdu	Chief Executive Officer
	Mrs.Sihine Demeke	Finance Officer
July 2024 onwards	Professor Endrias Zewdu	Chief Executive Officer (CEO)
	Dr.Gewado Ayledo	Project Coordinator, RESTORE
	Prof. Teshale Sori	Senior Veterinary Expert, RESTORE
	Mr Ermias Ambachew	Webmaster, RESTORE
	Ms Atklti Ambaw	Project Cashier, RESTORE

Appendix 3. List of Advisory board/committee (Ethiopian Veterinary Journal)

Previous

- Andy Catley, Tufts University, E-mail: Andrew.Catley@tufts.edu
- Berhanu Admassu, Tufts University, E-mail: berhanu.admassu@tufts.edu
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E-mail: Getachew.Abebe@fao.org

- Gijs van't Klooster, Food and Agriculture Organization of the United Nations, E-mail: Gijs.Vantklooster@fao.org
- J. B. Malone, Louisiana State University, Baton Rouge, Louisiana, USA
- Kurt Peters, Humboldt University, Berlin, Germany
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- Moges Woldemeskel, University of Tennessee, 2407, River Drive, Knoxville, Tennessee 37919, USA
- P. Dorchies, Ecole Nationale Veterinaire de Toulouse, Toulouse, France
- Solomon Hailemariam, African Union, Addis Ababa, Ethiopia
- Takele Argaw, FDA, Washington D.C., USA
- Teshome Mebatsion Merial & Sanof Inc. teshome.mebatsion@merial.com
- Teshome Yehualashet, Tuskegee University, Alabama, USA
- Yilma Jobre, Food and Agriculture Organization of the United Nations, Addis Ababa, Ethiopia, E-mail: yilma.jobre@fao.org

Current

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- Prof. Getachew Abebe, Food and Agriculture Organization of the United Nations, Addis Ababa, Ethiopia, E-mail: getachewabebe625@gmail.com
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- Prof. Million Mulugeta, David Geffen School of Medicine at UCLA, Director, Animal Model Core, Vatch & Tamar Division of Digestive Diseases, UCLA, VA
- Greater Los Angeles Healthcare System, Los Angeles, USA, E-mail: MillionMulugeta@mednet.ucla.edu
- Prof. Teshome Mebatsion Head, Viral Disease, Boehringer Ingelheim Animal Health France 813 Cr du 3° Millénaire, 69800 Saint-Priest France, E-mail: Teshome.Mebatsion@boehringer-ingelheim.com
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- Prof. Temesgen Samuel, Associate Dean for Research and Advanced Studies, College of Veterinary Medicine, Tuskegee University, Williams-Bowie Hall (101) Tuskegee, Alabama 36088. E-mail:

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- Prof. James Wood, University of Cambridge, UK, E-mail: jlnw2@cam.ac. uk
- Prof. Arcangelo Gentile, President of The World Association for Buiatrics, Department of Veterinary Medical Sciences, University of Bologna., E-mail: arcangelo.gentile@unibo.it
- Prof. John B. Kaneene, Director, Center for Comparative Epidemiology, Michigan State University, E-mail: kaneenej@msu.edu
- Dr. Aynalem Haile: ICARDA principal scientist and small ruminants' breeder, E-mail A.Haile@cgiar.org
- Dr Alemu Yami: Freelance consultant on Animal feed and livestock development, E-mail: alemuyami@gmail.com


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A world in which working horses, donkeys and mules are free from suffering and have a life worth living
Brooke Mission
To achieve immediate and lasting positive change to the lives of working horses, donkeys, and mules and the communities that depend on them
Major achievements
- 153,024,353 Birr of investment in building animal welfare infrastructures: 50 Health Posts, 28 Water infrastructures, 13 Animal Welfare and Health centres in Market places and Universities beneficing millions of equines and farm animals
- 20,000,000 Birr direct funding to government structures is establishing sustainable Drug and Vaccine Revolving Schemes
- Trained thousands of Animal Health Providers
- Facilitated the endorsement of Essential Veterinary Medicines List for 6 livestock species of Ethiopia
- Working with 5 Universities Facilitating Skills Based Learning for Undergraduate Vets through establishing Clinical Skill Labs and Animal Welfare and health centres
- Pioneering Exclusive Urban and Rural Working Approaches with Equine Owning Communities and Stakeholders reaching for over 480,000 Equines Annually
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Part Two: Animal Health Field and Regulatory Services in Ethiopia

Gedion Yilma[1], Alemayehu Mekonnen[1], Wondwosen Asfaw[2]

[1]MOA, [2] Private Consultant

Animal health field services

Executive summary

Livestock are extremely important in Ethiopia to economic development and poverty reduction. Ethiopia has one of the largest livestock inventories in Africa, providing support for the livelihoods of the vast majority of the rural poor. However, the economic benefit derived from the livestock sector is not commensurate with the economic potential, and the sub-sector still needs to be tapped. One of the major constraints is the wide range of livestock diseases prevalent in the country. Ethiopia is endemic to a number of livestock diseases causing high degrees of mortality and morbidity, posing significant economic, food security, livelihood, and public health impacts.

Modern veterinary services started relatively recently in Ethiopia, around 1887, following the introduction of rinderpest into the country. Vaccine production for the major cattle diseases in Ethiopia began in the early part of 1945 by the then MoA. The production took place in a small laboratory building at Gullele. In 1963, the entire establishment of the Gullele veterinary laboratory was transferred to Debre-Zeit and named the National Veterinary Institute (NVI). It is at the National Veterinary Institute that the preparation of a large number of vaccines of sufficient quality and quantity began.

Figure 1: National Veterinary Institute (NVI)

To satisfy the growing demand for veterinary services and to allow gradual takeover from expatriate experts, a substantial number of Ethiopians were trained locally and overseas. A significant breakthrough in veterinary education in Ethiopia was the establishment of the School of Animal Health Assistants in

1963. The Faculty of Veterinary Medicine (FVM AAU) was established in 1979 to cater for the training of high-level professionals. During the last quarter of the century, the Faculty of Veterinary Medicine of Addis Ababa University has graduated around 25-30 veterinarians annually. The country has seen a proliferation of veterinary faculties in the last two decades, resulting in an increasing supply of a large veterinary workforce. Fourteen veterinary schools /faculties in the country produce over 500 graduates per year.

Figure 2: Emperor Haile Selassie visit school of animal health assistants

Figure 3: The first batch of veterinary students one year before graduation

Figure 4: Emperor Haile Silassie with fifth batch graduates of Animal Health Assistants in June 1968

Currently, clinical animal health services are provided mainly by the public sector, with limited involvement in the private sector. The number of staff and the number of delivery points for veterinary services has increased dramatically. The government veterinary field service is based upon a system of woreda veterinary clinics and is increasingly supported by satellite animal health posts at the kebele level. Inadequate budget, Irregular supplies of drugs and logistic problems, and lack of essential equipment and consumables hamper public sector veterinary clinical service delivery. Regional governments are in the process of building more clinics to reach out to every kebele. It is also unclear how the expanding fixed-point clinic system would be supported in terms of operating budget. On a positive note, private veterinary practice is rapidly emerging in all regional states of the country to bridge the gap in public services. However, regulation of the rapidly emerging private sector remains a big concern, and unethical and illegal practices are widespread. This is eroding the confidence of livestock producers in private veterinary services, and urgent action is required to rectify this.

Ethiopia is endemic to a wide range of Transboundary Animal Diseases (TADs) and zoonosis. The large-scale annual vaccinations for prophylactic and outbreak containment have reduced widespread morbidity and mortality losses from different endemic and epidemic diseases of different livestock species. The use of the vaccination calendar is well established in all regional states and has assisted in targeting various Transboundary (TADs) and endemic diseases during the season and the time they are likely to occur. However, quantified epidemiological and economic data that shows the impact of vaccination over the years is hard to come by. Disease prevention and control require functional linkage among all stakeholders and well-coordinated activities in order to achieve desired goals. This is especially the case for TADs that are highly contagious or transmissible and have the potential to spread very rapidly, irrespective of administrative and national borders. However, such linkages and coordination between federal and regional veterinary services are deficient, negatively impacting disease prevention and control efforts.

Since the introduction of rinderpest into Ethiopia in the 1880s and the resulting pan-African epidemics, there have been national and international efforts to control and eradicate the disease from Ethiopia. Successive projects, including Joint Campaign 15 (JP-15), Pan African Rinderpest Control (PARC), and Pan African Control of Epizooties (PACE), were carried out to control and ultimately eradicate the disease. Ethiopia has been a pioneer in the development of progressive and efficient eradication strategies for rinderpest. Both OAU/IBAR and the FAO have recommended the Ethiopian PARC strategy as a model for other PARC and GREP member states. The 76th General Session of the OIE officially recognized Ethiopia

as free from rinderpest in May 2008, according to the provisions of chapter 8.13 of the Terrestrial Code.

Ethiopia has several disease-specific contingency plans and prevention and control plans for priority diseases, including PPR, FMD, LSD, HPAI, RVF, Rabies, Anthrax, Brucellosis, and ECF. Some of these plans are being implemented through government and project funding from development partners. The implementation of the national strategy for progressive control and eradication of peste des petits ruminants (PPR) from Ethiopia has shown that it is possible to manage and control PPR disease in goats and sheep in areas of Ethiopia and so reduce its economic and social impact through risk-based targeted vaccination and built the surveillance, laboratory and vaccine production capacity of the National Veterinary Services. This risk-based approach should be scaled up and expanded to the management of other TADs and zoonosis as it ensures focused intervention, efficient recourse utilization, and timely response. There are also recent initiatives to implement the rabies control and elimination strategy and control of young stock mortality.

Ethiopia has rapidly expanded its live animal and meat exports in the past two decades. Commendable efforts have been made in the establishment of quarantine centers and check posts to facilitate trade. There are about 11 functional privately-owned export abattoirs in Ethiopia, which are registered by the Ethiopian Agricultural Authority (EAA), producing on average 18 thousand tons of chilled/ frozen meat and offal annually for export to the Middle Eastern countries. However, recent trends show a dramatic fall in meat and live animal exports, which require timely intervention by the government.

Veterinary legislation is the foundation of any efficient animal health policy and is a critical element for all countries. In Ethiopia, the veterinary legislation has not been updated for many years and is obsolete or inadequate in structure and content for the challenges facing veterinary services in today's world. The absence of an up-to-date legal framework that complies with scientific advances, international standards, and the requirements of trading partners limits the effectiveness of existing public and private animal health services, negatively impacts disease prevention, control, and eradication efforts, and makes it difficult for the country to expand and diversify its market share for its livestock and livestock products.

Ethiopia cannot meet the growing demand from smallholder farmers and semi-intensive and intensive commercial producers for free service from existing fixed-point public clinics. Moreover, to prevent and control major TADs and zoonosis, to further expand the livestock and livestock products export trade, a new rethinking of the delivery of animal health services as part of Ethiopia's broader transformation is required. The document provides major recommendations to address these issues and improve the quality of veterinary services based on the WOAH PVS evaluation done in 2011 and the WOAH legislative mission performed in 2014.

Public animal health services

Historical development of animal health service in Ethiopia

Traditional veterinary services are believed to have been in practice in Ethiopia long ago. Traditional healers (Wegeshas) treated both human and animal patients by drenching herbal drugs, incising and cauterizing abscesses and wounds using sharp objects and hot metals, mending fractures, and rehabilitating dislocations. Such practices still exist in some parts of the country.

Modern veterinary services started relatively recently in Ethiopia, around 1887, following the introduction of rinderpest into the country. In 1887, the Italian government deployed a team of veterinary experts to Ethiopia to assess the situation. This study resulted in the establishment of the first vaccine production laboratory in Asmara. Following this, in 1889, clinics were established in Karen, Gashena Setit, and Akale Guzaye Awraja of the then Eritrea province in a bid to expand veterinary services. In addition, a veterinary team deployed by the French government from 1908 to 1914 carried out rinderpest vaccination programs for six years (MoA, 1984).

Drs. Alemework Deferese Beyene and Engeda Yohannes were the first Ethiopians to complete their veterinary education in London, UK, and Maryland, USA, respectively, and returned home just before the Italian invasion of Ethiopia. After the end of the Italian occupation in 1942, there was a monthly bul-

letin entitled "Geberena Kebtu" issued by the animal health and production division, focusing on various livestock diseases and their treatment and control methods. Moreover, in 1952, a book was published by Dr. Alemework Deferese on the distribution, etiology, clinical symptoms, and treatment and prevention methods of livestock diseases. All these efforts have played a substantial role in imparting basic knowledge of veterinary science and practices in the country (MoA, 1984).

Vaccine production for the major cattle diseases in Ethiopia began in the early part of 1945 by the then MoA. The production took place in a small laboratory building at Gullele in Addis Ababa under the direction of Dr. Mepherson, a senior bacteriologist provided by FAO. Dr. Mepherson was assisted by two trained and highly skilled technicians, Gedlu Behailu and Kifle Meshesha. The laboratory-produced goat-adapted (caprinized) rinderpest vaccine for the local zebu and lapinized vaccine for exotic and grade cattle. The Gullele laboratory also prepared the CBPP vaccine for field use (Asefa, 2009).

Until the later part of 1955, field vaccinations of both rinderpest and CBPP were delivered in payment of Eth. Birr 0.5/dose. Later, the Ethiopian government decided to deliver both the rinderpest and CBPP vaccinations free of charge. One of the major persuasive reasons that influenced the government to make such changes was that some farmers and herders showed strong unwillingness/resistance to bring their cattle to vaccination centers in payment. Instead, these cattle owners opted to resort to "active immunization", infecting their healthy cattle with the secretions and excretions of affected animals (Asefa, 2009).

The Gullele Veterinary Laboratory also managed an establishment for the training of veterinary scouts/vaccinators at Holleta. The establishment was fully financed by USAID, with two American veterinarians (Dr. Murohy and Allen) as supervisors and some Ethiopian general agriculturalists as assistants. The establishment trained some 900 vaccinators annually, providing a course of theoretical and practical fieldwork running for a period of four months per batch (Asefa, 2009).

In 1963, the entire establishment of the Gullele veterinary laboratory was transferred to Debre-Zeit and named the National Veterinary Institute (NVI). It is at the National Veterinary Institute that the preparation of a large number of vaccines in sufficient quality and quantity began using a skilled workforce, facilities, and a better organizational setup. The French government took the major share of the foreign aid for NVI (Department of Veterinary Services, 1972). Since then, the NVI has made tremendous contributions to disease control efforts through the national veterinary services. Currently, the National Veterinary Institute produces and supplies most of the vaccines needed in the country, as well as an occasional surplus for export. The NVI is managed as a government enterprise and operates on a cost-recovery basis.

Ethiopia became a member of the World Organization for Animal Health (WOAH) in 1977. As a member of the WOAH, the Ethiopian Veterinary Services subscribes to the fundamental principles of ethical, organizational, and technical nature. Compliance with these fundamental principles by the Ethiopian Veterinary Services is important to the establishment and maintenance of confidence in its international veterinary certificates by the Veterinary Services of other WOAH Member Countries.

To satisfy the growing demand for veterinary services and to allow gradual takeover from expatriate experts, a substantial number of Ethiopians were trained overseas. To meet the need for medium-level professionals, the School for Animal Health Assistants was established in 1963 (Department of Veterinary Services, 1972). This was a significant breakthrough in veterinary education in Ethiopia. The school has trained 1,890 animal health assistants in a period of 40 years. Its administration came under the Faculty of Veterinary Medicine of Addis Ababa University in 1984 and lasted until 2002 when the program was transferred to Alagae Technical and Vocational Training Center (FVM, 2005).

The Faculty of Veterinary Medicine (FVM AAU) was established in 1979 to cater for the training of high-level professionals. During the last quarter of the century, the Faculty of Veterinary Medicine of Addis Ababa University has graduated around 25-30 veterinarians annually. Most of them are working at national and international levels in areas of veterinary education, research, development, and business involving governmental institutions, NGOs, and the private sector. The faculty has also launched post-graduate studies since 1996 (FVM, 2005).
Moreover, the veterinary services which mainly started with the objective of controlling rinderpest, has also made considerable progress in areas of meat inspection and quarantine, tsetse and trypanosomiasis control, establishment of central and regional veterinary diagnostic laboratories and new veterinary fac-

ulties.

Structure and function of public animal health services at federal and regional state levels.

Following the establishment of federal system in Ethiopia In 1993, the country is decentralized into autonomous regional states, which also resulted in the decentralization of animal health services. The veterinary service of the country has been organized both in the federal, as well as regional levels. In the federal, it is structured under the Ministry of Agriculture, Ethiopian Agricultural Authority, Animal Health Institute, and Ethiopia Institute of Agricultural Authority. While in the regions, it is organized under bureaus/agencies in charge of agricultural development.

Major duties and responsibilities for federal veterinary service include:

- Formulation of appropriate national policies, strategies, programs, and projects for veterinary service and preparation of up-to-date veterinary proclamations, regulations, and directives and their implementation;
- Establish a system that enables the promotion the participation and role of the private sector in agricultural sector development; create conducive conditions for the implementation of the same;
- Establish a system and infrastructure that enables to improve the quality and accessibility of animal health services;
- Establish a system that enables the prevention and control of animal diseases; lead and coordinate studies and research with respect to the same;
- Quarantine of animals and animal products brought into and taken out of the country;
- Establish a system for registration and monitoring of animal health technology, input, and service; establish a system for monitoring the quality, health, and safety of production.

Major duties and responsibilities for regional veterinary service include:
Designing and implementing regional livestock diseases and executing different federal control/eradication programs against major transboundary diseases in their respective regions.

- Provide veterinary public health service to ensure wholesome meat and livestock products for human consumption and
- provide a diagnostic service for livestock diseases and implement effective, passive, and active disease surveillance system;
- Issuance of certificate of competence for private veterinary clinics, animal health posts, drug shops, and pharmacies and monitor the quality of service;
- Deliver clinical service through a network of clinics and animal health posts and improve the quality and coverage of public veterinary service.

Table 1: Staff and institutional profile for public veterinary services at the regional level

		Animal Health Infrastructure				Human resource						
	Region	Health clinic	Health Post	Lab	Slaughter Houses	PhD	MSc	DVM	BVSc	AHA and Level IV	Labo.	Total
1	Oromia	452	2335	4	114		75	865	1910	4786		7636
2	Amhara	145	2973	2			32	500	802	3531		4865
3	SNNP	94	384	2	86		19	306	442	1077		1844
4	Sidama	20	92	1	25		7	50	152	625		834
5	Southwest	35	182	1	32		15	39	252	567		873
6	Tigiray	179	11	1			2	53	95	331		481
7	Afar	38	237	1				7	5	279		291
8	Somali	14	1164	1	4		15	47	60	1235		1357
9	Beni/gumz		450	1			7	28	275	581		891
10	Gambella	9	57	1				9	2	2		13
11	Diredewa	1	22					2	2	27		31
12	Harere	11	1				1	9	1	25		36
13	Addis Ababa	6		1	3		4	33	9	76		122
Total		1,004	7,908	16	264	0	177	1,948	4,007	13,142	0	19,274

Table 2: Staff profile at Federal Veterinary Institutes

	Institute	PhD	MSc	DVM	BVSc	BSc (VLT)	AHA and others	Total
1	Ministry of Agriculture							
2	Ethiopia Agricultural Authority	**7**	**47**	**68**	**11**	**9**	**21**	**163**
3	Animal Health Institute	**3**	**42**	**27**	**20**	**16**	**18**	**123**
4	National Veterinary Institute	6	37	-	2	**32**	-	37
5	Ethiopian Institute of Agricultural Research	**12**	**34**				**28**	**74**
6	Higher learning institutes (Vet Colleges /schools)	82	486	60	38	74	35	775
Total		**0**	**0**	**0**	**0**		0	0

Coordination, collaboration, and functional linkage between federal and regional veterinary services

Disease prevention and control requires functional linkage among all stakeholders and well-coordinated activities in order to achieve desired goals. This is especially the case for transboundary animal diseases that are highly contagious or transmissible and have the potential to spread very rapidly irrespective of administrative and national borders and require coordinated international efforts for rapid, effective control/response.

Effective disease control and eradication of TADs will require evidence that national standards on disease, surveillance, detection, containment, and reporting are being applied across Ethiopia in a timely, efficient, and effective manner, with an accountability chain to the competent authority. The capability of the veterinary services to coordinate its resources and activities (public and private sectors) with a transparent chain of command, from the central level (Chief Veterinary Officer, CVO) to the field level of

the veterinary services in order to implement all national activities relevant for WOAH Codes (i.e., surveillance, disease control and eradication, food safety and early detection and rapid response programs) is one of the key competencies under the WOAH PVS evaluation.

One of the key findings of the WOAH PVS evaluation done in 2011 was the absence of a legislated chain of command between federal and regional veterinary services. As a result, linkages and coordination between federal and regional veterinary services are deficient, technical accountability has remained an issue, and animal health service delivery is highly fragmented.

Ethiopia has a federal arrangement in which the regional veterinary services are answerable to their respective regional states not to the federal government. Federalism implies that responsibilities are devolved to the states to the degree that they are local matters. However, transboundary disease control requires national and regional approaches to be effective; therefore, they are not matters of limited local interest. If one state fails to undertake effective control measures, all states fail. This would have profound economic effects on all states and the nation as a whole.

Ethiopia, through the Pan African Rinderpest Campaign (PARC), has been highly successful in the eradication of rinderpest. This was mainly due to the dynamic and efficient Branch Co-ordination Office structure implemented at the start of the program. In this structure, the national program has ownership of the inputs and manages the campaign. The region's second personnel to man the system, and many activities are carried out in collaboration with regional and woreda-level structures.

The prevention, control, and eradication of major TADs in Ethiopia requires new thinking and approaches and making policy shifts in the management of TADs. The country can draw lessons from other countries that have similar government systems and are implementing very successful livestock disease prevention and control interventions. In these systems, the financial control and management of transboundary diseases are federal responsibilities. Federal budgetary and quarantine powers in regard to transboundary disease control are the tools that the federal veterinary services require to ensure state compliance with the policies and strategies agreed upon in their joint planning.

One of the major recommendations of the PVS evaluation in 2011 was to consider the creation of a formal National Veterinary Committee/hub or equivalent where the national CVO and all regional heads of animal health meet together formally and at regular intervals to discuss and agree on policy and programs, and to monitor their nationally consistent implementation. Consider also inviting a key laboratory representative (head of AHI) and a small number of other key senior stakeholders, including the private sector.

Animal health status of Ethiopia and the impact of livestock diseases

Livestock are essential in Ethiopia to economic development and poverty reduction. Ethiopia has one of the largest livestock inventories in Africa, providing support for the livelihoods of an estimated 80 percent of the rural poor. Animal rearing is an integral part of agricultural production, and the estimated livestock population approximates 70 million cattle, 42.9 million sheep, 52.5 million goats, 13.3 million equines, 8.1 million camels, and 57 million poultry (CSA, 2021). Additionally, Ethiopia's wildlife includes more than 320 species of mammals (36 endemics) and 862 species of birds (18 endemics), among others, creating a rich ecosystem and an extensive interface among people, livestock, and wildlife (Murphy et al. 2019).

Ethiopian pastoral communities and farmers heavily depend on livestock for their livelihood. Livestock serves as a source of cash income for incidental/daily expenses (poultry, egg, and milk sale), big expenses (fattened cattle and sheep/goat), quality protein supplementing a cereal-based diet, and power for crop farming.

However, the economic benefit derived from the livestock sector is not commensurate with the potential, and the sub-sector still needs to be tapped. Overall, the livestock sub-sector contributes some 45 percent of agricultural GDP, 15-18 percent of national GDP, and 5-17 percent of total exports (IGAD, 2010). Undoubtedly, the widely prevalent livestock diseases are major constraints to Ethiopian livestock development. The vulnerability of livestock production and trade to disease epidemics is undermining invest-

ment in a potentially valuable economic activity that would increase employment in rural areas, raise rural incomes, and assist in alleviating poverty.
In Ethiopia, there are numerous records of the presence of major transboundary animal diseases (TADs). Rinderpest has been eradicated, and lots of other endemic diseases are put under considerable control, there are still some severe TADs like CBPP, CCPP, FMD, LSD, AHS, PPR, SGP, AHS, and ND, which are limiting the productivity and international trade of livestock and their products. Besides affecting the production of livestock products, livestock diseases have other impacts on the highland mixed crop-livestock system, namely their impact on the work performance of oxen, which could lead to severe food insecurity and poverty.

The impact of animal diseases stems from direct losses due to mortality and its indirect effects through slow growth, low fertility, and decreased work output that results from morbidity. The direct and indirect losses from livestock disease have significant economic, food security, and livelihood impacts on livestock keepers and the national economy. The wide prevalence of these diseases, coupled with the poor capacity of the veterinary services for early detection and response, has denied the country its fair share in the international livestock and livestock products market. Moreover, some of these diseases are zoonoses, seriously impacting human health. An annual loss due to mortality ranges from 8-10% for cattle, 12-14% for sheep, 11-13% for goats, and 56.9% for poultry. These figures are even much higher, more calves, lambs, and kids. The monetary value of these losses is very substantial. Moreover, existing data indicate that annual production losses emanating from these diseases could reach 30-50 percent. Since young replacement stocks are more affected both in terms of mortality and morbidity, it would undermine the sustainability of developments in the sector (MoA, 2012).

Ethiopia is also endemic to a wide range of zoonotic pathogens. Roughly 80% of households have direct contact with domestic animals, creating an opportunity for infection and the spread of disease (Lindahl and Grace, 2015). With respect to zoonotic disease burden, Ethiopia ranks third in Africa and fifth in the world (Grace et al., 2012).

Zoonotic diseases may have the potential to impact in four ways: (1) they threaten the health of animals resulting in illness, loss of productivity, and death; (2) they threaten the livelihood of people dependent on livestock as a major source of income; (3) they cause illness and death in people, which in turn causes additional economic and societal loss; and (4) they cause negative impact on national economies by impeding livestock and its products export trade (Pieracci et al., 2016).

Major activities and outputs of federal and regional veterinary services

In the past years, concerted efforts were made by regional and federal veterinary services to prevent, control, and or eradicate priority livestock diseases. Most vaccines of interest to livestock owners available in Ethiopia are manufactured at the National Veterinary Institute (NVI). The domestic production of some 22 kinds of vaccines in millions of doses per annum by NVI must have reduced widespread morbidity and mortality losses from different endemic and epidemic diseases of different livestock species. The use of the vaccination calendar at the health post and district level is well established in all the regional states and has greatly assisted in targeting various TADs and endemic diseases during the season and the time they are likely to occur.

According to regional veterinary services, there has been a reduction in outbreaks over the last years, and most of the vaccination, roughly 80-90 percent, is used for prophylactic purposes. However, quantified epidemiological data on reduction in terms of disease incidence and prevalence and economic data on the monetary value of the loss saved due to vaccination is complex to come by. Implementation of the control policies and strategies is mainly monitored in terms of the number of vaccinations achieved and not by monitoring the disease targeted for control or eradication.

Ethiopia has several disease-specific contingency plans and prevention and control plans for priority diseases, including PPR, FMD, LSD, HPAI, RVF, Rabies, Anthrax, Brucellosis, and ECF. The prioritization is done using the WOAH (founded as OIE) methodological manual and CDC prioritization tool for zoonotic diseases. Most of these plans are only approved by some arms of government and lack resource

and financial plans and proper legislative backing for implementation. Two national plans that were adequately funded and implemented are rinderpest and PPR control and eradication, which are discussed below.

Rinderpest: During the late 19th century, Ethiopia suffered one of the worst famines in the country's history. The intensity and the ripple effect of the various factors that contributed to the famine make this period a crucial point in the country's history. The Italians introduced the pivotal cause that made the drought to the Great Famine. While occupying Massawa, the Italians imported cattle from Asia. As a result, the cattle plague, known as rinderpest, which devastated Europe in the 1700s, was introduced to Ethiopia. Rinderpest, which got a foothold through an Ethiopian seaport in 1887, decimated the cattle population of northern Ethiopia, and later on, it was spread to the rest of the country and Africa by 1897 (Pankhurst 1964, Zewde 2001). Like so many of the other droughts, Ethiopia could have survived the drought of the late 1880s with much lower loss of lives if it had not been for the devastation caused by rinderpest.

Joint Campaign 15 (JP 15) was the first pan-African program for the control of rinderpest. The campaign in Ethiopia reduced the incidence of the disease to a significant level. However, the disease was not totally eradicated. As a follow-up to JP 15, the PARC Project in Ethiopia has been highly successful in eradicating rinderpest in the country. This has been achieved through an epidemiologically rational strategy, which categorizes the country by risk factors and targets resources accordingly. Within the strategy, surveillance plays a more significant role than vaccination. In fact, Ethiopia has been a pioneer in the development of progressive and efficient eradication strategies. Both OAU/IBAR and the FAO have recommended the Ethiopian PARC strategy as a model for other PARC and GREP member states. Countries must take a series of steps in order to obtain official recognition by OIE that they are free of RP and its causative virus. This is a three-stage process commonly known as the OIE pathway. The first stage, provisional freedom from rinderpest, was achieved in 1999 in the final year of the PARC project. The two subsequent stages in the eradication process, freedom from rinderpest disease and rinderpest infection, were achieved during the PACE era. The 76th General Session of the OIE officially recognized Ethiopia as free from rinderpest in May 2008, according to the provisions of chapter 8.13 of the Terrestrial Code. In 2011, FAO and the OIE declared the world free from rinderpest, making it the first animal disease to be eradicated in the history of humankind.

Figure 5: Crossing the Baro River during JP 15

Figure 6: Local and expatriate staff involved in JP 15

Peste de Petit Ruminants (PPR): PPR is a highly contagious transboundary animal disease (TAD) that affects small ruminants. PPR was first suspected in Ethiopia in 1977 following clinical observations consistent with infection with PPR (Pegram and Tereke, 1981). It was later diagnosed as the causative agent of disease in goats in the country in 1991 (Roeder et al., 1994). Later on, the virus was determined to be genetic and clustered within lineage III (Kwiatek et al., 2007; Banyard et al., 2010). The disease is one of the major killer diseases of sheep and goats, which are the main livestock assets of poorer households, causing food security to be compromised within the affected areas. During the national diseases prioritization exercise by the veterinary service in 2015, following OIE guidelines, PPR became the priority TAD in the country. Previous studies of the disease in Ethiopia have shown a higher prevalence of the disease in pastoral areas with fewer but significant pockets of persisting infection in highland areas.

Ethiopia has developed a national strategy for progressive control and eradication of peste des petits ruminants (PPR) from Ethiopia aligned with the Global and Continental PPR Control Strategy. The plan is to eliminate PPR and gain recognition of the OIE as a PPR free country within 10 years (2025/26). The progressive control strategy proposes a step-wise approach to strengthen the PPR control capacity sustainably.

In line with this strategy, the Progressive PPR control and eradication program implemented by the Supporting Horn of Africa Resilience (EC-SHARE) project has been implemented. The Project has shown that it is possible to manage and control PPR disease in goats and sheep in areas of Ethiopia and so reduce its economic and social impact through risk-based targeted vaccination and built the surveillance, laboratory, and vaccine production capacity of the National Veterinary Services. The program has made commendable achievements through a targeted vaccination approach using real-time disease notification, participatory disease surveillance (PDS) with pen-side tests, and sero-surveillance. Following the end of the EC0SHARE project, several projects funded by various development partners and MoA are supporting the implementation of the PPR progressive control and eradication strategy.

The introduction of new outbreaks from neighboring countries challenges the progressive control and

eradication of PPR in Ethiopia. Besides the unregulated and extensive livestock movement within the country, most of Ethiopia's borders are located in porous pastoral areas, and populations on both sides of the border are the same or closely related. As a result, animals move across the borders, freely transmitting PPR and other diseases. Whatever Ethiopia achieved in the prevention and control of PPR can easily be lost unless similar programs are implemented in neighboring countries. In practical terms, they constitute the same epidemiological unit and should be treated accordingly for disease prevention and control purposes. In the absence of this, cross-border MoUs signed with most of the neighbors and coordination meetings can do little to avoid the introduction of PPR into Ethiopia.

Progress towards rationalization of animal health services in Ethiopia

The government's operational capacity and effectiveness can be improved by rationalizing the delivery of public good veterinary services while divesting those services that can be commercialized and benefit individual owners of livestock. The overall aim is the delivery of efficient and effective animal health services. This has been done globally, including in most African countries, and has brought substantive changes to the quality of animal health service delivery. Cognizant of this, Ethiopian veterinary services developed a privatization roadmap in 2014, still awaiting the approval of the government.

One of the benefits of rationalization of veterinary service delivery is that the public sector will be able to focus on those issues of overriding national importance which should be addressed at the moment. The activities well suited to public sector execution include regulation of veterinary service delivery, formulation and supervision of epidemiological surveillance and reporting, formulation and supervision of national disease control and eradication programs, and formulation and supervision of livestock inspection and certification programs. It also relieves the government from undue concentration upon delivering veterinary clinical services, and the major savings made from withdrawing from these services can be used to fund public good activities mentioned above.

Challenges and opportunities in public animal health service delivery

The quality of public veterinary clinical services is poor: Over the past several years, the government has made concerted efforts to improve animal health coverage throughout the country. However, this continued attempt to deliver a broad range of services to livestock owners over the full geographical extent of the country has not brought the much-needed change in the quality of animal health service delivery. Due to inadequate budget, Irregular supplies of drugs and logistic problems, and lack of basic equipment and consumables, access to regular and reliable public animal health services is inadequate. Most of the budget allocated goes to salary expenditure, and little is left for operational costs, leaving veterinary staff office-bound.

Regional policies for the development of animal health services are still based on the construction of more expensive clinics and animal health posts. Most of the regional states are making massive investments in fixed-point public clinics. Due to the low rate of cost recovery, these new clinics suffer from the same constraints as the existing facilities; their activities are hampered by a lack of operational budget, irregular supplies of drugs, and a shortage of transport and consumables. It is generally accepted that a substantial number of livestock owners do not have access to formal public veterinary services. This incomplete coverage by the government veterinary services has left gaps that are currently filled by traditional healers, illegal traders, and some private veterinary practitioners.

With these extremely limited resources, the Government cannot satisfy the growing demand for veterinary clinical services from smallholder farmers and the growing semi-intensive and intensive livestock operators. It is most unlikely that this will change, and a new rethinking of the delivery of animal health services as part of Ethiopia's wider transformation is required.

Low rate of cost recovery to self-sustain animal health service: Clinical and preventive services are heavily subsidized by the government. The importation and distribution of veterinary drugs in Ethiopia has been liberalized since 1991. Even though importation is fully liberalized and left to the private

sector, there is considerable competition from the regional governments with regard to distribution. The regions purchase veterinary drugs through tenders on an annual basis and sell them at subsidized prices without considering the cost of handling transport and storage of drugs. All major vaccines for TADs (former OIE List A diseases) are manufactured by the National Veterinary Institute (NVI) and distributed free of charge through subsidy from the federal government. Vaccines for endemic diseases are sold at subsidized prices by regional states, and field operational costs for delivering the vaccines are free of charge.

Perceptions depicting livestock-keeping communities as not willing to pay for animal health services have been refuted by many studies in the past. A recent study in 2023 by the Ethiopian Veterinary Association through funding from the HEARD project "Community Willingness to Pay (WTP) for Vaccination Services for Livestock Diseases in Ethiopia" has shown that:

- In the Mixed Crop Livestock system, 93.3% of respondents are willing to pay, while 5.6% are against paying for vaccination services and hence are not willing to pay. A few more, 1.1%, were found to be undetermined in their decision.
- In the pastoral/agro-pastoral production system, 61.3% of the respondents are willing to pay, while 34.0% are unwilling, and 4.7% are undetermined.
- In the urban/peri-urban production system, 91.5% of the respondents are still willing to pay if the service is provided with payment. Only 2.2% are undetermined, and 6.3% are unwilling to pay for vaccination services.
- The proposed cost of vaccination per individual animal, as reported by the various actors, seems to be too small compared to the market price of a given animal.
- However, respondents have also pointed out the various challenges that need due consideration, such as irregularity and unavailability of the service as needed or delayed vaccination, limitations of coverage to all kebeles/villages, and their ability to pay when they want to vaccinate a large number of animals.

Recently, a few regional states introduced cost recovery schemes to improve the performance of public animal health service delivery. The most notable example is the one by the Amhara Regional State. The program was officially initiated in April 2013 E.C. after the regional council endorsed the scheme and instructed each district to allocate one million ETB in the form of a revolving fund (RF) for purchasing veterinary drugs and equipment. The total RF money allocated by the regional government and districts was 315 million Birr in 2021. The clinics make a 15 percent margin on veterinary drugs and charge for services. Transfer of the revenues generated by the cost recovery to a special account or revolving fund, under the responsibility of the district has provided sufficient budget to procure and replenish stock two or three times per year.

As a result, the scheme has enabled the region to ensure a regular and consistent supply of veterinary drugs in veterinary clinics and health posts throughout the year. However, the range of veterinary drugs used in the region remains limited, and the scheme has made little impact in changing this trend[1]. The introduction of the veterinary cost recovery scheme has minimized the price gap between public and private animal health service providers. The unfair competition due to subsidized or free service has reduced the protection of emerging private initiatives.

However, there is still a difference in price as well as service charges between the two sectors, and this could change when a full cost recovery scheme is introduced. The scheme has enabled the regional government to reduce its financial burden and make the service financially sustainable and independent from erratic central budgeting processes and cumbersome systems of financial control. A decentralization of

1 file:///C:/Users/user/Downloads/ajol-file-journals_439_articles_177378_submission_proof_177378-5209-453245-1-10-20180910%20(1).pdf

the decision-making on the use of funds generated by cost recovery at the district level has improved the utilization of resources since local staff generally have a better idea of their needs.

Some federal institutes, such as the Animal Health Institute (AHI) and the Kality Veterinary Drug and Input Quality Control Laboratory, have developed a funding model that introduces cost recovery for laboratory services provided for the commercial sector and export testing. The proposals are awaiting approval by the federal government.

Core public good services are neglected: The veterinary service delivery in Ethiopia needs to be rationalized. The prominent role played by the public sector in the provision of formal veterinary clinical services is most unfortunate as it diverts the public veterinary services from their primary role: that of providing core public good services. Focusing on the wrong priorities, undertaking the wrong tasks, and decreasing government operational budgets all limit the ability of public sector veterinary services to deliver services appropriately and, at the same time, undermine the increasing role the private sector can play in animal health services.

As a result, core responsibilities of the public veterinary services include providing an enabling legislative framework; quality assurance of public and private animal-health services; planning, coordination and implementation of national disease-control programs; disease surveillance and other early warning measures, epidemiological analysis, disease reporting at national and international level; risk analysis as an input to quarantine, surveillance, contingency planning and priority setting; quarantine and animal-movement controls; Veterinary Public Health and Food Safety etc. are poorly funded and not given the attention they deserve.

The growing pool of unemployed veterinary graduates: The country has seen a proliferation of veterinary faculties in the last two decades, resulting in an increasing supply of a large veterinary workforce. 14 veterinary schools /faculties in the country produce over 500 graduates per year and the public sector is only able to absorb a few of these. This abundance of trained professionals and veterinary auxiliaries graduating from the various higher learning institutes is not effectively utilized. Due to fiscal constraints, the Government has been forced to abandon its policy of employing all veterinary graduates.

Youth unemployment has become a very critical cause of many nationwide problems in Ethiopia. Youth age groups, whether educated or non-skilled, can be the reasons for economic growth if the labor force could be managed properly and used as a key resource for development. Most graduates need help securing jobs from both the government and private sector. This makes the youth and their families frustrated and cuts their hopes of leading a better life after graduation.

The need for the Government to support the poor livestock-keeping communities: Given that some 30% of the rural population exists in extreme poverty (below the internationally recognized poverty line of $1.25 per person per day). A Gross National Income (GNI) per capita, which is approximately half that of sub-Saharan Africa, it is clear that privatization could deprive a significant proportion of the rural population of access to animal health clinical services. Strategies must be in place to prevent this.

Private Animal Health Services

Historical development of private animal health service in Ethiopia

In the 1980s and 90s, countries throughout the world started implementing structural adjustment programs to refocus government services and improve efficiency. In Africa, where agriculture and livestock are vital to the national economy in many countries, animal health and the delivery of veterinary services have been particularly important components of this process.

Against this background, FAO has published a document entitled *Principles for Rational Delivery of Public and Private Veterinary Services with reference to Africa*[2] to be used by all relevant actors as a guide and

2 https://www.fao.org/3/w4338e/w4338e00.htm

framework to change, strengthen, and develop the rational delivery of veterinary services within each country as required.

Ethiopia has never kept pace with this reform process compared to other African countries. However, some important reforms and milestones were achieved. The importation and distribution of veterinary drugs in Ethiopia were liberalized in 1991. Even though importation is fully liberalized and left to the private sector, there is considerable competition from the regional governments with regard to distribution. The regions purchase veterinary drugs through tenders on an annual basis and sell them at subsidized prices.

Until the issuance of the market economy policy of the Federal Democratic Republic of Ethiopia, the provision of animal health services, as well as the regulatory tasks, was the sole responsibility of the government. Following the new economic policy in the 1990s that calls for greater participation of private entrepreneurs in the economy, PARC Ethiopia project-initiated reform measures aimed at rationalizing the delivery of veterinary services in Ethiopia. PARC Ethiopia pursued these reforms by establishing a loan scheme for private practitioners. However, despite this broader economic policy, the adoption of legal and economic measures to provide an environment conducive to the development of a private animal health care system needed to be improved.

The credit scheme was launched in April 1996 after an agreement between the Ministry of Agriculture (MOA) and the Development Bank of Ethiopia (DBE) for channeling and managing a credit fund to be extended to eligible private veterinary practitioners was signed. As of June 2000, the Development Bank of Ethiopia (DBE) had approved loans to 28 borrowers amounting to ETB 2.3 million, of which ETB 2.1 million has been disbursed to 27 professionals and sub-professionals. The achievement of the credit scheme was far below the set target of 200 beneficiaries over a period of 4 years due to the need for more confidence and commitment on the part of private practitioners. Some of the primary reasons for the low performance of the scheme were that the concept was relatively new, and the enabling environment was not created; private practitioners were being discouraged by the type of collateral required by the scheme, the interest rate of the scheme failed to attract private operators, etc.

With all its drawbacks, the scheme laid the foundation for private service delivery in Ethiopia. Moreover, the scheme conducted several training sessions for various level professionals to familiarize them with the concept of private veterinary practice and create awareness of private veterinary service delivery in Ethiopia, which motivated several government employees to go private. Following this and other initiatives, private veterinary practice rapidly emerged in all regional states of the country to bridge the gap in public services. In 1996, there were an estimated 33 private veterinarians in Ethiopia (LMP, 1996); by 2010, the number had risen to 486 (MoA, 2010), indicating a compound annual growth rate of over 20%.

The EU funded PARC program also supported a study to introduce cost recovery in the public services. The study clearly revealed the subsidies provided by the government and the unfair competition this causes for an emerging private sector. The study was completed and submitted to the Ministry of Agriculture in 2000 but was never approved and implemented.

Table 3: Number of private veterinary clinics, pharmacies, and drug shops by region

	Region	Privet vet. services	
		Clinic	pharmacy
1	Oromia		
2	Amhara	569	447
3	SNNP	22	322
4	Sidama	2	62
5	Southwest		
6	Tigiray		
7	Afar		
8	Somali		
9	Beshangul Gumz		
10	Gambella		
11	Diredewa		2
12	Harere		1
13	Addis Ababa		
Total			

The current role and functions of private animal health services

Currently, participation of the private sector in the delivery of veterinary services is increasing. The private sector's role in animal health service delivery is limited to the sale of veterinary drugs and requisites through pharmacies and drug shops and the provision of clinical services from licensed veterinary clinics. Moreover, the importation and distribution of veterinary drugs in Ethiopia has been liberalized since 1991 and left for the private sector.

Highly subsidized or free-of-charge services by the public veterinary services remain undermining the private sector. All clinical services and vaccines for TADs are provided free of charge. Vaccines for endemic diseases are subsidized, and regional states cover all operational costs related to vaccination. Farmers are only charged the actual wholesale tender price of the drug plus some markup. The total costs for transport, handling, storage, and disposal of expired drugs are not included in the price. This has led to a situation whereby private practitioners have to compete with a highly subsidized public veterinary service. This unfair competition has discouraged private investment. Private practice is often regarded as not viable.

New private practices and drug shops are rapidly being established within an unregulated environment. Potentially, this will negatively impact veterinary privatization as it will most likely lead to an increase in malpractice - misuse of drugs, including the use of out-of-date products, use of unsuitable products, under-dosing, over-charging, and so on. This, in turn, will (i) erode the confidence of livestock producers in the private veterinary sector, (ii) discourage senior decision-makers from supporting privatization, and (iii) consequently could significantly delay the progress of veterinary privatization.
Formal (licensed) private providers of clinical services and veterinary drugs are facing increasing competition from unlicensed service providers and uncontrolled illegal operators. This could lead to cost-cutting and malpractice.

The development of private veterinary practices and their sustainability require a more determined and entrepreneurial approach in the future. The Government, through the regulations and its development programs; the private sector, with its professional associations; the University, through the adaptation of its curricula; the banking sector, and the donors all have an important role to play in the development and recognition of the profession in the private sector.

Figure 7: Veterinary drugs shop at the Turmi market, Ethiopia

The use of CAHWs in remote pastoral areas of the country

Conventional government veterinary services have consistently failed to establish effective or sustainable systems of delivery in the remote pastoral areas of Ethiopia. This lack of success is due to resource constraints, poor veterinary infrastructure, security concerns, and numerous logistical problems associated with servicing highly mobile communities in harsh terrain with limited infrastructure. Alternative services delivery systems using CAHWs in remote pastoral areas of the country have been promoted in the last few decades to reach remote marginalized areas of the country.

Community-based animal health workers are knowledgeable farmers, usually livestock owners, who are selected by their communities and trained to provide basic animal health services at the village level. In Ethiopia, community-based animal health workers provide a range of community services depending on their training and the material resources available to them. They often provide preventive and curative services relevant to the most pressing animal health problems in remote and marginalized areas of the country.

Experiences from the development of CAHW systems indicate that these workers can have a substantial impact on livestock morbidity and mortality through the treatment and prevention of a limited range of animal health problems. Factors for success include community involvement in the design and implementation of these systems and involvement of the private sector to supply and supervising CAHWs[3].

In 1995, in the Afar region of Ethiopia, PARC demonstrated that CAHWs can carry out rinderpest vaccination rapidly, effectively, and cheaply. This intervention was crucial in eliminating the disease from

3 https://www.livestock-emergency.net/userfiles/file/veterinary-services/Catley-et-al-2004.pdf

remote areas of the region that were otherwise inaccessible to public veterinary services.

Figure 8: CAHW giving service in pastoral areas of Ethiopia

Figure 9: Trainees (CAHWs) under practical training sessions. Photo credit: Berhanu Admassu et. al

Some of the major challenges impacting CAHW systems in the pastoral areas of Ethiopia are discussed below.

Lack of legal support for veterinary-supervised community-based animal health worker networks: In Ethiopia, the use of CAHWs in remote pastoral areas of the country is broadly accepted by the federal and regional governments. However, there is no legislative framework that clearly defines their areas of operation, roles and responsibilities, linkage, and supervision by veterinarians or para-veterinarians. Therefore, legislative reform to support privatized, veterinary-supervised CAHWs should

be a priority in Ethiopia wishing to improve basic services in marginalized areas.
Lack of adherence to training guidelines and manuals: Training is usually conducted by resource persons from the Government and the facilitating organizations. Training guidelines have been developed — minimum standards and guidelines for the Design and Establishment of a Community-Based Animal Health Workers System (2004). In 2006, a trainer's manual for the Design and Establishment of Community-Based Animal Health Workers Courses in Ethiopia was developed. The training manual clearly guides on the content, duration, objectives, and pedagogical requirements, persons qualified to train, and the evaluation of the CAHWs training. The training guidelines and the manual are meant to harmonize the training for CAHWs. However, many of the training agents do not adhere to these training guidelines, and there is no mechanism in place to ensure adherence to these guidelines. As a result, significant differences exist in terms of training content, duration, and CAHWs' capacities between different regions and locations.

Concerns on the technical competence of community-based animal health workers: For many veterinarians who make or influence policy, the ability of CAHWs to correctly diagnose diseases and administer drugs is a key issue. In part, these concerns relate to the short duration of training of these workers and in some areas, the use of illiterate CAHWs. Justifiably, policymakers need to feel confident that the use of CAHWs will not lead to drug resistance or food safety problems.

CAHWs system is poorly utilized for disease reporting and surveillance: Establishing and maintaining nationwide animal disease surveillance systems is a major challenge in Ethiopia. Important constraints include the need to access remote and often large areas characterized by poor infrastructure and communications and the need to conduct adequate surveillance with limited financial resources.

Community animal health workers provide a helpful link between the livestock keepers/community and the district veterinary authorities in terms of disease reporting and surveillance. They can be trained to complete basic monitoring forms and report outbreaks of important diseases to the nearest veterinarian or veterinary assistant. However, there is no motivation for them to submit reports, nor is there any tangible compelling mechanism in place to make them accountable.

Lack of sustainability of community-based animal health workers: Sustainability of the CAHWS services is often related to the level of income generated from their livestock health work, linkage with local drug suppliers, the level of training and supervision by veterinary statutory bodies, and institutional arrangement for legalization and promotion of the services delivered by CAHWs. These requirements for the effective operation of CAHWs are often lacking, resulting in a high dropout rate in many CAHW programs. The other reason has been the selection process of the Community-Based Animal Health Workers (CAHWs) whose qualities do not always suit the communities.

Moreover, most of the CAHWs operating in Ethiopian pastoral areas were selected by local-level government authorities and/or veterinary officers, funded and implemented by NGOs or other development partners. It has been observed that when these organizations cease to operate, the CAHWs' services are also discontinued.

Poor supervision and regulation of the CAHWs systems: In many of the areas where CAHWs are active, there needs to be a clear problem of supervision, related to the legal relationship between CAHWs and the other bodies of animal health professionals. The capacity of government veterinary departments to train, regulate, and supervise CAHWs and other para-professionals and ensure the quality and reliability of the supply of veterinary drugs is a major challenge on the ground.

Incoherent relief and development assistance: In emergency and relief situations such as drought, conflict, or livestock disease epidemics, a typical response of aid agencies is to provide free or subsidized veterinary drugs. However, without careful planning with communities, government, and private suppliers of veterinary products, these programs can seriously undermine the financial sustainability of exist-

ing private services. This problem is partly an issue of coordination between the relief and development sections of donors, but ultimately, clarification of policy on veterinary relief interventions is the responsibility of the government.

Challenges and opportunities in private animal health service delivery in Ethiopia.

Privatization of veterinary services is a global trend that enjoys widespread support. Despite this, Ethiopia is lagging behind other countries due to a lack of harmonized policies and direction. Some of the major challenges to the expansion and delivery of quality private animal health service delivery are elaborated below.

Inadequate legal framework supporting private animal health service delivery: An effective and viable private sector plays a lead role in the provision of animal health delivery services in an environment conducive to profitable business transactions. Although the policy basis has been laid, including the "Public Private Partnership Proclamation No. 1076/2018" issued in 2018, the "Animal Diseases Prevention and Control Proclamation No. 267/2002" and the Veterinary Services Rationalization Road Map in 2014, there has not been much progress in developing a favorable legislative framework to promote participation of the private sector and the road map is yet to be ratified by the Government of Ethiopia.

Article 17 of the Animal Disease Prevention and Control Proclamation No.267/2002 broadly provides for the private sector's involvement in animal health service delivery. However, secondary legislation, which was expected to be detailed pursuant to the proclamation, is not available. As a result, there is a lack of clarity regarding licensing, rights and responsibilities, and delineation of tasks within the sector. This lack of legal definition and protection greatly increases the risk to private investors.

GTP2 policy and targets have supported a public model of veterinary service through the construction of veterinary offices, at least at the woreda level, with government-paid staff but very limited operational budgets. This model of veterinary service delivery is generally recognized as ineffective and inefficient. Nevertheless, it makes the government visible by providing jobs with salaries in every woreda in the country. The ten-year perspective plan is an opportunity for a robust new vision for the National Veterinary Service that would guide all veterinary service development.

Heavily subsidized public veterinary services undermine privatization: At present, public veterinary services remain highly subsidized or provided free of charge. All clinical services and vaccines for TADs are provided free of charge. Vaccines for endemic diseases are subsidized, and regional states cover all operational costs related to vaccination. Farmers are only charged the actual wholesale tender price of the drug plus some markup. The total costs for transport, handling, storage, and disposal of expired drugs are not included in the price. This has led to a situation whereby private practitioners have to compete with a highly subsidized public veterinary service. This unfair competition has discouraged private investment. Private practice is often regarded as not viable.

The NVI was restructured in 1999 and obtained full administrative and financial autonomy. Vaccines are since July 2000 charged at full cost. To cope with this new arrangement the federal and regional governments have allocated budgets for the purchase of vaccines for former List A and List B diseases. Therefore, even under the current arrangement, livestock owners will still not be charged for former List vaccinations. The Regional States perform vaccinations for endemic (Former List-B disease) and are also heavily subsidized. They are often conducted as a prophylactic measure or as a response to an outbreak, e.g., ring vaccination. The only difference is that the cost of the vaccine that the government formerly subsidized through NVI is now subsidized through federal and regional governments.

Veterinary input distribution is not fully liberalized: All veterinary-related activities are highly dependent on the regular and assured availability of quality inputs. The importation and distribution of veterinary drugs in Ethiopia have been liberalized since 1991. Even though importation is fully liberalized and left to the private sector, there is considerable competition from the regional governments with regard to distribution. The regions purchase veterinary drugs through tenders on an annual basis and sell them at subsidized prices.

All major vaccines are manufactured by the National Veterinary Institute (NVI) and distributed through the public sector. Private veterinary practitioners only occasionally participate in the delivery of vaccination services because the government or public veterinary service providers primarily provide the service. They consider both the vaccine and the service to be inaccessible to private practitioners. Because of this, they consider vaccination services to be an unattractive business. Those vaccines, which are sold at cost, such as FMD and rabies, are produced in very limited quantities and are used mainly by livestock exporters, commercial dairy farms, and urban pet owners. Pet animal vaccines such as canine distemper and pardon are imported by the private sector. Their market is limited to urban centers.

Inadequate private sector support and promotion: Private animal health service delivery can only be successful with the support of the Government. In countries where the private sector was supported and promoted, success was imminent. For instance, in Kenya and Uganda, credit privatization schemes were initiated with the support of Government, development partner and the respective Veterinary Professional Associations. The beneficiaries of the schemes were the Veterinary professionals who could access affordable credit (if they had collaterals) and start private veterinary practices. Through the privatization schemes, a substantial number of private veterinary practices have since been established, especially in the provision of clinical services in dairy farming areas. Since then, the privatization scheme in Kenya, previously known as the Kenya Veterinary Association Privatization Scheme (KVAPS), has been transformed into a broader credit facility, namely, 'The Kenya Livestock Trust Fund (K-LIFT)' and it is open not only to Veterinarians as was the case before but also to veterinary paraprofessionals and other entrepreneurs in the livestock sector.

The majority of private sector service providers are drug shops: The majority of private sector service centers are drug shops, which tend to be in the major woreda centers. Privatization must not continue this tendency, as delivery of farm-level clinical services is a key requirement. The private veterinary service mandate must promote the establishment of mobile veterinary clinics that deliver clinical services at the farm level. This remains a distortion that must be corrected.

Presence of illegal practitioners and drug vendors: In many parts of the country, illegal practitioners and drug vendors are competing with private practitioners. Black market outlets for veterinary drugs are widely spread. Adulteration, improper handling and storage, and drug sales well beyond their expiration dates have reduced consumer confidence. This is negatively impacting Livestock production as major disease problems are not being treated cost-effectively with appropriate drugs. The veterinary profession suffers because they are losing initiative to untrained traders and need to carry out the role they were trained to do.

Informal services from public service employees (moonlighting) are a major component of animal health care available to livestock-keeping communities. Public animal health staff supplement their salary through private out-of-hours work. This is depressing the market for private professional services as they compete with government employees who are not paying taxes.

The current state of the provision of animal health clinical services and supply of veterinary drugs is getting worse, and if this situation persists, it will become increasingly difficult to control.

Public Private Partnership (PPP) and animal health services

Ethiopia's current veterinary service delivery system is predominantly public sector-led, with government-owned veterinary clinics providing the majority of services in a subsidized form and vaccination free of charge. However, this public sector-dominated model has resulted in limited coverage and access to veterinary services, especially in remote and underserved areas of the country. Many livestock owners, particularly in rural and peri-urban areas, still need more adequate access to quality and affordable veterinary services.

The public veterinary service delivery system faces significant resource and capacity constraints. The government's budget allocation for the veterinary sector needs to be improved to meet the growing service

demand. This has led to suboptimal service quality, long waiting times, and poor responsiveness to the needs of livestock owners.

The private veterinary sector in Ethiopia has been slowly emerging, with the presence of private clinics in major towns, and individual practitioners, especially in urban areas. However, the engagement of the private sector in veterinary service delivery has been limited, due to a lack of enabling policies, regulatory frameworks, and financial incentives. Leveraging the expertise, resources, and innovation of the private sector can help expand the reach and improve the quality of veterinary services across the country.

Adopting PPPs in the veterinary sector can help combine the strengths of the public and private sectors, leading to more efficient and effective service delivery. PPPs can facilitate the introduction of new technologies, management practices, and innovative service delivery models that can enhance the overall quality and accessibility of veterinary services. By sharing risks and responsibilities, PPPs can also optimize the utilization of available resources and improve the financial sustainability of the veterinary services delivery system.

Improving access to quality veterinary services is crucial for maintaining the health and productivity of livestock, which are critical assets for the rural livelihoods in Ethiopia. Enhanced veterinary service delivery through PPPs can also support Ethiopia's efforts to comply with international standards and requirements for livestock and animal product exports.

By addressing the current challenges and leveraging the strengths of both the public and private sectors, PPPs in veterinary service delivery can play a transformative role in improving animal health, enhancing livestock productivity, and supporting the overall development of the livestock sector in Ethiopia.

Collaborations between the public and private sectors are invaluable in strengthening the effectiveness of veterinary services in the long term. Public-private partnerships enable the pooling of resources and create synergies across sectors to help improve access to services that would otherwise be unattainable by either sector working in isolation. Public-private partnership (PPP) in the veterinary domain is defined by the World Organization for Animal Health (WOAH)[4] as "a joint approach in which the public and private sectors agree on responsibilities and share resources and risks to achieve common objectives that sustainably deliver benefits". Through PPPs, the public Veterinary Services and private actors, such as private veterinarians, producers' associations, or private companies, work together to address complex animal health challenges. PPPs may represent a means of strengthening veterinary services and improving animal health programs.

PPP in the veterinary domain is widely practiced globally, both in developed and developing countries, with good examples to consider, analyze, and replicate.

Ethiopia has enacted a new Proclamation No. 1076/2018 facilitating Public-Private Partnership (PPP), recognizing that the private sector is essential to support the country's economic growth and improve the quality of public services, particularly in infrastructure. A PPP Board is also formed to grant approvals at key milestones in the project development process, especially since it is responsible for the approval of PPP pipeline projects, approving a PPP project to tender and award.

The Animal Diseases Prevention and Control Proclamation No. 267/2002 was issued on 31st January 2002 by MoA, giving particular attention to PPP in animal health service delivery. In 2014, the Ministry of Agriculture produced the Veterinary Services Rationalization Roadmap. The road map outlines a proposal for increased participation of the private sector in veterinary service delivery. The government of Ethiopia is currently endorsing the road map.

Recently, a Public-Private Partnership (PPP) task force committee was established under the Animal Health and Veterinary Public Health Unit of the Ministry of Agriculture to coordinate PPP-related activities in the country's Veterinary service delivery system.

4 https://www.woah.org/app/uploads/2021/03/oie-ppp-handbook-20190419-enint-bd.pdf

Best practices and lessons learned in the implementation of PPP in animal health services.

1. Disease control through vaccination, and especially control of TADs, has traditionally been the role of the Government. However, the government's performance in this role has not been satisfactory. In Ethiopia, a vaccination contractual arrangement scheme (2015) involving the government and private sector (Veterinarians, Veterinary Assistants, and CAHWs) was piloted by the Ethiopian Veterinary Association through support from the EU-funded LVC/PPD project.

Private Veterinarians, Veterinary Assistants, and CAHWs were identified and inducted appropriately. The Induction covered various aspects of the vaccination campaign, including vaccination modalities, logistics, and programs; vaccination teams; coordination; roles and responsibilities of the various players; vaccination records; identification of vaccinated animals; handling of vaccines; vaccine dosages; species of livestock involved; areas to be covered; expected targets; awareness creation; etc.

Under this pilot scheme, 4.23 million sheep and goats were vaccinated against PPR and SGP in 6 districts (pastoral areas); an average post-vaccination seroconversion of 92% was recorded, well above the target of 80% (against the public sector record of 53%) in the same agro-ecological areas and production system). The results indicated a high level of efficiency and effectiveness in the vaccination campaign. The feasibility study conducted by Tufts University also showed a significant variation in the vaccination cost/vaccinated animal.

2. Through EU funded HEARD project, eight alternative PPP modalities were identified and six of them were tested[5]The PPP types were differentiated by the types of partners involved, the initiation, funding, and governance of the partnership. The models include private vaccination services, vaccination services through sanitary mandate, mobile clinical services, community-based women vaccinators for NCD control, and strategic community-based endo- and ectoparasite control by private service providers.

The PPP models were assessed to evaluate their performance, document experiences/ lessons gained during the implementation, and identify success and driving factors for the sustainability of the PPP models. All the PPP models under testing were performing very well, as expressed by most of the FGD and KII participants, field observations, and records kept by the service providers. Some of the models were identified to have the most satisfactory arrangement and assessed to be sustainable as opposed to the others. Some weak links observed by the evaluation include vaccine supply chain failure, and the viability of some of the private veterinarian businesses is not ensured. In general, the evaluation finding shows that the vaccine supply chain currently in place does not seem sustainable and, therefore, needs a suitable exit strategy.

5 https://cgspace.cgiar.org/bitstream/handle/10568/128300/PublicPrivatePartnership_HEARD.pdf

Figure 10: Public-private partnerships for veterinary service delivery have been established in Ethiopia (photo credit: ILRI).

3. The Ministry of Agriculture has started administering animal quarantine centers in partnership with private investors through a Public-Private Partnership (PPP) approach. A foreign company is contracted to run the Mile livestock quarantine center and is involved in operating and maintaining the export quarantine facility under the regulatory control of the Ministry. Currently, the Ministry operates five animal quarantine centers in Mile, Jigjiga, Metema, Humera, and Almehal, which are the exit corridors for the export of cattle, camel, and small ruminates to the Middle East and North Africa (MENA).

A critical aspect of a PPP arrangement related to livestock facilities such as quarantine centers is that private companies will only be responsible for routine day-to-day management of the facilities. In contrast, the government retains control of the procedures followed by these companies, including quality control and approving the final international animal health export certificate. Private companies must adhere to agreed operating standards set by the government or risk penalties or the cancellation of contracts.

4. PPP between a company raising day-old chicks and producing feed, EthioChicken, and the public Veterinary Services of Ethiopia[6]. EthioChicken raises poultry parental stock and produces genetically improved day-old chicks (hybrid breed for meat and egg production) in Ethiopia. The day-old chicks are then raised to 45 days old by agents. EthioChicken trains the grower agents, and they provide the chicks with poultry healthcare, such as vaccination. These 45-day-old chickens are delivered to smallholder farmers via a distribution network developed through PPPs between EthioChicken and the national and regional public Veterinary Services under the supervision of the Ministry of Agriculture.

5. Delivering Contagious Caprine Pleuropneumonia Vaccine through Public-Private Partnership (PPP) Franchise Model in Borena Zone was implemented by Abyssinia Agrovet with the support from Canadian International Development Research Center (IDRC) and Tufts University. The objective of the pilot project was to design and test an alternative, effective, and efficient vaccine delivery and input supply model led by Small and Medium Enterprise (SME) using the CCPP vaccine as a candidate product. 87% of the total goat population in the project area has been vaccinated against CCPP. Once the vaccination is completed, the pilot will be evaluated in terms of its effectiveness and efficiency.

Through the experiences illustrated above, the country has drawn many lessons in adopting PPP for contacting vaccination services, running animal health posts, and operating livestock health services. It is also important to note that most of these experiences are appropriately evaluated to assess their effec-

6 C:/Users/user/Downloads/fvets-09-735269.pdf

tiveness, efficiency, and impact. This could pave the way for scaling up and introducing similar practices for other livestock service facilities involving animal health clinics, slaughterhouses, live animal markets, artificial insemination centers, etc.

Challenges in implementing PPP in animal health service delivery.

The challenge of PPPs animal health service delivery in Ethiopia

The main challenges associated with implementing PPPs for veterinary service delivery in Ethiopia include:

- The government's provision of subsidized veterinary clinical services and free vaccines and vaccination services is a significant challenge in implementing effective PPPs for veterinary service delivery in Ethiopia. This approach makes it difficult for private veterinary practitioners to compete and establish a viable business model and can discourage private sector investment and participation in the veterinary service market.
- Weak legal and regulatory framework, including lack of clear policies, laws, and regulations governing PPPs in the veterinary sector.
- Limited access to long-term financing and investment capital for private veterinary service providers, including difficulties in securing financial loans for establishing and expanding private veterinary facilities.

To overcome these challenges, the government needs to develop a comprehensive PPP policy and regulatory framework for the veterinary sector, minimize subsidies on veterinary clinical services and gradually withdraw from providing free vaccination services, strengthen the capacity of both public and private stakeholders, and create incentives to encourage private sector participation in veterinary service delivery for the successful implementation of PPPs in this in Ethiopia.

Animal health regulatory services

Animal health policy and legislation

As a follow-up to GTP I and GTP II, Ethiopia has developed and is implementing a Ten-Year Perspective Plan (2021-2030)[7]The major focus areas of the plan for agricultural development are improving animal husbandry, fodder development, and animal health. Several policy reform measures have also been identified to expand the inflow of foreign currencies.

The plan set ambitious targets to accomplish the objectives of agricultural development during the ten years, including raising the proportion of those with improved breed, raising the total quantity of milk production, increasing the average daily milk yield, increasing the total quantity of meat obtained from cattle, goats, sheep, and camels and increase egg production and chicken meat production, increase honey production and regular water fish and aquaculture production. Moreover, the plan envisages taking measures to enable the private sector to take the driving seat of economic growth and become the primary source of development finance, thereby ensuring structural transformation and the sustainability of development. The achievement of the set targets related to livestock development, including the export of meat and live animals, very much hinges on the quality of the National Veterinary Services.

In line with the ten-year perspective plan, ministers, including the Ministry of Agriculture, developed detailed sector-specific plans. Some of the primary targets set under the MoA ten-year agricultural plan related to the governance of animal health services include improving the coverage and accessibility of animal health services, strengthening and expansion the animal health revolving fund scheme, imple-

7 https://www.ircwash.org/sites/default/files/ten_year_development_plan_a_pathway_to_prosperity.2021-2030_version.pdf

menting the rationalization road map, establishing Veterinary Statutory Body (VSB), promulgation and enforcement of one proclamation and seven secondary legislations, implement the animal health strategy for pastoral areas, etc. Moreover, one of the policy reform areas identified by the plan includes enhancing the role of the private sector.

The GoE has also recently launched a new livestock sector development initiative called "Yelimat Tirufat". According to the 2022 launched "Yelemat Tirufat," the ambitious government plan aims to accelerate the efforts of Ethiopia in fulfilling food self-sufficiency at national and household levels. The Yelemat Tirufat development campaign launched in November 2022 focuses on nutritional opulence. This is a four-year development program that aims to boost the productivity and production of dairy, eggs, chicken meat, honey, and related hive products (MOA, 2022). The program also has the added objective of creating job opportunities, increasing exports, and hastening import substitution (Dessie et.al., 2023). These are important aspirations that can only be realized through setting realistic targets, strategies, and operational plans to be supported by all relevant government, non-government organizations, and development partners. As it was realistically and practically demonstrated, the European Union, through its delegation in Ethiopia, is one of the prominent supporters of the Ethiopian Agricultural sector development, specifically the livestock sector, in order to improve production and productivity as well as market access to the sector.

According to the WOAH code, the quality of Veterinary Services depends on a set of factors, which include fundamental principles of an ethical, organizational, legislative, regulatory, and technical nature. Veterinary Services shall conform to these fundamental principles regardless of the political, economic, or social situation of their country.

The federal animal health and veterinary public health executive lead, the competent authority, is structured under the Ministry of Agriculture (MoA). Proclamation No. 1263/2021 Definition of Powers and Duties of the Executive Organs[8] has clearly defined the powers and duties of the MoA.
Moreover, proclamation No. 1263/2021 established the Ethiopian Agricultural Authority (EAA) and Animal Health Institute (AHI) as autonomous federal government organs having their own legal personality. The former EAA took all regulatory functions of the Ministry of Agriculture, while AHI replaced the former National Animal Health Diagnostic and Investigation Center (NAHDIC) with an expanded role in animal health research in addition to disease diagnosis and investigation.

Veterinary legislation is the foundation of any efficient animal health policy and is a critical element for all countries. In Ethiopia, the veterinary legislation has not been updated for many years and is obsolete or inadequate in structure and content for the challenges facing veterinary services in today's world. The absence of an up-to-date legal framework that complies with scientific advances, international standards, and the requirements of trading partners limits the effectiveness of existing public and private animal health services, negatively impacts disease prevention, control, and eradication efforts, and makes it difficult for the country to expand and diversify its market share for its livestock and livestock products.

The legal framework for animal disease control is Proclamation 267/2002, which also provides the legal framework for the import and export of animals and animal products. Apart from Proclamation 267/2002, the main legal texts that are relevant to the veterinary domain are Proclamations 274/1970 and 81/1976 on abattoirs and meat inspection, implemented by Regulations (428/1972), Proclamation 728/2011 providing for the Veterinary Drug and Feed Administration and Control system, Service Fees for veterinary Drug and Feed Registration and Licensing Council of Ministers Regulation 325/2014, Veterinary Drug and Animal Feed Administration and Control Authority establishment Council of Ministers regulation 272/2012 and also live animals marketing proclamations No. 819/2014[9]. The latter provides with respect to the marketing of live animals, i.e., cattle, sheep, goat, camel, and other animals to be designated as such by the Ministry of Trade. Provisions under this trade proclamation pertinent to animal health services include pre-marketing health checks, issuance of transport permits and health certificates, animal

8 http://www.efda.gov.et/wp-content/uploads/2023/06/Definition-of-Powers-and-Duties-of-the-Executive-Organs-Proclamation-No.-1263-2021.pdf

9 https://faolex.fao.org/docs/pdf/eth170211.pdf

identification, quarantine, and monitoring the quality standards of live animals to be supplied to the export market.

The quarantine services Several quarantine stations and border check posts are located at strategic locations in the countries to facilitate livestock exports.

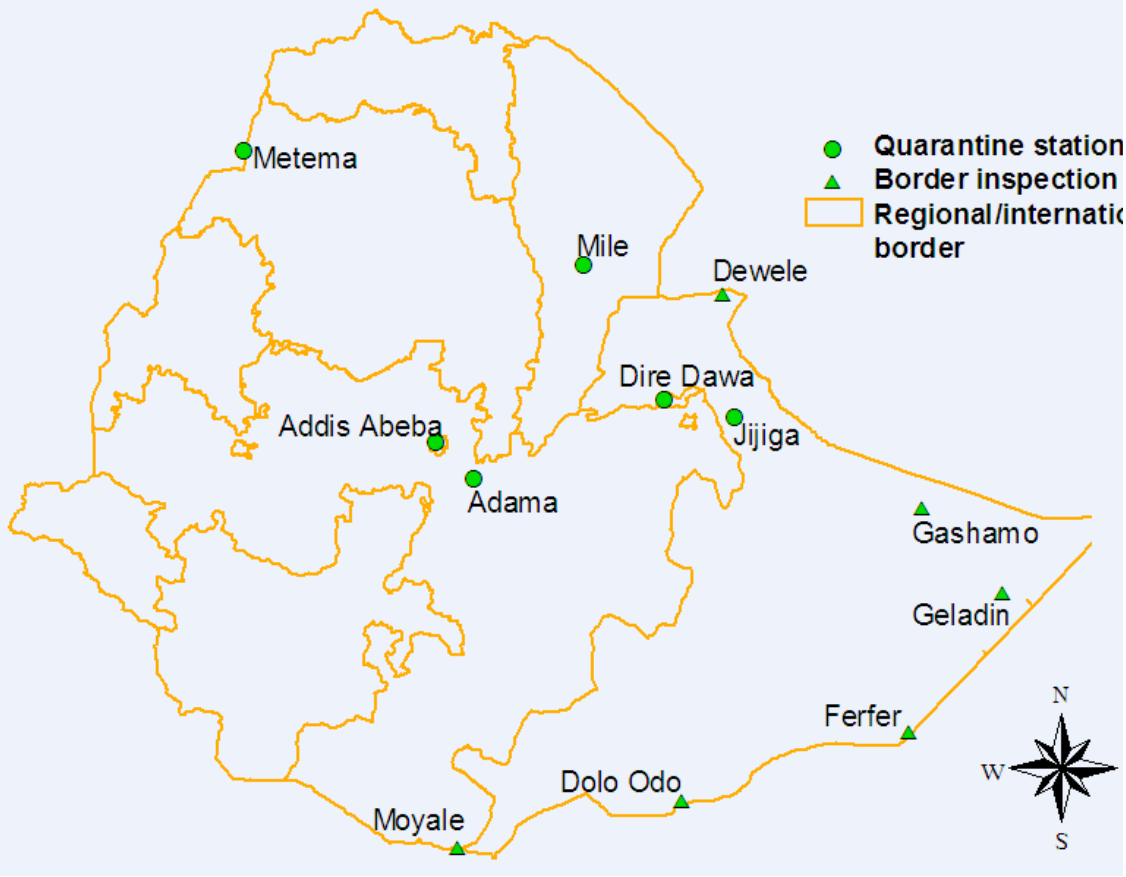

***Figure11** Geographic location of quarantine canters and check posts in the country:*

Live animal export performance over the last few years

Private sectors in Ethiopia, especially the live animal traders, officially export live animals to IGAD, COMESA member countries such as Djibouti, Sudan, and Egypt, as well as outside COMESA, particularly to the Middle East countries. A vibrant informal trade also exists between Ethiopia and Somalia, Kenya, Somalia, Sudan, and Djibouti. However, Ethiopian livestock trade, including export, is primarily characterized by informal trade, with the proportion of formal trade being comparatively much lower.

Trends for the formal trade in live animal export numbers show an 87 percent decline in volume from 416,454 heads in 2018/2019 to 51,587 in 2019/20. Similarly, value declined by 90 percent in the year 2019/20. Lack of live animal supply, illegal cross-border trades, continuous feed price increases, and poor policy implementation all hinder export performance.

Table 4: Volume and value of export over the last years

S/N	Year	Quantity in No	Value in USD in Million	Remarks
1	2011	469,903	146.9	
2	2012	785,078	207.1	
4	2013	675,874	166.4	
5	2014	647,713	186.7	
6	2015	536,288	148,9	
7	2016	664,005	147.8	
8	2017	279,480	67.4	
9	2018	353,489	60.9	
10	2019	416,454	45.7	
12	2020			Will be added once INFO gained,
13	2021			
14	2022			
15	2023			

Meat inspection and certification regulatory services

Export abattoirs

The Export Abattoir Inspection and Certification Directorate (EAICD) is a regulatory Directorate established under the Ministry of Agriculture with the objective of controlling and monitoring the meat inspection and certification activity at all export abattoirs that are destined for export trade. But now the meat inspection and certification activities have been under the EAA, Animal Product Regulatory Lead Executive office, technically.

There are about 11 functional export abattoirs in Ethiopia which are registered by the EAA, producing on average 18 thousand tons of chilled/ frozen meat and offal annually for export to the Middle Eastern countries, especially the United Arab Emirates and Kingdom of Saudi Arabia, earning a considerable amount of foreign currency for both the companies and for the country which plays a role lifting our economy. There are also about five export abattoirs under different stages of construction.

Table 5: Designed slaughter capacity of export abattoirs in Ethiopia

No	Company name	Designed capacity in tone	Remark
1	Modjo modern export Abattoir	5,230	Goat and mutton
2	Lunna export Abattoir	5,230	Goat and mutton, Beef
3	Organic export Abattoir	4,500	10,000 soon coming (Goat and mutton, Beef)
4	Abyssinia export Abattoir	5,000	Goat and mutton, Beef
5	Hashim export Abattoir	5,000	Goat and mutton, Beef
6	Allana Akseker export Abattoir	6,000	Goat and mutton, Beef
7	Halal export Abattoir	5,000	Goat and mutton
8	ELFORA Bishoftu export Abattoir	5,300	Goat and mutton, Beef
9	ELFORA Metehara export Abattoir	4,500	Goat and mutton, Beef
10	Alnujum export Abattoir	5,000	Goat and mutton, Beef
11	Jigjiga export Abattoir	6,000	Goat and mutton
12	Abergelle export Abattoir	6,000	Goat and mutton, Beef
13	Allana frigorifico Boran Foods PLC	90,000	Beef, mutton and goat meat
14	BinRoe export Abattoir	4,500	Goat and mutton
	TOTAL	157,260	

There is a team consisting of 5 - 10 meat inspectors and/or inspector veterinarians, assigned at each functional export abattoir by EAA to carry out the daily regulatory activities of antemortem and post-mortem inspections with general sanitation and hygiene control and finally certify the product for export. A total of about 60 meat inspectors are working in all functional export abattoirs. All functional export abattoirs are ISO 22000-2005/2018 certified, have a certificate of Halal from the Oromia Regional Islamic Affairs Supreme Court (ORIASC), are members of the Ethiopian Meat Producer and Exporter Association, and all are privately owned abattoirs.

Figure 12: Beef quality control activity ***Figure 13: Refrigerated meat transporting truck***

The major export markets for Ethiopian sheep and goat meat are the United Arab Emirates (52%) and the Kingdom of Saudi Arabia (41%). The remaining 7 percent of meat is exported to Kuwait, Qatar, and other countries.

Table 6: value (in million USD) and volume (in thousands) of meat exports from 2017-2022

	Exported meat by type	2017/18 (2010)		2018/19 (2011)		2019/20 (2012)		2020/21 (2013)		2021/22 (2014)	
		Volume in ton	Value In 106 USD	Volume in ton	Value In 106 USD	Volume in ton	Value In 106 USD	Volume in ton	Value In 106 USD	Volume in ton	Value In 106 USD
1	Sheep and Goat meat	16,545	90.42	14,958	81.4	11438.3	64.85	13269.48	72.71	18661.48	119.14
2	Beef	1,683	5.39	1,737	5.65	380.75	1.36	226.03	0.8		
3	Offal	1,552	4.41	2,416	5.61	2461.89	3.33	2304.38	5.6	4027.82	
	Total	19,780	100.23	19,112	92.65	14,280.94	69.54	15799.89	79.11	226,89.3	119.14

Domestic abattoir services

In Ethiopia, there are over 250 domestic slaughter facilities in the major cities and towns of the country, which slaughter varied numbers of animals for local consumption. They are categorized as big and medium towns and rural (LMP, 2008). The veterinary services of regional states are responsible for carrying out the regulatory activities in the meat inspection and certification generally. MoA trains some certified meat inspectors (around 70) meat inspectors. In contrast, the management and administration of the day-to-day activities of the abattoir is under the Municipal office of each town or city administration.

The usual ante and post-mortem inspections, along with sanitation and hygiene control, are done in most of the abattoirs. In medium and big town slaughter facilities, there are relatively better hygiene and inspection practices, but the overall situation requires major improvement. In practice, animals that are adequately inspected, certified as healthy, and slaughtered hygienically provide practically aseptic and safe meat. However, microbial contamination occurs following slaughter, evisceration, and dressing

operations through contact with unhygienic equipment, tools, hands, clothes, and objects in the slaughter environment, etc. Much of this contamination has to do with the operational procedures applied routinely, the design and layout of slaughter facilities, the health and sanitary status of humans and also the sanitary status of equipment. In addition, the location, types of construction materials, and waste disposal systems are crucial for ensuring that a slaughter facility operates under hygienic conditions to produce safe meat for consumption. Contaminated meat is a favorable substrate for the growth and multiplication of pathogenic microorganisms.

Table 7: Regional States Distribution of Domestic Abattoirs

S/N	Regional Distribution	Quantity
1	Addis Ababa	3
2	Afar	-
3	Amhara	33
4	Benshangul Gumuz	-
5	Dire Dawa	1
6	Gambella	-
7	Harari	2
8	Oromia	114
9	SNNP (4 New regions)	143
10	Somali	4
11	Tigray	29
	Total	329

(Personal Communication with Disease Prevention and Control Desk, Senior Vet Dr Mesfin Tilaye)

The slaughter of animals for meat production in the rural setting is often carried out under inadequate conditions. In these slaughter facilities, relatively few animals are slaughtered on the ground in unhygienic situations. The hide serves as bedding to protect the meat from direct contact with the ground. Evisceration also takes place in this position as there is no means for the hoisting of animals. Meat produced under such conditions often lacks not only minimum hygiene standards but also veterinary inspection practices to avert serious health hazards to humans from zoonosis.

Livestock Identification and Traceability System (LITS)

Livestock Identification and Traceability systems (LITS) were adopted in public livestock breeding centers, ranches, livestock research centers, and some dairy farms operated by individuals in livestock research centers in earlier times, which the system was only to identify and yet could not trace animals. Ethiopian Federal MoA had established ET-LITS as a pilot implementation program in early 2015 in the livestock export corridors, namely Northern Abergelle market shades, representing the mixed crop-livestock production system and Borana pastoral areas (Guji/Bale), representing the pastoralist production system for export livestock only, (USAID, 2014)

The Ethiopian Livestock Identification and Traceability System (ET-LITS) was under the Ministry of Agriculture (MoA) through its LITS Directorate and with assistance from the ICT Directorate. Recently, the LITS was transferred to the Ethiopian Agriculture Authority, an autonomous regulatory body under the MoA. As of EAA, the LITS Desk is in the Animal Quarantine and Regulatory Executive office, while the ICT Directorate remains in MoA to handle system administration tasks such as hardware maintenance, antivirus updates, modem and network configurations, connectivity, and backups.
Six markets have been identified as pilot areas, including Yabelo (Haro Bake), Elwoya, Dubluk (Mega), Moyale (Oromia and Somalia), Negele Borena, and Ginir (Melka Oda). Some guidelines require the registration of premises, including holding grounds, markets and feedlots, export slaughterhouses, rendering facilities, quarantines, border posts, ports, and laboratories (MoA, 2021 & 2011). The LITS also targeted animals destined for export.

As the main source of exported animals coming from the southern parts of the country, especially from the Borena areas, the original plan was revised to start with the identification of animals from the feedlot and quarantine level of the Southern Borena. Extension of LITS in meat product traceability has also

been planned. Some preliminary works, such as establishment identification and registration, capacity building training, and format development, have been carried out in all export abattoirs, but the system is not yet functional.

The program proposed using ICAR-approved tamper-proof plastic tags for animal identification and requiring purchasers to cover the cost of the devices (Bet, B 2016 and MoA, 2021). The actual implementation of LITS in the export of livestock via export quarantine started in 2020, and almost 40 thousand animals have been exported to different countries.

Regulation of the veterinary profession and professionals

The quality of a country's veterinary services depends on a range of factors, including fundamental principles of an ethical, organizational, and technical nature. Compliance with these principles depends on their personnel, who should have the necessary qualifications, scientific expertise, experience, and independence to ensure that they make sound professional judgments and decisions. The integrity of the work of veterinarians, veterinary para-professionals, and other members of the veterinary personnel must be guaranteed. All categories of veterinary personnel must be subject to legal disciplinary provisions.

This is achieved in most parts of the world through regulating the veterinary profession and professionals by establishing a veterinary statutory body (or veterinary council/board). The WOAH defines a VSB as "an autonomous regulatory body for veterinarians and veterinary professionals," and its functional and legislative framework is outlined in the WOAH Terrestrial Animal Health Code article 3.4.6.

The WOAH has, since 2006, included the VSB in its standardized Performance of Veterinary Services (PVS) evaluation matrix and now possesses valuable information on the 'Level of advancement' (Levels 1 to 5, according to increasing compliance with international standards) of VSBs in Africa and around the world.

Within the 52 Member Countries of the WOAH in Africa, 36 (69%) have established formal VSBs that conform to some or all of the WOAH criteria, as listed in the WOAH Terrestrial Code. The remaining countries, including Ethiopia, for a variety of reasons, are in the process of establishing, did not manage to establish, or do not envisage being able to establish such bodies[10].

Article 18 of the Ethiopian Proclamation no. 267/2002, which provides for the prevention and control of animal diseases, sanctioned the establishment of a veterinary council for the registration and licensing of animal health professionals and states that conditions for the registration and establishment of the council shall be determined by a regulation to be issued pursuant to the Proclamation. However, despite the relentless efforts by the veterinary professionals and their association over the last decade, the establishment of the VSB of Ethiopia has never materialized.

The 2011 evaluation of the Ethiopian veterinary services by the WOAH PVS team has stated that the absence of a VSB has profound implications, especially in the area of Veterinary faculties accreditation and the risk of inconsistent standards of graduates, especially given the rapid increase in recent years of the numbers of new Veterinary schools in the country. It also stated that disciplinary actions and other sanctions in cases of professional negligence and other malpractices cannot legally be pursued. To fill the void, the Ethiopian Veterinary Association and others have tried to develop a code of conduct and various CPD materials/modules. However, both the developed CPD material and code of conduct are voluntary and there is no established mechanism to ensure their consistent and uniform application. Moreover, there is no national accreditation system for veterinary CPD materials based on selected educational quality criteria, which will also be regularly re-evaluated and modified in close collaboration with the relevant stakeholders.

10 http://bastiaensen.be/pdf/23-Bastiaensen-VSBs_in_Africa.pdf

Challenges and opportunities in the delivery of animal health regulatory services

At the request of the Government of the Federal Democratic Republic of Ethiopia, a WOAH Veterinary Legislation mission took place in 2014. The mission identified the following as primary weaknesses of the proclamation 267/2002.

- The Proclamation has no subsidiary legislation; this undermines transparency and good governance because many regulatory aspects are controlled in practice, but there is no information on the specific requirements or procedures to be followed;
- The veterinary chain of command and the arrangements for coordination and information sharing with the Regional (state) Veterinary Services remain unclear;
- Lack of collaboration between Federal agencies. This is particularly important for dealing with zoonotic diseases, the safety of foods of animal origin, and notifiable diseases in wildlife;
- Total omission on the topic of veterinary diagnostic laboratories as they are key part of the infrastructure for the diagnosis, reporting, surveillance, and control of notifiable diseases;
- No provision for promoting animal welfare in accordance with WOAH standards;
- No provisions for animal identification or product traceability;
- Key WTO-SPS principles and concepts are not addressed, including harmonization with international standards, the use of equivalence and regionalization, and, above all, the application of sanitary measures proportional to risk.

At the request of the Ministry of Agriculture, the WOAH legislative mission also reviewed a 2014 draft Proclamation on Animal Health, Welfare, and Veterinary Public Health and several draft Regulations, including one providing for the establishment of a Veterinary Council. The drafting, review, and updating of these primary and secondary legislations, with support from the WOAH legislative mission and several projects funded by development partners, took almost ten years. The draft Proclamation on Animal Health, Welfare, and Veterinary Public Health is recently resubmitted to the Council of Ministers for approval and final promulgation by the parliament. The ratification process will depend on the government's priority since there are a number of laws awaiting approval. The approval process of the secondary legislation and strategic documents, including the "Veterinary Rationalization Roadmap," are also pending and awaiting the promulgation of the proclamation.

Ethiopia in 2018 developed a Food and Nutrition Policy (FNP)[11] that identified food safety and nutrition as a governmental responsibility. Among the FNP's seven objectives for food and nutrition is one that seeks to "improve the safety and quality of food throughout the value chain" – a goal that creates an enabling policy framework for strategies, laws, and regulations related to the safety of food across the food system. While the FNP is not specific to food safety, it strengthens the legal environment for food safety.[12]

Evidence and Action Towards Safe, Nutritious Food (EatSafe) conducted a review in 2022 to analyze existing food safety policies, regulations, and standards at the national, regional, and local levels in Ethiopia. The review noted that responsibility for food safety regulations, compliance, and inspection in Ethiopia is fragmented and disjointed across different ministries and executive governing bodies. Food safety authorities are distributed among several Ministries – most notably, the Ethiopian Food and Drug Authority within the Ministry of Health, the Ministry of Trade and Industry, and the Ministry of Agriculture – as well as their respective regional offices, local authorities, and municipalities. At present, no integrated coordination mechanism exists to clarify overlaps or gaps in food safety regulations. The fragmentation of regulatory authorities was also observed in compliance and inspection activities.

11 https://www.nipn.ephi.gov.et/sites/default/files/2020-05/Food%20and%20Nutrition%20Policy.pdf

12 https://www.gainhealth.org/sites/default/files/publications/documents/Review%20of%20Food%20Safety%20Policy%20in%20Ethiopia.pdf

For example, meat hygiene related to the slaughtering of animals for export purposes is covered by two agencies whose duties overlap: the MoA and the Ethiopia Food and Drug Authority (EFDA), which is part of the MOH. By contrast, the production of meat for domestic markets (e.g., from municipal abattoirs to local butcheries) is not covered by those agencies. Furthermore, the Ministry of Trade regulates meat butcheries' fair-trading practices and metrological (i.e., weight) issues. The review also found that traditional food markets are almost entirely unregulated, classified as "illegal trade" in Ethiopia. Food safety laws and regulations focus only on formal food sectors, overlooking traditional market settings.

Proclamations 274/1970 and 81/1976 on abattoirs and meat inspection, implemented by Regulations (1972), are outdated – nearly 45 years old – and do not fit current realities and contexts. After many years of effort, Ethiopia has been unable to update its animal health legislation based on the review and recommendations of the WOAH legislative mission. Throughout much of the last two decades, draft legislation has existed; however, the process of editing and commenting by various institutions and higher authorities has been prolonged. Promulgation of legislation in Ethiopia is a prolonged and un-dynamic process. This is in sharp contrast with other countries, where amendments to existing proclamations and regulations are presented on a regular basis and posted on a website.

One Health initiative in Ethiopia (OH)

Zoonotic, emerging, and re-emerging diseases are a growing global concern to Public Health. With the interplay at the human-animal-wildlife-environment interface of these diseases, the collaboration of these sectors through a One Health approach is pivotal for effective measures for effective prevention, early detection, and rapid response. The justification for the 'one health' concept has been well highlighted and articulated at the international level. International bodies, i.e., WHO, the WOAH, and FAO, are working together to prevent and control health risks at the human-animal-ecosystems interface. They have developed global strategies and tools to ensure a consistent, harmonized approach throughout the world and to better coordinate human, veterinary, and environmental health policies at the national and international levels. The Quadripartite Organizations (FAO, UNEP, WHO, and WOAH) have also developed the One Health Joint Plan of Action (2022-2026) that outlines the commitment of the four organizations to advocate and support the implementation of One Health collectively.[13].

In their efforts to meet obligations under the International Health Regulations (IHR) (2005), a critical mass of countries has now undergone capacity assessments (both voluntary self-assessment and Joint External Evaluations). The IHR, a legally binding agreement among WHO member states, obligates countries to develop and maintain minimum core public health capacities, as stipulated in Article 54 of the regulations, to prevent, detect, and respond to human health events[14].

Ethiopia has a history of cross-sectoral collaboration in the management of infectious diseases and other public health threats. Several registered ad-hoc initiatives have been spearheaded following the occurrence of different health threats at the global level in the last two decades. While these initiatives engaged different sectors, enhancing multi-sectoral collaborations, they were limited in their lifespan and specific in their target. They were disbanded once the reduction of the anticipated threat was achieved. Some of the best examples to be cited include ad hoc OH initiatives established in response to threats posed by the Highly Pathogenic Avian Influenza, Rift Valley Fever, and Ebola Hemorrhagic Fever, and investigation of unknown liver diseases. The contribution of the multisectoral coordination mechanism established to control the recent global pandemic (COVID-19) can be considered an exemplary approach.

Ethiopia has achieved considerable One Health approach activities to push forward the Global Health Security Agenda (GHSA) commitments and to prevent, detect, and respond to existing and emerging health threats. A significant development has been the establishment of the National One Health Steering Committee (NOHSC) in 2016 with the signing of a Memorandum of Understanding (MoU) between relevant ministries under the auspices of the One Health platform for the prevention and control of prior-

13 https://www.fao.org/3/cc2289en/cc2289en.pdf

14 https://iris.who.int/bitstream/handle/10665/43883/9789241580410_eng.pdf?sequence=1

ity zoonotic diseases and other health threats. A One Health zoonotic diseases re-prioritization was conducted in 2019, identifying anthrax, rabies, brucellosis, HPAI, and RVF as the top five priority zoonotic diseases, and a national One Health Strategic Plan (2018 – 2022) has been developed and endorsed by the relevant sectors. To support the national OH strategic plan, other strategic documents have also been developed, including Multisectoral Zoonotic Diseases Risk Communication Strategy; Multisectoral Zoonotic Diseases Outbreak Investigation Guideline; Multisectoral Prevention and Control Strategies for Rabies, Anthrax, and Brucellosis; Multisectoral Preparedness and Response Strategies for HPAI and RVF.

The NOHSC established different national technical working groups, including Rabies, Anthrax, Brucellosis, Emerging Pandemic Threats, Antimicrobial Resistance, and a national One Health Communication task force to promote multi-sectoral coordination and collaboration on OH-related activities. Disease-specific strategy documents with embedded surveillance strategies have already been developed for most of the priority zoonotic diseases. Furthermore, the NOHSC, with the support of development partners, established Regional One Health Platforms in Amhara, Tigray, Oromia, SNNP, Somali, Benishangul-Gumuz, Gabella, Harari, Dire dawa, and Sidama regional states. Moreover, joint disease surveillance and outbreak investigation activities and joint vaccination activities against zoonotic diseases have been conducted.

Despite these achievements, operationally, its uptake still needs to be improved, and there are still many challenges, especially related to governance, coordination, and accountability, that ultimately affect the effective implementation of One Health in a proper multi-sectoral approach. The policy and practice changes needed to address zoonotic diseases require strong political commitment, financial investments, and institutionalized national One Health programs. There is a significant gap in political commitment, skilled workforce, domestic financing, and legal frameworks to strengthen coordination, collaboration, and communication among One Health stakeholders in Ethiopia.

On top of this, the delineation of tasks and mandates among public institutions makes for a segmented organization of work in which institutions operate independently of one another and from the perspective of their respective discipline or sector. As a result, joint actions and sharing of surveillance and outbreak data between human, animal, and wildlife health sectors continue to be a challenge. This clearly put the spotlight on the urgent need to strengthen the platform further to bring the desired result and ensure sustainability.

General Conclusion and recommendations

As indicated in the introductory part, modern veterinary services started over 100 years ago. Since then, the service has grown slowly but steadily. The introduction of rinderpest to Ethiopia was the initial springboard for the establishment of veterinary services in the country. The services, as well as vaccine production, followed by manpower development, became the priority of the country to tackle rinderpest, which was achieved at the beginning of this century, more than 100 years later. Diseases like rinderpest have been blessing-in-disguise as long as animal health institutional development is concerned in Ethiopia. In addition to disease control and eradication programs, veterinary services focus on the prevention and control of public health hazards originating from animals. Ensuring safe and healthy livestock products aimed at domestic and international markets is a priority focus, as indicated in the document. The following major recommendations are made to ensure the quality of veterinary services meets global standards and addresses the shortcomings identified by the WOAH PVS evaluation of Ethiopian veterinary services in 2011 and the WOAH legislative mission in 2014.

- Full overhaul of primary and secondary legislation on animal health and welfare in compliance with global standards, new scientific advances, and requirements of trading partners
- Create strong linkage between federal and regional veterinary services and maintain effective and joint monitoring of disease prevention and control activities
- Establish a functional and autonomous Veterinary Statutory Body (VSB) to regulate the profession

and uphold professional ethics and standards.

- Rationalize the animal health service delivery system through the endorsement of the road map developed in 2014. Gradual withdrawal of Government from clinical services and focus on core public suitable activities
- Introduce a fee-based service delivery model for public animal health services. This entails developing a national guideline for cost recovery in consultation with regional states and other stakeholders to harmonize the approach throughout the country. Draw lessons and best practices from regional states that have implemented cost recovery schemes.
- Strengthen and support private sector participation and investment in animal health service delivery. This involves engaging banks, micro–Finance Institutions, and Savings and Credit Cooperatives to assist aspiring new entrepreneurs with the provision of loans or guarantee funds to establish veterinary clinics and veterinary drug outlets or expand an existing business.
- Develop objective and transparent systems for the accreditation, monitoring, and supervision of CAHWs.
- Promote public-private partnerships (PPPs) in the delivery of animal health services. Establish PPP units within the MoA to facilitate the initiation and coordination of PPP activities and outreach to the private sector.
- Strengthening and institutionalization of the One Health Approach to foster sustainable collaboration and coordination at all levels. This involves the establishment of a formal National OH Multi-sectoral Coordination Mechanism (OH-MCM) that shall assume the overall coordination and collaboration among different relevant stakeholders on all matters related to OH and shall be supported by technical working groups and a vibrant secretariat through which coordination of the sectors and all reporting would be channeled.

References

Assegai Woldegiorgis, 2009. Ethiopia celebrates a successful rinderpest eradication campaign, notes on the activities of the award committee.

CSA, 2021. Agricultural Sample Survey 2020/21. Federal Democratic Republic of Ethiopia, Central Statistical Agency (CSA).

Department of Veterinary Services, 1972. A review of animal health and livestock productivity factors in Ethiopia 1965-1971.

Faculty of Veterinary Medicine, 2005. Silver Jubilee Magazine 1979-2004

Grace, D., Mutua, F., Ochungo, P., Kruska, R., Jones, K., Brierley, L., Lapar, L., et al., 2012. Mapping of poverty and likely zoonoses hotspots. Zoonoses Project 4. Report to the UK Department for International Development. Nairobi, Kenya: ILRI

IGAD LPI Working Paper No. 02 – 10, October 2010. The contribution of livestock to the economies of IGAD Member States. Study findings, application of methodology in Ethiopia, and recommendations for future work.

Lindahl, J.F., Grace, D., 2015. The consequences of human actions on risks for infectious diseases: a review. Infection, Ecology, and Epidemiology 5: 30048. DOI:10.3402/iee.v5.30048.

MoA, 2012. Animal health Strategy document

MoA, 1984, History of Ministry of Agriculture

urphy, S.C., Negrón, M.E., Pieracci, E.G., Deressa, A., Bekele, W., Regassa, F., Wassie, B.A., et al., 2019. One Health collaboration for zoonotic disease control in Ethiopia. Revue Scientifique et technique (International Office of Epizootics) 38 (1), 51–60

Pieracc, E.G., Hall, A.J., Gharpure, R., Haile, A., Walelign, E., Deressa, A., Bahiru, G., et al., 2016. Prioritizing zoonotic diseases in Ethiopia using a one health approach. One Health 2: 131-35. doi: 10.1016/j.onehlt.2016.09.001

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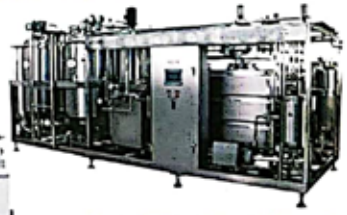

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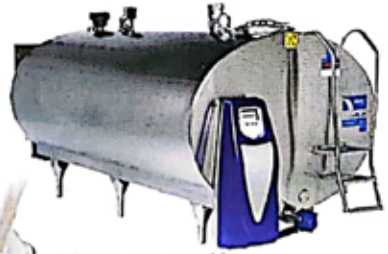

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Part Three:Veterinary Vaccines, Drugs, and Other Inputs in Ethiopia

Takele Abayneh[1], Segedu Shiferaw[2] and Wondwosen Asfaw[3]

[1]National Veterinary Institute (NVI), [2] Ethiopian Agricultural Authority (EAA), [3]Private Consultant

General Introduction

Ethiopia covers a total land area of 1,112,000 square kilometers (472,000 sq. miles). It is home to around 128 million inhabitants, making it the 13th-most populous country in the world and the 2nd-most populous in Africa after Nigeria. In Ethiopia, the agricultural sector is a cornerstone of the people's economic and social lives. Livestock is an integral part of the agricultural sector. The contribution of live animals and their products to the agricultural economy accounts for 40%, excluding the values of draught power, manure, and transport of people and products. Livestock is the key component in this sector. In fact, Ethiopia has the largest livestock population in Africa, with 70 million cattle, 42 million sheep, 52 million goats, 8 million camels, and 56 million chickens. The economic and social importance of animal resources at the household and national level, and also in the past, has generated significant income from export trade. Although Ethiopia has the largest number of animals in Africa, its contribution to the country's economy is still low. Therefore, a continuous commitment is required to reduce various constraints and increase the economic contribution of the livestock sector (Leta, S. and Mesele, F., 2014).

Livestock diseases are the major cause of economic losses to the peasant farmers and pastoralists in Ethiopia, amounting to hundreds of millions of birr annually because livestock is the chief source of cash income to smallholders, contributing up to 88% in the highland crop-livestock farming system. Diseases are an important cause of reduced productivity of meat and milk as well as draft power, hides, and dung fuel. Although many of the diseases could be controlled by available vaccine technology, timely recognition of the disease followed by the acquisition of the pharmaceuticals is lacking due to the remoteness of the livestock holder, the shortage of infrastructure facilities to support health services delivery, and the lack of essential medicine due to currency problems. Consequently, in Ethiopia, the majority of disease interventions consist of mass treatment following outbreaks rather than preventive measures (Dawit A. and Mebrate G., 2020). Veterinary vaccines in Ethiopia are almost entirely produced and supplied by the National Veterinary Institute. The institute produces 23 different types of vaccines against transboundary diseases of livestock as well as other critical sporadic diseases. Currently, few poultry vaccines are being imported by large commercial farms, although NVI comprises the major share. Veterinary vaccine distribution is solely done by the public sector, which may have an impact on vaccine accessibility. Vaccine supplies against transboundary livestock diseases are the responsibility of the Federal Ministry of Agriculture, while other important sporadically occurring diseases are those of the regional agricultural offices.

The Ethiopian National Veterinary Drug List contains different veterinary pharmaceutical product categories. Such as:

- Antibacterial (penicillin group, cephalosporin group, tetracycline group, sulphonamide group, aminoglycoside group, macrolide group, quinolones group, lincosamides group and different types of combination products);
- Different types of antifungals and their combination;
- Antiprotozoal (anticoccidials, trypanocides, and other related drugs);
- Anthelmintic (benzimidazoles group, imidazolethiazoles group, microcycline lactones group, salicylanilides group, and different types of combination products);
- Acaricides (organophosphates group, carbamates group, pyrethroids and pyrethrins, and others like amitraz);
- Gastrointestinal drugs (Anti-diarrheal drugs, Bloat remedy, Laxatives, Antiemetic);

- Cardiovascular drugs (Diuretics);
- Central nervous system drugs (Analgesics, Steroids, non-steroidal anti-inflammatory drugs, Sedatives);
- Drugs used in Anesthesia (General Anesthetics, Local Anesthetics);
- Hormonal Preparations
- Anticoagulants
- Fluids and electrolytes are used for metabolic disorders (Vitamins, minerals, etc.)
- Vaccines (bacterial and viral vaccine etc.)

Veterinary pharmaceutical products are imported to Ethiopia from China, India, Latin America, the USA, and European countries. Most of the products are antibiotics and anthelmintics and do not meet the country's demand. Veterinary medicines are fundamental for the treatment, prevention, and control of both infectious and noninfectious animal diseases. The provision of successful animal health services requires the availability of safe, effective veterinary drugs and their required quality and quantity. In addition, the available drugs must be presented and used rationally.

Veterinary vaccines

Vaccine production for the major cattle diseases in Ethiopia began in the early part of 1945 by the then MoA. The production took place in a small laboratory building at Gullele in Addis Ababa. In 1963, the entire establishment of the Gullele veterinary laboratory was transferred to Debre-Zeit and named the National Veterinary Institute (NVI). It is at the National Veterinary Institute where the preparation of a large number of vaccines in sufficient quality and quantity began using a skilled workforce, facilities, and a better organizational setup.

Vision and Mission of NVI

Vision: By 2029, G.C., the institute will fulfill the national demand for veterinary vaccines and drugs and be a competitive Institute in Africa.

Mission: Producing and supplying quality veterinary vaccines, drugs, and biologicals at affordable prices for the domestic market which supports the livestock sector, generating foreign currency by exporting products and sustaining profitability

National Veterinary Institute (NVI) was established at Bishoftu /Debre Zeit in 1964. 40 persons were under the Ministry of Agriculture, and technical assistance was obtained from the French Government through the French Veterinary Mission in Ethiopia. At that time, most people did not know the NVI's real value for the welfare of the national animal resources and for the African continent. Today, it is one of the most well-known veterinary vaccine-producing institutions in Africa, with its multidisciplinary professional staff having many years of experience.

The infrastructure of NVI is well developed and plays an important role in the attraction of an international institution, the Pan African Veterinary Vaccine Control Center (PANVAC), which is under the African Union. Moreover, it has been given the responsibility to produce and supply enough vaccines for PTA (Preferential Trade Area) countries of Eastern, Western, and Southern Africa. The institute has reached the level of using state-of-the-art equipment and technologies for biological production and vaccine-related research.

Since the creation of the institute, several million doses of different vaccines have been produced and dispatched to protect millions of animals from various infectious diseases. According to the evaluation performed in 1983 by IEMVT (Institute D'Elvage et de Medicine Veterinaire de pays Tropicaux) on the production potential of African laboratories, NVI was graded as the biggest vaccine producing center of all veterinary laboratories in tropical Africa.

Moreover, the institute won the International Gold Mercury Award in 1982 in recognition of its positive contribution to national development at the 22nd Conference for Peace and Cooperation.

Gold Medal award from the Ministry of Science Technology.

Different medals and certificate awards are available from government and non-government organizations, professional associations, and universities.

Proclamation No. 25/1992 and Council of Ministers Regulations No. 52/1999 organized the National Veterinary Institute as a public enterprise.

The institute is:

1 Certified with ISO/QMS 9001: 2015 by an international accrediting company, ALCUMUS/ISOQAR, and it is dedicated to the Development, Manufacture, Sales, and Distribution of veterinary vaccines as its primary mandate.

2 certified ISO/IEC 17025:2017 In Research and Development Laboratory for the following tests

3ABC ELISA for FMD
C-ELISA for CBPP & CCPP
RBPT FOR BRUCELLOSIS and
ELISA for PPR

By: Ethiopian National Accreditation Office /ENAO/

The institute possesses more than 57 years of experience in the production and distribution of veterinary biological products for both domestic and international markets (in more than 26 African countries). The vaccine production capacity of the institute in the early years was about 4 million doses per year, but currently, it has the capacity to produce more than 300,000,000 doses. The institute has a total surface area of 24 hectares of land. NVI actively takes part in problem identification and looks for solutions by developing and promoting research products to alleviate livestock disease-related problems and, at the same time, to protect animal welfare and the environment.

Ordinarily, the institute works harmoniously with the national veterinary service delivery institutions, which are stakeholders of the discipline. The institute has been working in collaboration with national and international institutes on vaccine development and improvement, vaccine production, pathogen identification and characterization, and other related technology transfer activities.

The list of vaccines currently produced by NVI

Bacterial vaccines

1 CCPP

2 CBPP T144

3 CBPP T1SR

4 Anthrax

5 Blackleg

6 Bovine Pasteurellosis (Hemorrhagic Septicemia)

7 Ovine Pasteurellosis

8 Fowl Typhoid

9 Fowl cholera

Viral vaccines:

10 Peste des Petits Ruminants (PPR)

11 Sheep & Goat Pox (SGP)

12 Lumpy Skin Disease (LSD)

13 Foot & Mouth Disease (FMD) – serotype O, A and SAT2

14 African Horse Sickness (AHS) – serotype 2, 4 and 9

15 Camel Pox (CMP)

16 Newcastle [HB1, Lasota, Thermostable & Inactivated]

17 Fowl pox

18 Infectious Bursal Disease

19 Marek's disease vaccine

20 Rabies

Product services provided by NVI

- Laboratory Test Services

ISO / IEC 17025:2017 certified laboratory tests

  - Bacterial identification
  - Antibody detection for specific diseases (ELISA, CFT, HAI, RBPT, AGID, SNT)
  - Isolation and identification of some viral pathogens
  - Molecular detection (Classical and real-time PCR) of specific viral and bacterial pathogens
- Feed analysis
- Training Services NVI provides hands-on training on:
  - Bacterial isolation and identification,
  - Serological techniques (ELISA, CFT, HA, HI, etc.),
  - Virus isolation and identification,
  - Molecular biological techniques and
- Feed analysis.

Veterinary vaccines

History of Veterinary Vaccine Production in Ethiopia

The main drive for the start of vaccine production in Ethiopia was due to the global initiatives against rinderpest control by the mid-1960s, which was causing significant losses to the cattle population. Thus, the history of veterinary vaccine production in Ethiopia is associated with the establishment of the Imperial Veterinary Laboratory in 1963, which was initially established in Gulele, Addis Ababa, within the compound of the then Pastor Institute, where it started producing Rinderpest and CBPP vaccines. Later, in 1964, the laboratory was relocated to Bishoftu and renamed Imperial Veterinary Institute (የከብት ህክምና ኢንስቲትዩት) which again is renamed as National Veterinary Institute after the end of the Imperial reign. The Institute started its operation with 40 persons under the Ministry of Agriculture with technical support from the French Government through the French Veterinary Mission in Ethiopia. In the beginning,

NVI was producing only four vaccines, namely, Blackleg, CBPP, Anthrax & Ovine pasteurellosis. Currently, the institute produces a total of 23 types of veterinary vaccines and is one of the largest veterinary vaccine manufacturers in sub-Saharan Africa.

Status of Veterinary Vaccine Production in Ethiopia

Table 1: Types and doses of vaccine produced by NVI for domestic use over the last five years (2017-2021 GC)

No	Bacteria Vaccines	Unit	2017	2018	2019	2020	2021
1	CBPP T144	Dose	-	-	-	-	-
2	CBPPT1sr	Dose	7,304,100	6,151,600	7,555,180	10,056,450	4,951,450
3	Anthrax	Dose	22,282,900	27,083,600	14,071,100	17,186,850	17,134,200
4	Blackleg	Dose	10411500	-	8,040,500	8,190,500	6,910,100
5	Ovine Pasteurellosis	Dose	15,563,750	11,326,000	10,231,950	13,755,400	9,568,200
6	Bovine Pasteurellosis	Dose	11,996,830	11,518,500	6,756,050	13,363,350	8,993,600
7	CCPP	Dose	8,571,500	2,778,800	8,053,000	4,620,500	5,763,200
8	Fowl Cholera	Dose	-	-	-	121,700	1,982,500
9	Fowl Typhoid	Dose	3869100	5,182,400	6,966,600	10,015,650	6,036,100
	Viral vaccine	Dose					
10	Lumpy skin disease	Dose	26,747,600	20,928,700	30,992,800	27,450,500	27,981,700
11	Sheep and goat pox	Dose	24,498,400	18,103,000	27,458,150	18,688,900	23,699,100
12	PPR	Dose	19,816,400	21,171,401	33,971,500	17,319,860	22,090,400
13	FMD	Dose	475,710	212,050	119,640	141,200	247,490
14	Camel pox	Dose	1,636,100	1,379,100	1,400,200	1,306,600	1,482,000
15	Africa Horse Sickness	Dose	9,696,900	4,762,150	8,026,100	5,808,650	7,118,950
16	Mareks	Dose	1,232,950	1,840,200	1,874,600	3,905,500	2,807,200
17	Newcastle LASOTA	Dose	23,711,306	18,982,700	32,483,700	56,197,800	42,140,000
18	Newcastle HB1	Dose	9149700	10,252,100	18,943,900	28,913,900	11,196,400
19	Newcastle Inactivated	Dose	-	-	-	-	-
20	Newcastle thermo stable	Dose	23,971,220	17,213,478	33,097,100	20,908,100	26,544,800
21	Chicken pox	Dose	5,508,000	9,795,000	7,977,600	21,110,200	5,877,300
22	Gumboro	Dose	6,802,620	12,969,900	11,314,800	23,298,000	22,104,700
23	Rabies	Dose	179,236	161,040	187,960	238,334	263,535
	TOTAL		233,425,822	201,811,719	269,522,430	302,597,944	254,892,925

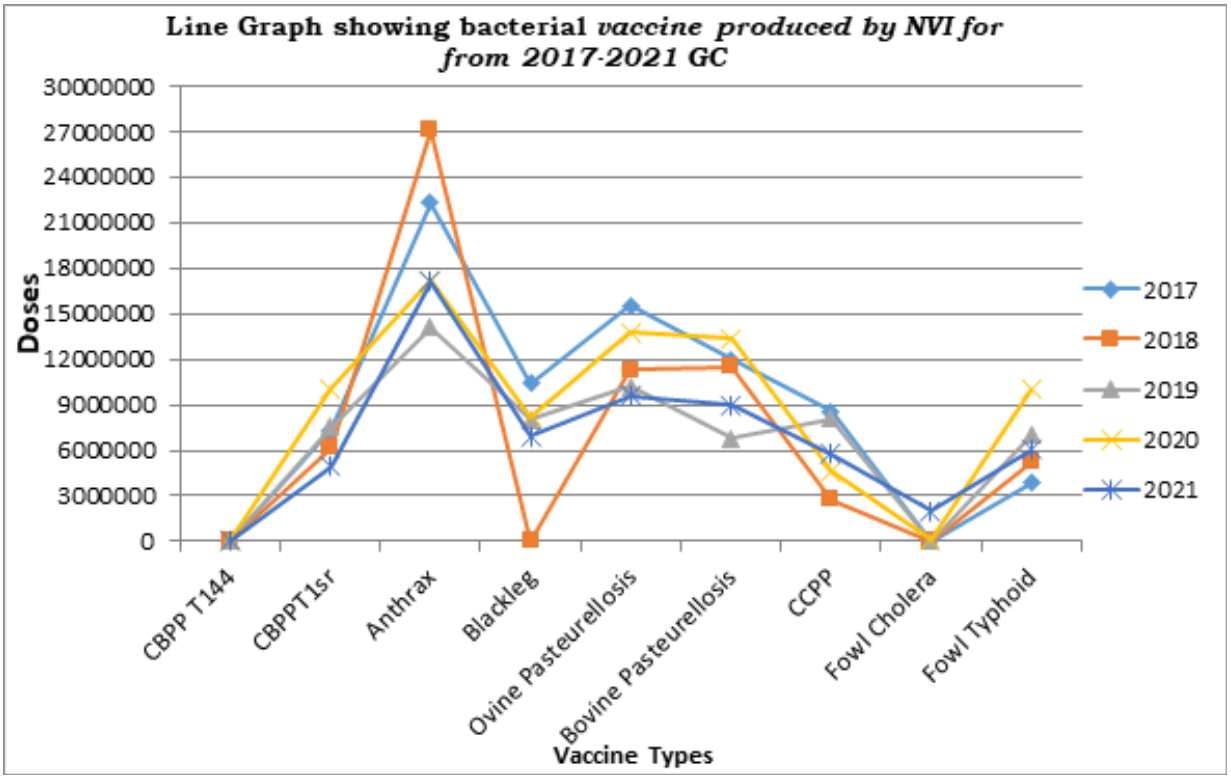

Figure 1: Summary of Bacterial vaccine produced by NVI from 2017-2021 GC

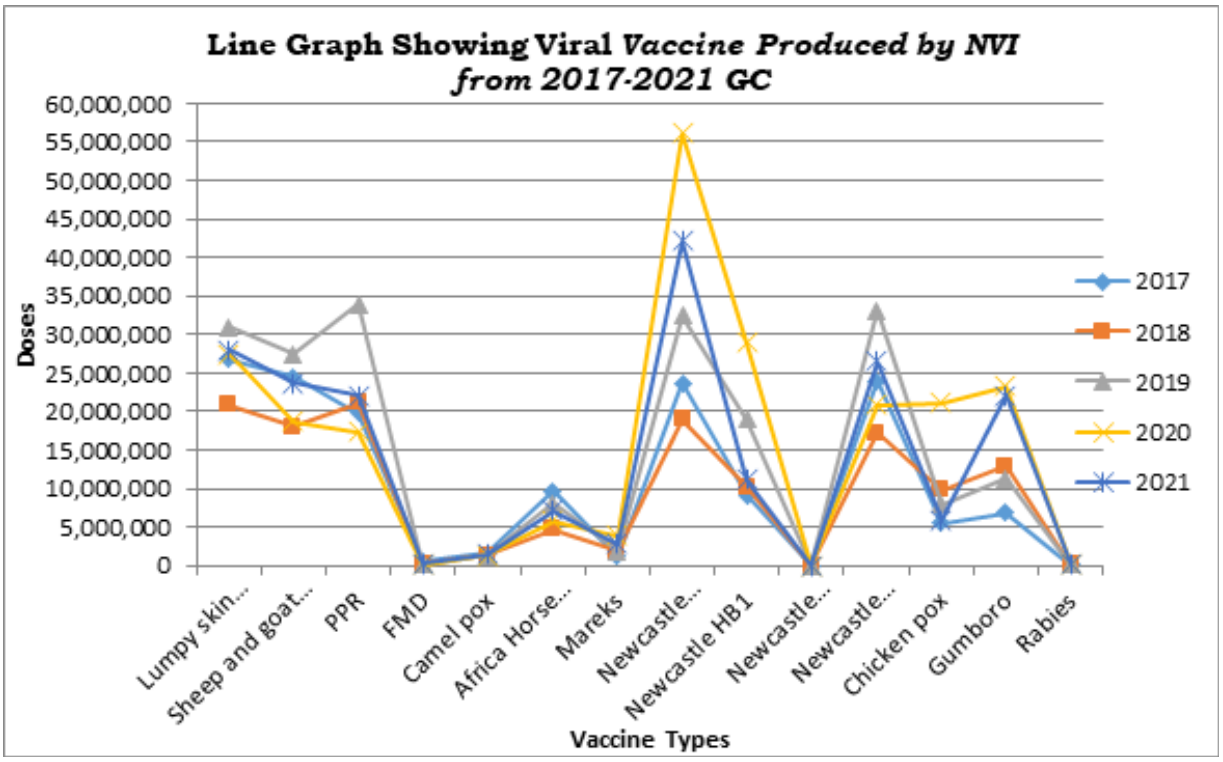

Figure 2: Summary of Viral vaccine produced by NVI from 2017-2021 GC

Types and doses of vaccines imported to Ethiopia over the last five years (2019-2023GC) with country of origin

The vaccines imported in the last five years that have been used for poultry were Fowl pox, Avian infectious bronchitis, Bursal disease, *Mycoplasma gallisepticum* bacterin, Newcastle disease vaccine, Live Mareks disease, Live herpes virus of turkey strain, and Corymune vaccine.

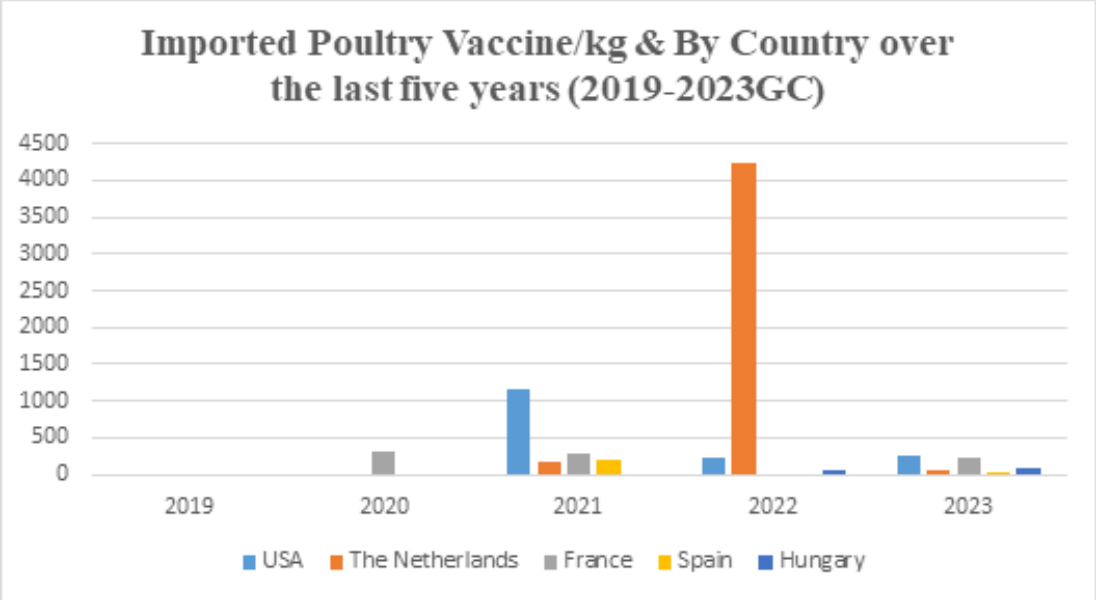

Figure 3: Imported Poultry Vaccine over the last five Years

Technological advances and capacity building have been made over the past years to increase the range, volume, and quality of vaccines produced locally.

A GMP-compliant Modern Laboratory was built at NVI, and new Machinery, such as Filling, Capsulation, and labeling Machines, as well as the Lyophilizer Machine (30,000 vials capacity) and fermenters (2500 liters capacity), was introduced.

Veterinary vaccine distribution systems in Ethiopia

Vaccine distribution is solely dome by the public sector, where the Ministry of Agriculture buys vaccines from the NVI and distributes them to farmers, including pastoralists in the eastern part of the country whose animals are most at risk of exposure to disease, given that they roam across a large area and mingle with wild animals. Vaccine distribution, however, is constrained by logistics for vaccine transport and storage. Owing to this, there is a limitation with vaccine accessibility, which may require the involvement of the private sector.

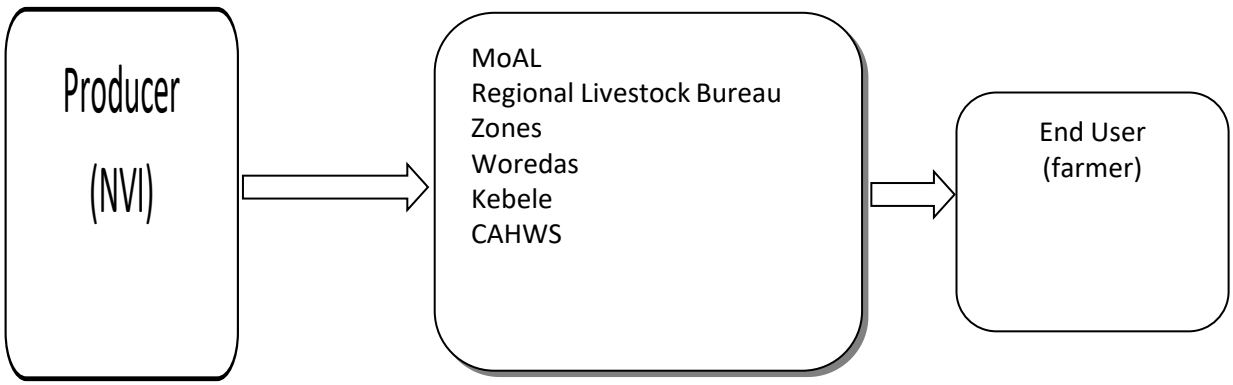

Figure 4: Vaccine distribution

Veterinary Drugs

History of veterinary drugs importation and regulation in Ethiopia

The Agricultural Input Supply Corporation (AISCO) was the sole government agency importing agricultural inputs, including veterinary drugs, since before 1990 GC. The distribution is done by the Ministry of Agriculture (MoA) to all the then-administrative regions of the country. A wide range of veterinary drugs and other inputs were procured and distributed, though not enough to meet the demand on the ground. Types of products include anthelminthic, antibiotics, antiprotozoal,

acaricide, vitamins, hormones, veterinary instruments, lab equipment reagents, etc. Until the issuance of the market economy policy of the Federal Democratic Republic of Ethiopia, the provision of animal health services and inputs was the sole responsibility of the government. Following the new economic policy in the 1990s that calls for greater participation of private entrepreneurs in the economy (Tada, P.R., 2001), the importation and distribution of veterinary drugs in Ethiopia has been liberalized since 1991GC. Even though importation is fully liberalized and left to the private sector, there is considerable competition from the regional governments with regard to distribution. The regions purchase veterinary drugs through tenders on an annual basis and sell them at subsidized prices. There was a veterinary drugs and equipment registration and inspection department under the MoA, which handled the veterinary drug registration, inspection, and import permit. The main points of evaluation of the registration documents were the certificate of pharmaceutical product (CPP), free sale certificate (FSC), and some other important technical documents. Sometimes, quality control tests were conducted through the pasture laboratory. At that time, there were not more than ten importers, and most of the manufacturers were from Europe; at around 1999GC, some manufacturers emerged from Pakistan, India, and Korea.

In 1999, the GC Drug Administration and Control Authority (DACA) was established under Proclamation No. 176/1999 to ensure the safety, efficacy, and quality of drugs for human and animal use and to maintain proper production, distribution, and use. The veterinary drug departed from DACA and established a Veterinary Drug and Feed Administration and Control Authority (VDFACA) under Proclamation No. 728/2011 and as per the Council of Ministers' regulation 272/2012 to execute the regulatory activities stated in the proclamation. VDFACA was replaced by the Ethiopian Agricultural Authority (EAA) in 2021GC and established under Proclamation No. 1263/2021 article 45. Its power and role are defined by Council of Ministers regulation No. 509/2022. The objective of the EAA is to establish and implement a strong regulatory system in the agricultural sector to improve international and national competitiveness and minimize and eliminate harmful impacts on human, animal, and plant health and the environment. The General Director leads the Authority and has two Deputy Director Generals (Livestock and Plant Regulatory). Veterinary Drug Regulatory is under the Livestock Regulatory Deputy Director General; the veterinary drug regulatory is working on regulating veterinary drugs in order to ensure the safety, efficacy, and quality of the products and to enhance the productivity and health of the livestock population.

Table 2: To show the Veterinary Drug importer and regulator

Year/GC	Imported by	Controlled/regulated by
Since before 1990-1991	AISCO	MoA
1991-1999	Private companies/ Importers	MoA (veterinary drugs and equipment registration and inspection department)
1991-2011	Private companies/ Importers	DACA
2011-2021	Private companies/ Importers	VDFACA
2021GC-Present	Private companies/ Importers	EAA

Types, value, and volumes of drugs imported into Ethiopia over the last three years

The Ethiopian Veterinary Pharmaceutical sector relies heavily on imports. The importing type of veterinary drugs are only a few types, not including the essential medicines; most of the veterinary drugs are

antibiotics and anthelmintic even if they do not cover the demand of the country's livestock population. The importers are importing different dosage forms of products such as solution/suspension for injection, powder for injection, bolus/tablets, water-soluble powder, oral liquid, and vaccine.

The types of veterinary drugs imported are:

Anthelmintic of different dosage forms, types, and strengths:

- Bolus form of Albendazole (300mg, 600mg & 2500mg), Tetramisole HCL + Oxyclonazid (450mg+ 450mg, 2000mg +1400mg), Levamisole HCL + Oxyclozanide (1000mg+1400 mg), Triclabendazole (250mg, 900mg), Tetramisole HCL 600mg and Oxyclozanide 2700 mg;
- Granule form of Fenbendazole (20% & 22%);
- Oral powder form of Piperazine citrate100%;
- The injection form of Ivermectin 1% is imported;
- Oral liquid form of Albendazole 10%.

Antibiotics of different types, strengths and dosage forms

- Injection form of Oxytetracycline (10% & 20%), Penicillin G Procaine + Dihydrostreptomycin Sulfate (20/20 & 20/25), Sulfamethoxazole + Trimethoprim (200mg + 40mg/ml & 400mg + 80mg/ml), Sulphadimidine Sodium n 33.3%, Enrofloxacin 10%, Tylosin Tartrate 20%, Amoxicillin Trihydrate 15%, and Gentamycin 10%;
- Powder for injection form of penicillin G Procaine + Penicillin Sodium,
- Oral powder form of Oxytetracycline HCL 200mg;
- In the form of an oral solution of Enrofloxacin 10%;
- Oxytetracycline is used in the form of a topical spray, 3.8%.

Antiprotozoal of different types, strengths, and dosage forms

- Granule for injection form of Diminazene Diaceturate + Antipyrin 2.36g, Diminazine Diaceturate + Phenazone + Vitamin B12 + Vitamin B6 and Isomethamidium HCL (125mg & 1gm).

Acaricides of different types, strengths, and dosage forms

- Deltametrine pour on (1% & 20%), Amitraz 12.5%.

Vitamins of different dosage form

- In the form of injection of Multivitamin and
- In the form of oral powder of Vit A+ Vit D3 + Vit E and Vitalyt.

Hormone are:

- Cloprostenol Sodium 0.250mg injection

Anticoccidial drugs are:

- Amprolium 20% oral powder.

Anthelmintic

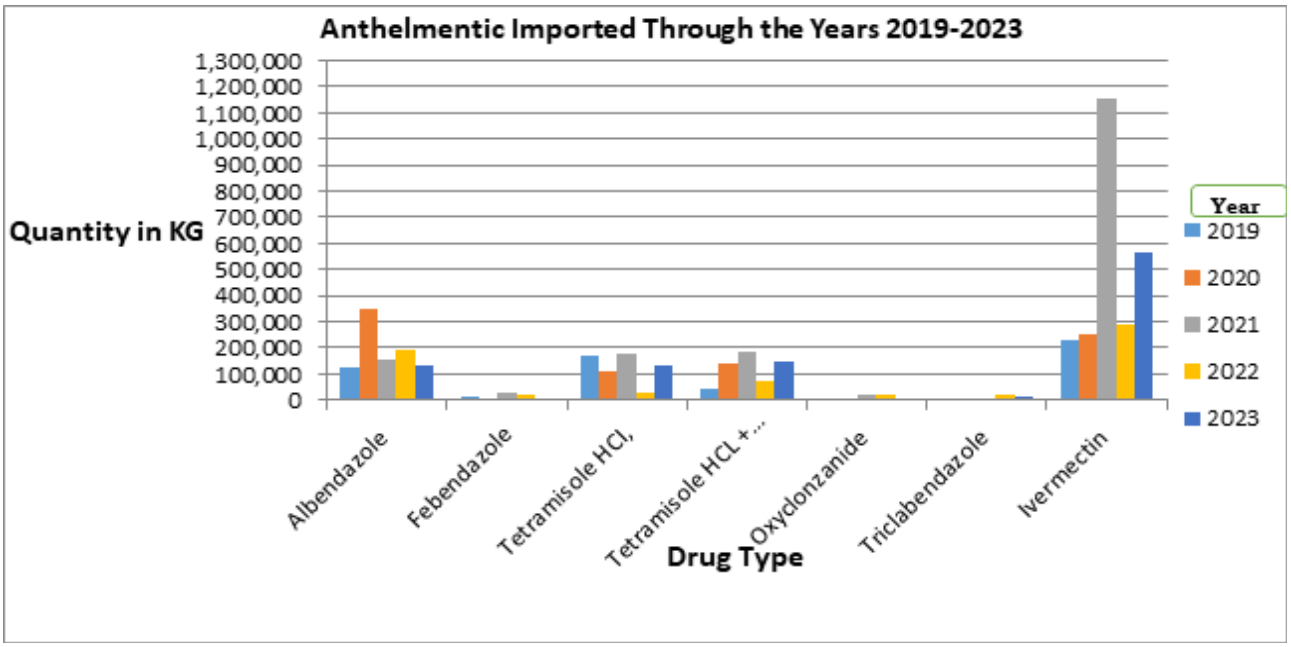

Figure 5.1: The veterinary Drugs (Anthelmintic) imported over the last five years

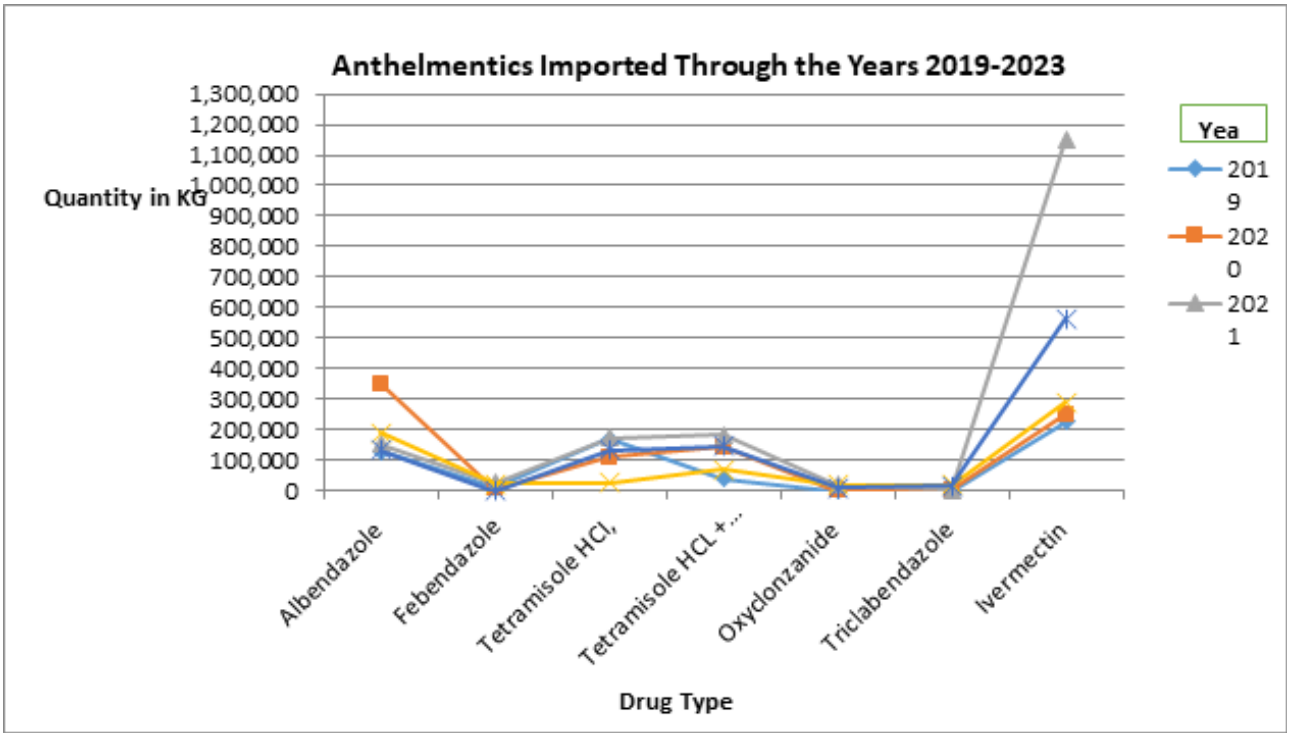

Figure 5.2: The veterinary Drugs (Anthelmintic) imported over the last five years

Table 3: Imported anthelmintic over the last five years with the country of origin

Anthelmintics Imported/Kg by Country for the last five years (2019 to 2023GC)				
Product	**China**	**India**	**Uruguay**	**Estonia**
Albendazole	712,792	242,544	0	0
Fenbendazole	44520	22,514	0	0
Ivermectin	2,461,286	23,014	24471	232.1
Oxyclozaide	48,449	0	0	0
Tetramisole HCL	227,630	185,057.00	0	0
Tetramisole HCL + oxyclonazid	248,580	325,027	0	0
Triclalbendazole	6,343	12,707	0	0
Total	3,749,600	810,863	24471	232.1

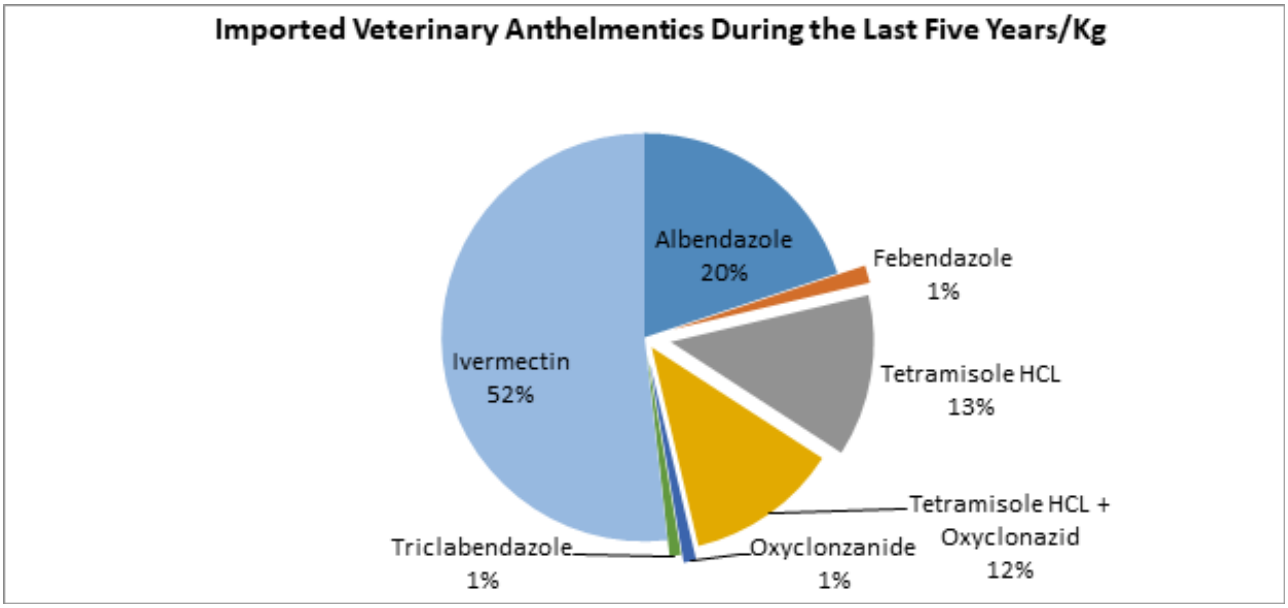

Figure 6: Imported Veterinary drug (Anthelmintic) during the Last Five Years/Kg

China is the leading country by supplying **Veterinary drug (Anthelmintic) to Ethiopia; t**he highest percentage of imported anthelmintic was ivermectin during the last five years (2021-2023GC).

Antibiotics

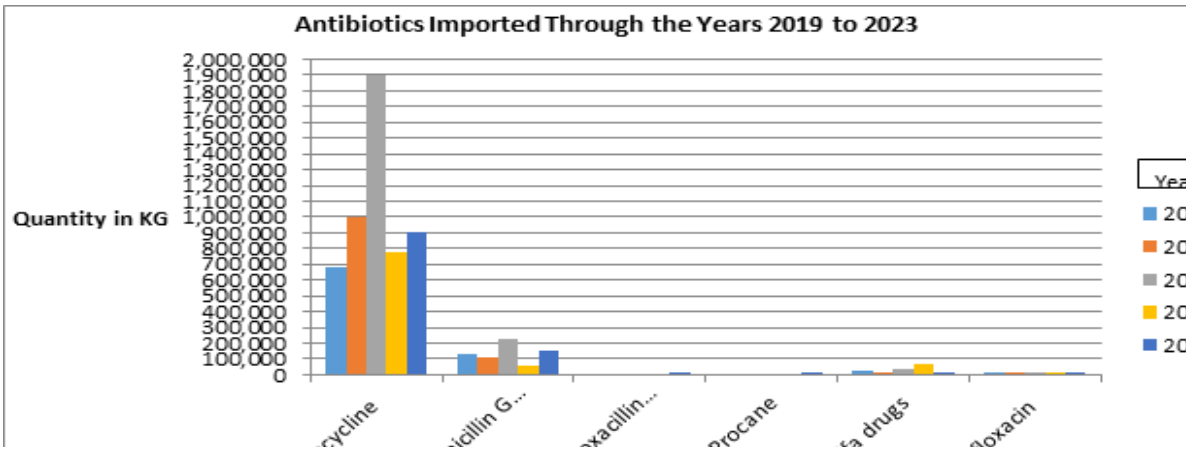

Figure 7.1: Imported Veterinary Antibiotics during the Last Five Years/Kg

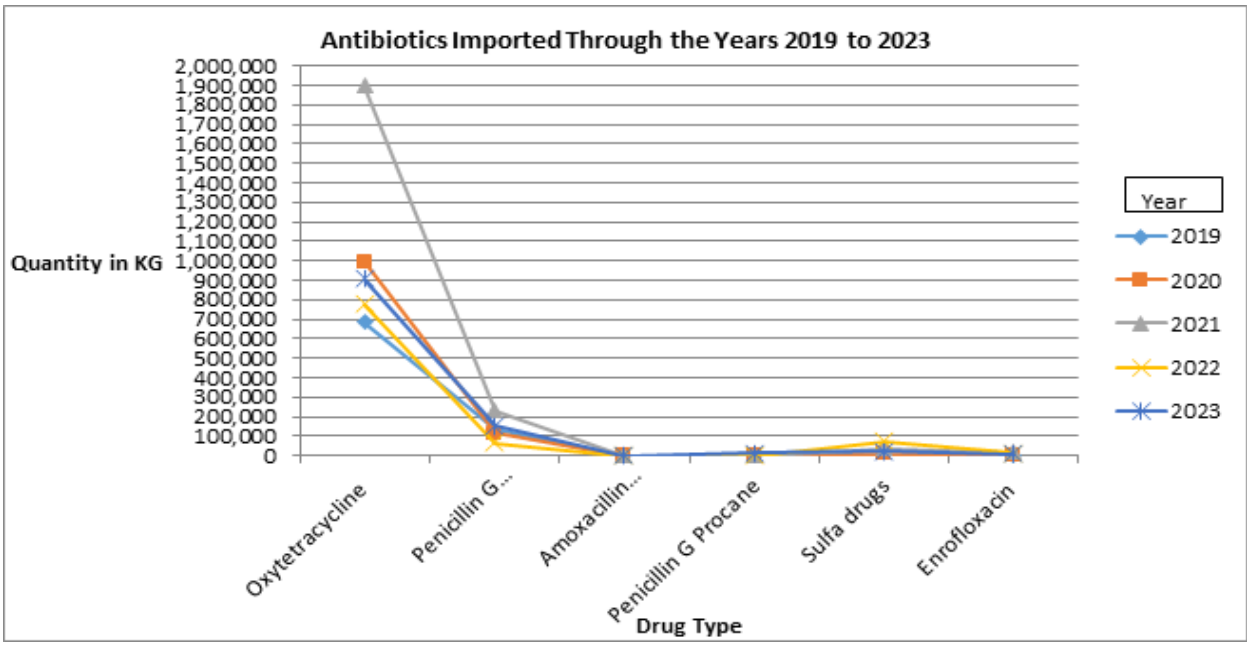

Figure 7.2: Imported Veterinary Antibiotics during the Last Five Years/Kg

Table 4: Imported Veterinary Antibiotics during the Last Five Years/Kg by country of origin

Antibiotics Imported/Kg by Country for the last five years (2019 to 2023GC)							
Product	**China**	**India**	**The Netherlands**	**Belgium**	**France**	**Estonia**	**Turkey**
Oxytetracycline	4,126,465	74,095	58,268	6,279.60	2,164	0	12
Penicillin G Procaine + Dihydrostreptomycin Sulfate	371,945	0	14,715	10,942	0	0	0
Sulfa	162,906	1,033	0	0	0	232.1	0
Enrofloxacin	0	0	4837.3		0	0	
Total	4,661,316	75,128	77,820	17,221.60	2,164	232	12

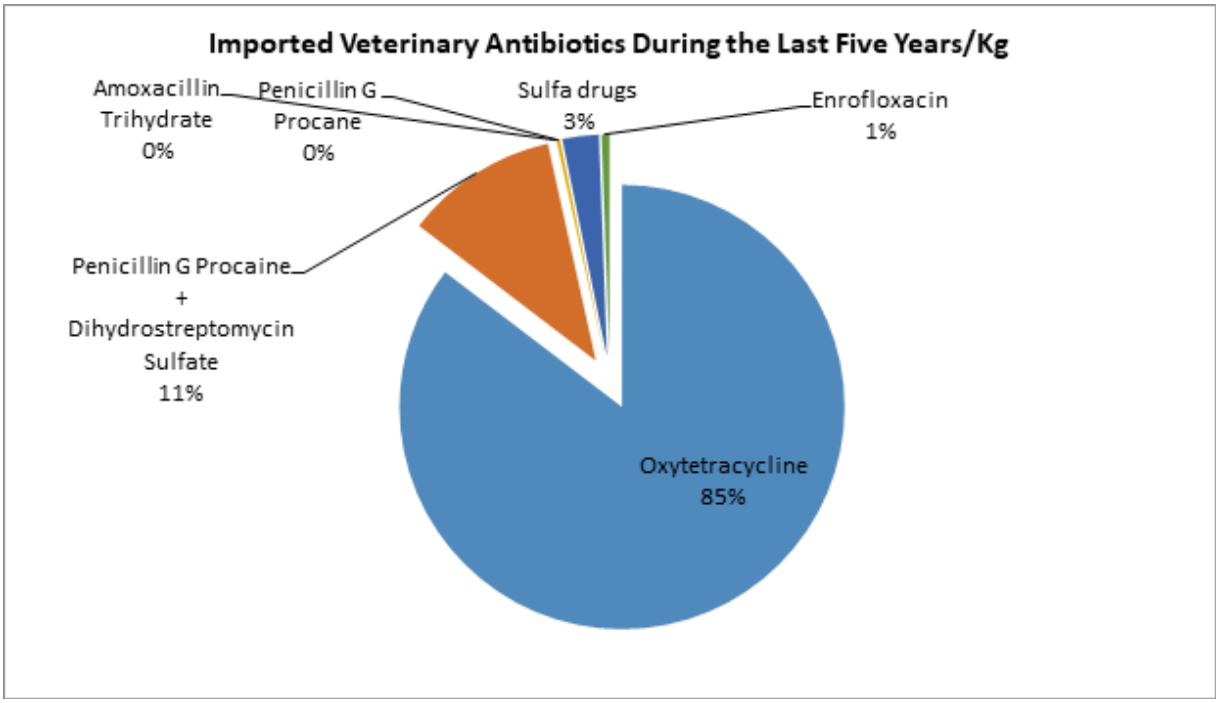

Figure 8: Imported Veterinary Antibiotics during the Last Five Years/Kg

The data of the last five years have shown that antibiotics are imported to our country from seven countries, but China is a leading country by supplying almost all veterinary products to Ethiopia. The highest percentage of imported antibiotics is oxytetracycline.

Other Veterinary Products (Multivitamin, Accuracies, Anticoccidial, Anti-protozoal & Hormone)

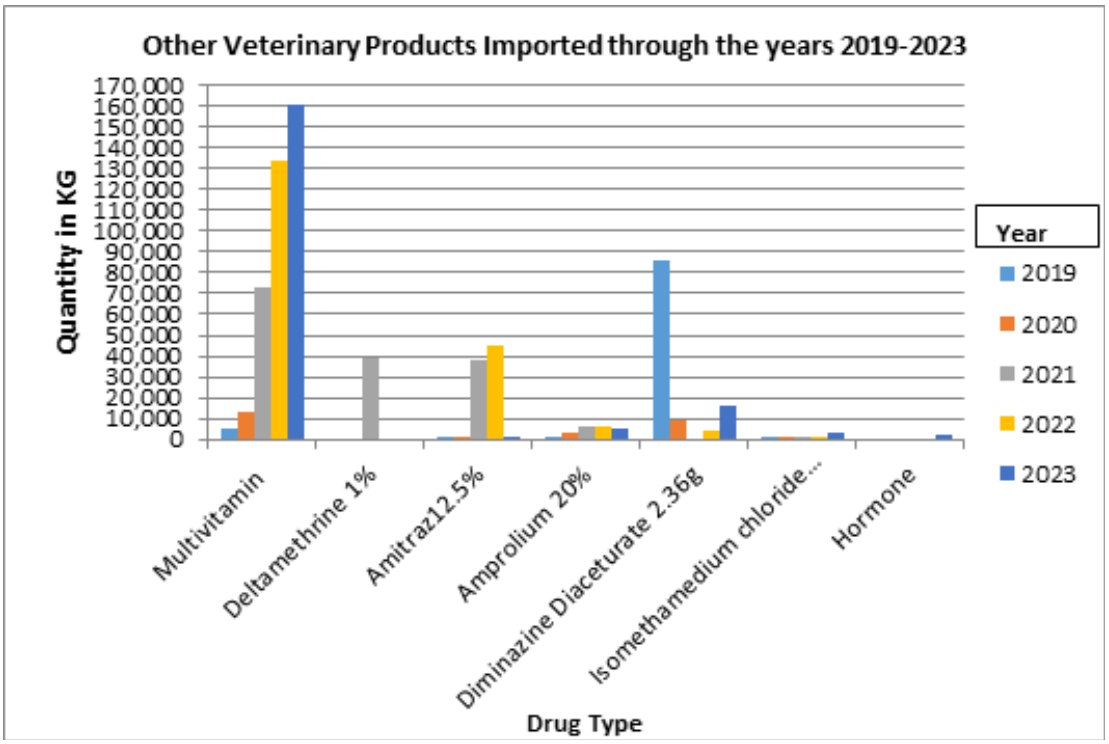

Figure 9.1: Imported Veterinary products during the Last Five Years/Kg

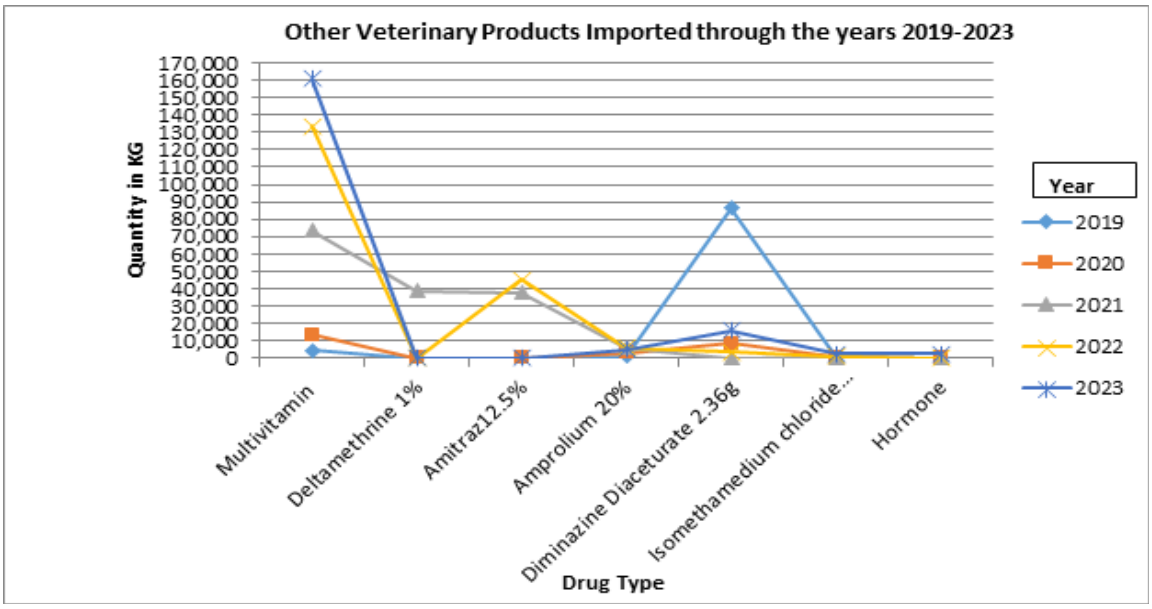

Figure 9.2: Imported Veterinary products during the Last Five Years/Kg

Other veterinary inputs: Import and distribution of instruments/devices, kits, reagents, and consumables

The imported veterinary instruments/devices in the last three years are an Automatic vaccination syringe, arm-length glove, balling gun, Burdizzo, CMT paddle, Emasculator, Electric sterilizer, Forceps, Hoof trimmer, knapsack spray, Microscope, obstetric kit, Postmortem kit, scalpel handle, Scissors, speculum, Surgical blade, Thermometer, treatment and vaccine needles, Treatment syringe and Trocar and cannula.

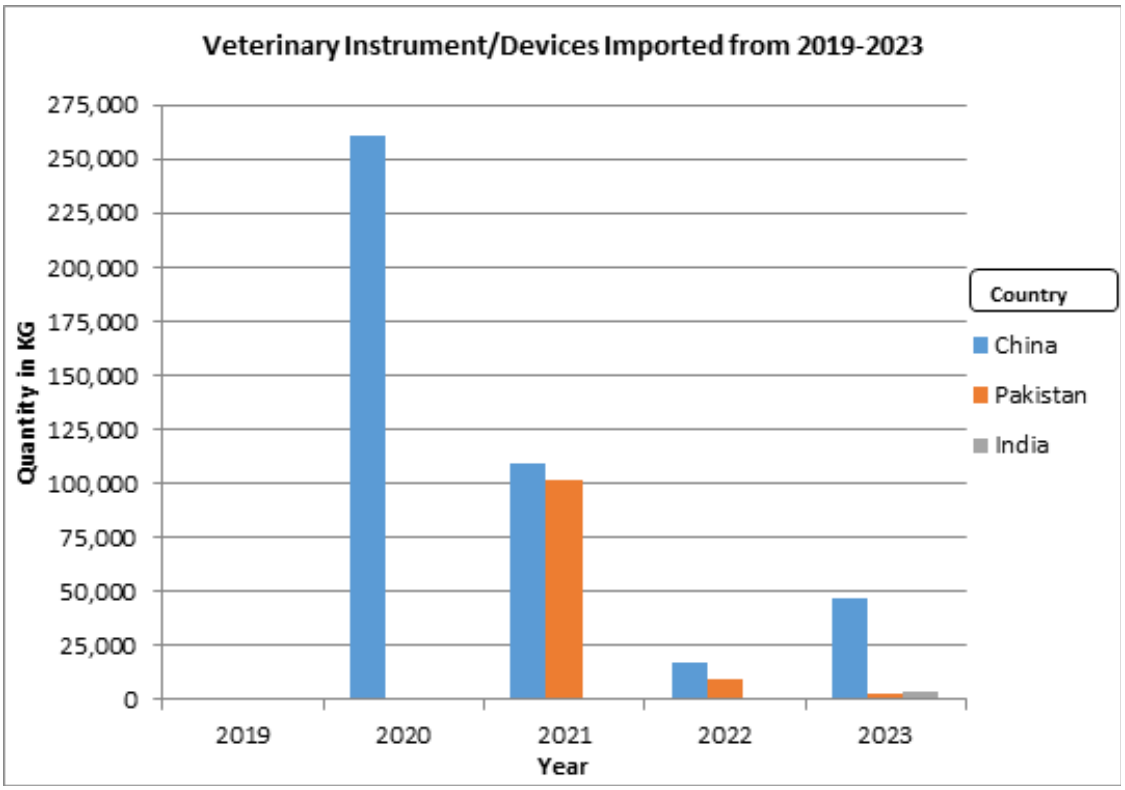

Figure 10.1: Imported Veterinary Instruments over the Last Five Years/Kg

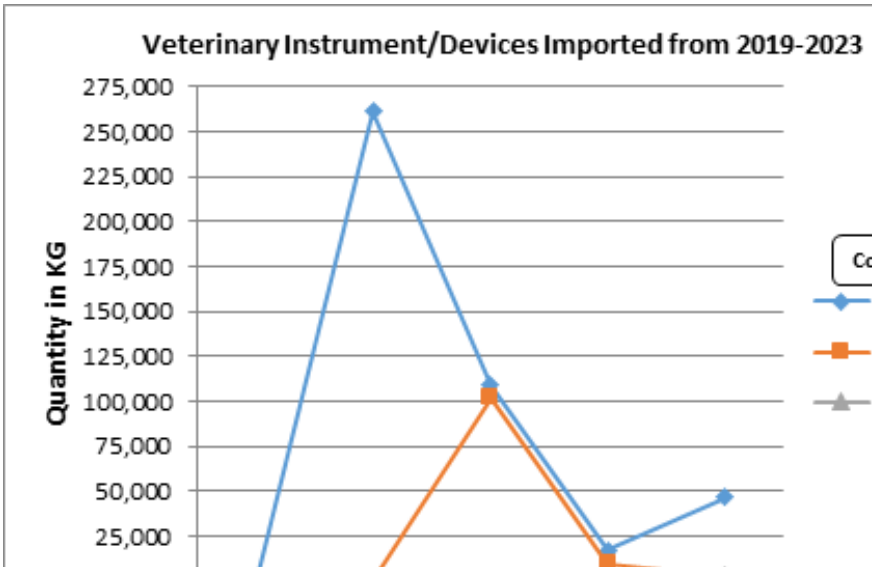

Figure 10.2: Imported Veterinary Instruments over the Last Five Years/Kg

Different veterinary instruments were imported in the last five years only from China and Pakistan. The country of origin of the suppliers/manufacturers of Veterinary drugs are:

- Asia: China, India, Korea, Vietnam, Indonesia, Pakistan
- Europe: The Netherlands, Estonia, Belgium, France, Turkey, Spain, Hungary
- Latin America: Uruguay, Peru
- North America: USA
- Middle East: Jordan

The local drug and equipment manufacturing companies in Ethiopia

There are five veterinary drug and equipment manufacturers in Ethiopia:

- National Veterinary Institute
    - Vaccine Manufacturing
    - Tablet/Bolus Manufacturing
- Alpha Vet Trading PLC Tablet/Bolus Manufacturing
- Adami Tulu Pesticides Processing Factory
- Agrifarm Agricultural Input and Equipment PLC Reusable Veterinary Syringe Manufacturing

The National Veterinary Institute:

Veterinary Vaccine Manufacturing was established in 1964 GC and manufactures 19 different bacterial and viral vaccines for animals.

Figure 11: National Veterinary Institute

Tablet/Bolus Manufacturing facility of NVI is established in 2022GC and manufacturing bolus/tablet.

Figure 12: NVI Veterinary tablet manufacturing

Table 5: Quantity of Bolus/ tablet manufactured by NVI over the last three years (2022-2024)

No	Year of manufacturing/GC	Quantity produced/bolus
1	2022	2.15million
2	2023	4.78million
3	2024	2.1million

Alpha Vet Trading PLC Tablet/Bolus Manufacturing is a private company established in 2024GC. Alpha Vet Trading PLC has purchased and transferred East African Pharmaceutical (EAP) PLC's veterinary

production line, including the transfer of the machines, related equipment, formulations, and technologies. It is located in Addis Ababa at Nifas Silk Lafto sub-city, Wereda 06. Currently, it is in the final stages of starting production.

Figure 13.1: Alpha Vet Trading PLC tablet manufacturing

Figure 13.2: Alpha Vet Trading PLC tablet manufacturing

Adami Tulu Pesticides Processing Factory is located approximately 170 kilometers south of Addis Ababa, specifically near the town of Zeway (Batu) in the Oromia Regional State of Ethiopia. Production and formulation operations began in February 2006 GC.

Table 6: Type of product manufactured/year

No	Type of product	Year of production (GC)/ Litter							Total Quantity/L
		2018	2019	2020	2021	2022	2023	2024	
1	Vetazinon (Diazinon) 60% EC	68086	70000	24816	1	0	18947	10535	92385

2	Ethiomiraz (Amitraz) 12.5% EC	40000	12705	0	0	0	0	0	52705
	Gross total in L	245,090 Liters of Veterinary Acaricide for the last 7 year							

Agrifarm Agricultural Input and Equipment PLC Reusable Veterinary Syringe Manufacturing was established in 2024 GC and manufactures reusable veterinary syringes. It is located in Addis Ababa at Nifas Silk Lafto sub-city, Wereda 06.

The Current veterinary drug distribution systems and the Role of public and Private sector

The pharmaceutical supply chain serves as the backbone of the healthcare industry, ensuring the timely and efficient delivery of life-saving medications to patients worldwide. At its core, the pharma supply chain encompasses a complex network of interconnected processes, stakeholders, and regulations aimed at safeguarding the quality, safety, and efficacy of pharmaceutical products.

The pharmaceutical supply chain refers to the series of interconnected activities involved in the sourcing, manufacturing, distribution, and delivery of pharmaceutical products to end-users, including livestock population, healthcare providers, pharmacies, and Veterinary clinics.

The Ethiopian veterinary pharmaceutical product distribution channel is based on the value chain:

The manufacturers/ suppliers from local/domestic and abroad, importers/distributors, and sellers are regulated and controlled by the Ethiopian Agricultural Authority; the retailers are regulated and controlled by the regional livestock department/agencies. The number of Veterinary Pharmaceutical companies in Ethiopia:

- Local veterinary drug and equipment manufacturers: 5
    - Vaccine manufacturer:1
    - Bolus/Tablet manufacturer: 2

    - Acaricide manufacturer: 1
    - Treatment syringe manufacturer: 1
- Total Importer and distributors: 159
- Total whole sellers: 157

Quality assurance system in veterinary drug production, import and distribution

The Ethiopian Agricultural Authority has a procedure for registering Veterinary drugs to ensure the availability of quality, safe, and effective veterinary products.

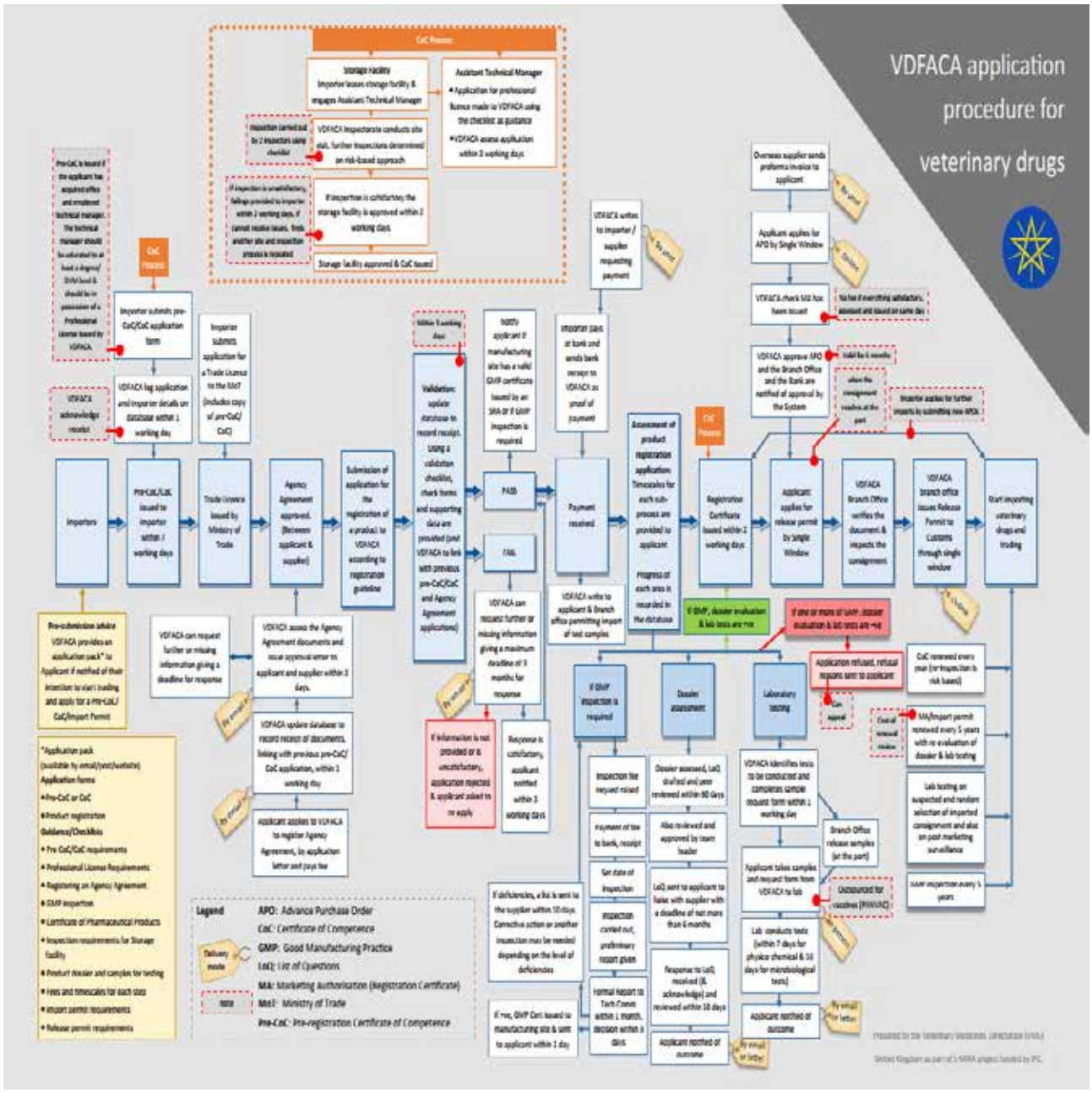

Figure 14: The procedure to register Veterinary drugs

Figure 14 shows the procedure for registering veterinary drugs. Importers/ wholesalers, manufacturers, and veterinary products can register after fulfilling all the requirements based on EAA guidelines. The purpose of Drug Registration is to ensure that a pharmaceutical product has been adequately tested and evaluated for safety, efficacy, and quality and that the product information provided by the manufacturer is accurate. It also allows the pharmaceutical product to be placed on the market until the registration period for the product has expired.

The main procedure for registering veterinary drugs:

- **GMP inspection** is a part of quality assurance that ensures medicinal products are consistently produced and controlled to the quality standards appropriate to their intended use and as required by the marketing Authorization or product specification.

- **Dossier evaluation**: evaluating Administrative and Technical documents of the products
- **Laboratory analysis** of the actual products.

The Authority has a laboratory for analyzing drugs and feeding and drug residue tests.

Figure 15.1: Animal Products & Inputs Quality Testing Center of EAA

Figure 15.2: Animal Products & Inputs Quality Testing Center of EAA

Figure 15.3: Animal Products & Inputs Quality Testing Center of EAA

Quality throughout the supply chain is essential to ensure that the quality of the pharmaceuticals is maintained from the manufacturer through to the end point of administration. Furthermore, these quality standards also help prevent counterfeit pharmaceuticals from entering into the legal supply chain. It, therefore, covers correct storage and distribution practices from the manufacturer to the distributor, wholesaler, and animal health facilities. Distribution is an essential activity in the integrated supply-chain management of pharmaceutical products. Various people and entities are generally responsible for the handling, storage, and distribution of such products. In some cases, however, a person or entity is only involved in and responsible for some aspects of the distribution process.

Figure 16: Upon the arrival of the GMP inspectors at the foreign manufacturing company

Figure 17: During Inspection of a foreign manufacturing company

Figure 18: During the presentation of the GMP report to the company's managers

To maintain the original quality of pharmaceutical products, every party active in the distribution chain must comply with the applicable legislation and regulations. Every activity in the distribution of pharmaceutical products should be carried out according to the principles of GMP, good storage practice (GSP), and good distribution practice (GDP), as applicable.

All parties involved in the distribution of pharmaceutical products have a responsibility to ensure that the quality of pharmaceutical products and the integrity of the distribution chain are maintained throughout the distribution process, from the manufacturer's site to the entity responsible for dispensing or providing the product to the consumer.

When the manufacturer/supplier supplies/sends the registered products to Ethiopia and as soon as the products have arrived in the Ethiopian port, the EAA's inspectors will be involved in identifying ship-

ments, processing all importation documents, completing any customs requirements, storing medicines properly until they leave the port, surveying the shipment for losses and signs of damage, take random samples for laboratory analysis and collecting the medicines as soon as they have been cleared. Then, the products will be distributed to the market if they pass on laboratory analysis; otherwise, it brings back to the country of origin or disposed of here in the country.

The challenges and opportunities in veterinary drugs production, import, and distribution in Ethiopia

Essential veterinary medicines save lives and improve health and well-being when they are available, affordable, of assured quality, and properly used. Access to veterinary drugs for livestock has become a major issue over the last decades.

The main challenges of importing veterinary drugs and raw materials are:

- Foreign currency issue.
- The importers are registered and imported veterinary drugs based on the needs of the regional livestock agencies.

Most of the registered and imported products are antibiotics and anthelmintics, even if they do not meet the country's demands.

The opportunities are:
The government is designing the National Strategy and Plan of Action for Pharma (NSPA-Pharma), which will be implemented from 2015 to 2025 for 10 10-year implementation action plan to solve poor infrastructure in the pharmaceutical sector.

The country creates a conducive environment for pharmaceutical manufacturing investment by launching different policies, strategies, and motivation packages such as:

- Favorable Market Factors and Improving Infrastructure.
- Currently, there is also a government strategy to substitute imports for local production.
- An attractive investment opportunity for investors in the pharmaceutical sector:

It is a priority investment area and the fastest-growing industry, with an annual growth rate of 15%. Ethiopia is the first African country to have developed a strategy for the pharmaceutical industry. Ethiopia presents an attractive location for investors in the pharmaceutical industry. The limited local production and particular policy focus make the pharmaceutical sector of Ethiopia potentially very profitable for investors. The Ethiopian pharmaceutical market offers a wide range of investment opportunities in the production of pharmaceuticals (in finished dosage form) as pharmaceutical manufacturing is a top priority for the government, which envisions becoming a central pharmaceutical manufacturing hub for Africa.

Favorable Conditions for Pharmaceutical Manufacturing

- The Kilinto Special Economic Zone (SEZ), designated for the pharmaceutical industry, is well-equipped with modern infrastructure.
- Fast-growing domestic and regional markets.
- Attractive investment incentives.

Investment Incentives

As per the Investment Regulation, priority sectors identified and have attractive incentives are listed below:

Fiscal Investment Incentives

Corporate Income Tax Exemption:

- Exemption from corporate income tax for up to 10 years, depending on the sector engagements.
- Additional 2-4 years exemption for SEZs enterprises with at least 80% export or input supply to exporters.
- Additional 30% deduction for three consecutive years if investment in underdeveloped regions.
- Exemption from income tax for up to 15 years for SEZ developers.

Import Exemption:

- **Capital goods**: 100% exemption from duties and other taxes on imports of capital goods (machinery & equipment).
- **Construction materials**: Full exemption from duties and other taxes on imports of construction & finishing materials (for investors who construct their factory).
- **Spare parts**: with a value up to 15% of the total value of capital goods (100% of the total value of capital goods for enterprises in SEZs that are fully exporters).
- **Vehicles**: Duty-free importation of delivery vans and trucks will be implemented according to the Vehicles Directive.

Export Incentives:

Companies that produce their products in Ethiopia and export have the following incentives:

- Full export duty exemption.
- Full import duty exemption on raw materials needed to produce export commodities.
- Additional two-year exemption for 60% exporters or input suppliers to exporters within or outside of SEZs.

In addition to tackling import-substitution opportunities in Ethiopia, investors can gain access to key export markets by leveraging Ethiopia's air connectivity, which currently offers access to 116 major international destinations.

Ethiopia's government is firmly committed to strategically supporting the country's pharmaceutical sector. A range of incentives are offered to investors in pharma. In addition, to facilitate quick and smooth entry into the market, the government has developed Kilinto Industrial Park specifically for the pharmaceutical sector. Located in Addis Ababa (the nation's capital), about 25 kilometers from the city center, Kilinto rests on 279 hectares of land, approximately 166 hectares of which is dedicated to manufacturers. The Park has all of the requisite infrastructure, including a state-of-the-art wastewater treatment plant, a reliable water supply, and a dedicated power substation. To ensure compliance with international Good Manufacturing Practices (GMP) and remove contamination, several measures, including segregation/ zoning of products, are implemented.

The Ethiopian Investment Commission provides all necessary services to investors looking to establish their ventures in pharmaceutical manufacturing during their pre-implementation, establishment, and operation journeys. The commission also offers services to investors looking to invest in industrial parks.

The way forward

Accessing the vaccine and medicine is mandatory for the health and welfare of the livestock population, so:

- The regional livestock agencies should include medicine for all species of animal when they announce a tender to buy medicine because the importers are registered and import veterinary drugs based on the needs of the regional livestock agencies.

- The Government should establish a government-owned supply agency like the Ethiopian Pharmaceutical Supply Service (EPSS) in order to import essential veterinary medicine that private importers do not import.
- It is a good opportunity for importers and other stockholders to participate in/invest in local veterinary drug manufacturing.

Conclusion

As we all know, Ethiopia is the first in Africa and tenth in the World in terms of livestock population. Equitable access to health products is a global priority, and the availability, accessibility, acceptability, and affordability of health products of assured quality need to be addressed in order to achieve the Sustainable Development Goal (WHO, 2019).

Accessing the vaccine and medicine is mandatory for **the health and welfare of the livestock population. Still, the** vaccines and medicine that are manufactured and imported do not cover the demand the animals throughout the country, even if the Government gives priority to getting foreign currency for the importer and manufacturer of medicine. The EAA also has given priority to registering medicines that have low demand for medicine on the fast-track registration process, and also, the registration fee is 1/5 of the medicines having high demand.

The importer registers and imports veterinary medicine based on the regional livestock agency's needs and tender. Most of the veterinary medicine imported is antibiotic and anthelmintic. Still, it does not include medicine for equine and pet animals or essential medicine for dairy cows like calcium-borogluconate, Intra-mammary infusion, intra-uterine bolus, and so on.

Equitable access to quality, Safe, and effective medicine is the right for all animals, so It is better to include the list of vaccines and medicines for all species of animals, even if the quantity depends on the need when preparing the tender to buy a vaccine and medicine. Importing substitutes is one of the government's strategic plans, and it supports local manufacturing companies in different ways. The government has already prepared the pharmaceutical manufacturing industry park, so it encourages different stockholders from locally and abroad to invest in veterinary pharmaceutical manufacturing in order to create accessibility of veterinary vaccines and medicine for the health and welfare of the animals and the public.

Reference

Dawit A. and Mebrate G., 2020. Review on the Major Infectious Animal Diseases in Livestock. African J. Basic & Appl. Sci., 12 (3): 56-64, 2020

Ethiopian Agricultural Authority's imported data of 2019-2023GC.

https://www.unido.org

Leta, S. and Mesele, F., 2014. Spatial analysis of cattle and shoat population in Ethiopia: growth trend, distribution and market access. Springer Plus, 3(1), p.310.

Tada, P.R., 2001. Economic Reforms and Structural Changes in Ethiopia since 1992an Inquiry.

World Health Organization, 2019. Governing Body matters: Key issues arising out of the Seventy-second World Health Assembly and the 144th and 145th sessions of the WHO Executive Board (No. SEA/RC72/14). World Health Organization. Regional Office for South-East Asia.

Part Four: Veterinary Diagnosis and Surveillance in Ethiopia

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Executive Summary

AHI was established with a mandate to carry out research on animal diseases, deliver diagnostic services, provide training for national and international experts, and provide advice on animal health issues, acting as a regional reference laboratory. It conducts research and investigation works that can prevent and control animal diseases before they cause economic, social, and environmental damage to make our country competitive and benefit from its animal resources in the domestic and international markets. The Institute owned five (5) animal research centers situated in different regions of the country with the aim to conduct prevention, control, and eradication measures in areas affected by Tsetse fly and Trypanosomosis.

The Ethiopian Agriculture Authority (EAA) Animal Products and Inputs Quality Testing Center (API-QTC) provides laboratory testing services to the public to verify the quality and safety standards of primary animal products (Meat, Milk, and Honey), veterinary medicinal products (VMPs) and Feed and feeding stuff dedicated for commercial purpose. API-QTC also assists the national regulatory bodies in taking legal actions against those involved in substandard manufacturing practices, the sale of unsafe and counterfeit animal drugs, feed, and animal source foods, setting standards as modern laboratories in areas of product quality assessment, and consequently meeting national and international standards.

In Ethiopia, there are Seventeen (17) regional veterinary laboratories, and their main functions are to carry out disease investigations, provide diagnostic aid to field veterinarians, refer to the national veterinary research institute for problems beyond their scope of work, and recommend measures for prevention, control, or eradication of diseases of economic and social importance in their areas.

Ethiopia's national animal health surveillance system (NAHSS) consists of three complementary systems: the Animal Diseases Notification and Investigation System (ADNIS), the monthly Disease Outbreak and Vaccination Activity Reporting System (DOVAR-2), and active animal disease surveillance conducted by Veterinary Laboratories. The veterinary laboratory system has been strengthened by the implementation of SILAB, which allows information sharing between and within laboratories.

Diagnosis

Brief history of veterinary diagnostic service in Ethiopia

Fifty years ago, the Ethiopia Veterinary Service was organized into seven divisions for administrative purposes, and one of them was the so-called 'division of Laboratory Service' and the now veterinary laboratories. The establishment of the first veterinary laboratory in Ethiopia dates back to the year 1905, when a veterinary institute came into being in Asmara, Eritrea, with the main objectives of producing vaccines and investigating livestock disease. The vaccine was Rinderpest vaccine from goat attenuated virus, which in this case was imported from Kenya. A second laboratory was set up in the year 1939 near Kechene, Medhane-Alem Cathedral, which ten years later (in 1949) was shifted to Gulele, Addis Ababa, under the aegis of the Ministry of Agriculture. This was subsequently transferred to its present site at Debre-Zeit in 1963, where it developed into a full-fledged National Veterinary Research Institute with the collaboration and financial assistance of the French Government. Initially, the institute produced only three types of vaccines, but later, in Oct 1979, it was reported that production increased in number and quantity (volume of doses), and reached about 28 million doses of different vaccines annually, and the number of staff was increased to 89, of which seven were French nationals.

A decade later, in 1973, another laboratory, Sholla Regional Veterinary Laboratory, was established at Sholla, Addis Ababa. It was jointly managed and run by the Government of Ethiopia and the British Overseas Development Programme until 1977 when the Ministry of Agriculture entirely took it over upon the termination of the British Overseas Development Programme.

At the same time, another regional veterinary laboratory was started at Bahir-Dar with the technical and financial assistance of the Government of the People's Republic of China, where the Chinese experts carried on the work until 1979. Two years later (1981), the establishment of Bedelle Regional Veterinary Laboratory was followed with the technical and financial assistance of UNDP/FAO. Regional veterinary laboratories have mainly carried out investigational work on parasitic and bacterial diseases, except the laboratory in Asmera, where several biologicals have also been produced. In fact, it was the only laboratory/institution in the country that was in the position to produce anti-snake and scorpion venom sera for human use. Before 1983 or the creation of regional states, veterinary laboratories were called 'Regional veterinary laboratories" (Zeleke D, 1979). Before the independence of Eritrea, the regional veterinary laboratories were only at Asmara, Bahir Dar, Sholla, and Bedele. Moreover, the National Veterinary Institute (NVI) at its present site was the only national reference laboratory for animal health.

More or less similarly, the main functions of the veterinary institutes were to; -produce biologicals/vaccines., provide diagnostic services to field veterinarians, investigate livestock diseases with a view to determining their seasonal and geographical incidences, mode of transmission, and spread, and carry out applied research in different veterinary fields (Worku M, 1972). In the subsequent years, additional regional and national veterinary laboratories were established in different parts of the country.

Geographic distribution of existing veterinary laboratories

With their work scope, mandate, and accountability, veterinary laboratories can be classified as national and regional veterinary institutes. The national veterinary laboratories include the Animal Health Institute (AHI), National Veterinary Institute (NVI), Animal Products, and Input Quality Testing Center (API-QTC). There are also about 17 regional veterinary laboratories operating all over the country (Table 1).

Table 1: Veterinary Labs, distribution, and establishment

S/N	Name of the Lab	Region	Established in	Who established
1	AHI	Oromia	1995	MoA with FLDP support
2	NVI	Oromia	1964	With French technical assistance
3	API-QTC	Addis Ababa	2011	Federal Government
4	Bahri-Dar Regional Lab	Amhara	1973	Ethio-China joint
6	Sholla Lab	Addis Ababa	1973	Ethio-British joint
7	Bedele Regional Lab	Oromia	1981	UNDP/FAO support
8	Asella Regional Lab	Oromia	1966	Swedish International Development Agency
9	Kombelicha Regional Lab	Amhara	1965	With Taiwan veterinarians
10	Mekelle Regional Lab	Tigray	1988	Government through FLDP
11	Hirna Regional Lab	Oromia	2001	Oromia Government
12	Sodo Regional Lab	Southern	1986	Regional Government
13	Mizan Regional Lab	Southwest	1999	SNNPR regional Gov't
14	Jigjiga Regional Lab	Somali	2008	Government through FLDP
15	Yabello Regional Lab	Oromia	2007	Oromia regional government.
16	Semara Regional Lab	Afar	2002	Afar Regional Government + FAO
17	Assosa Regional Lab	B/muz	2006	Wit B/Gumuz regional gevern.t
18	Dire dawa Lab	Dire dawa	1989	With Dire dawa administration
19	Jinka Regional Lab	Southern	2014	With regional government
20	Sidama Regional Lab	Sidama	2021	With Sidama regional govn.t

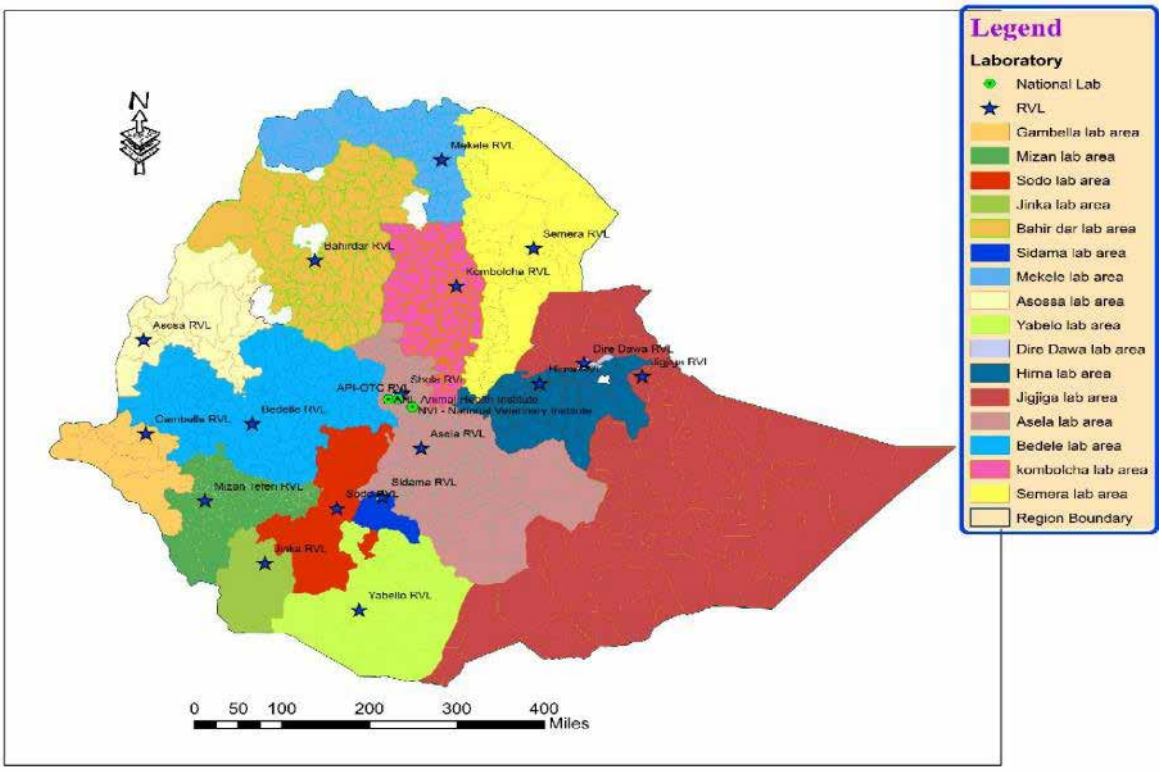

Figure 1: Regional Veterinary Labs and their Operation areas

Mandate and Accountability of Veterinary Laboratories.

Animal Health Institute (AHI)

AHI is an executive organ under the Ministry of Agriculture (MoA) established by Proclamation No. 1263/2021 by merging the National Animal Health Diagnostic and Investigation Center (NAHDIC) and National Institute for Control and Eradication of Tsetse fly and Trypanosomosis (NICETT). AHI has a head office in Sebeta town and is organized into the Animal Health Research Sector and Tsetse fly-Trypanosomosis Research Sector, both headed by Deputy General Directors who are accountable to the General Director (See AHI organogram indicated (Fig 2).

AHI was established with a mandate to conduct research and diagnostics relevant to the prevention and control of animal diseases of economic and public health importance and conduct prevention, control, and eradication measures in areas affected by Tsetse fly and Trypanosomosis, as well. The organizational setup of AHI and regional veterinary laboratories in Ethiopia mainly consists of federal and regional entities, respectively, where the AHI is governed under the jurisdiction of the Ministry of Agriculture and the regional veterinary laboratories under regional agricultural bureaus of their respective regional states. AHI has an alignment on a monthly and quarterly basis with the Ministry of Finance related to financial reports and also with Houses of People Representatives for reports related to the performance of its main activities.

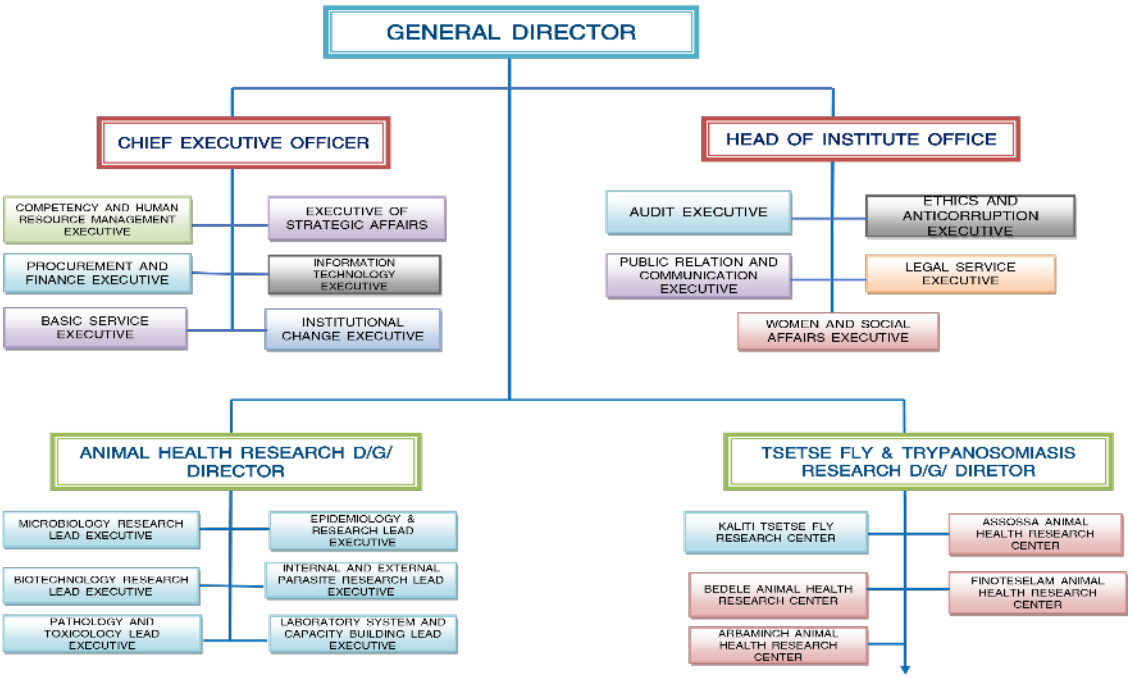

Figure 2: Organizational Structure of AHI

The Animal Product and Input Quality Testing Center (APVD-FQAC)

The Center History at a Glance

The Ethiopian Agriculture Authority (EAA) Animal Products and Inputs Quality Testing Center (API-QTC) provides laboratory testing services to the public to verify the quality and safety standards of primary animal products (Meat, Milk, and Honey), veterinary medicinal products (VMPs) and Feed and feeding stuff dedicated for commercial purpose. API-QTC was established in June 2014 as an entity of EAA (former VDFACA) to ascertain the quality and safety standards of regulated products through laboratory analytical work that maximizes livestock and public health protections. The laboratory started rendering laboratory services to the public in 2016 G.C.

In 2021, VDFACA was re-established as EAA 2021 by Proclamation No. 1263/2021 article 45. The Council of Ministers defines EAA's power and role under Regulation No. 509/2022. As a national regulatory authority, EAA regulates agricultural technologies, inputs, products, and services, mainly functioning on setting standards, product registration, inspection, testing, certification, and regulatory enforcement. By these, EAA verifies agricultural products and services compliance against national and international quality and safety standards.

Mandate and Accountability of the Center

API-QTC is mandated to provide laboratory testing and training services on:

- Veterinary Medicinal Products (VMPs), Vaccines, and Biologicals to ensure quality, safety, and efficacy of the products and thereby improve animal health services;
- Feed and feed supplements/additives intended for commercial purposes to ensure the safety, quality, and suitability of the feeding stuff to improve livestock development sectors (Poultry, Dairy, Fattening, Fish, Breeding Cattle, Sheep, and Goats);
- Food safety and quality testing activities focusing on biological hazards, chemical residues, and environmental contaminant surveillance and monitoring (animal source foods: Meat, Milk, Honey, Egg, and Fish) with particular attention on

- Bacterial foodborne pathogens (*Campylobacter* Spps, *E. coli O157:H7*, *L. monocytogenes, Salmonella* Spps and *S. aureus,*);
- Veterinary drug and pesticide residues, toxic minerals, and mycotoxins;
- Enumeration of quality indicator microorganisms;

- Milk and Honey nutritional proximate analysis to verify the quality of the products;
- Antimicrobial resistance surveillance and monitoring activities from animal source foods, feed, and related environments;

API-QTC also assists the national regulatory bodies in taking legal actions against those involved in substandard manufacturing practices and the sale of unsafe and counterfeit animal drugs, feed, and animal source foods; set standards as modern laboratories in areas of product quality assessment and consequently meet national and international standards; Provide training services to appropriate stakeholders and institutions related to its scope of functions and undertake research activities in collaboration with appropriate partners on quality and safety aspects of VMPs, feed and animal products and provide reliable data for policymakers and scientific communities.

Institutional Set-up

EAA has two main regulatory divisions, led by separate deputy Director Generals: Animal and Plant Regulatory. The Animal Regulatory Division is responsible for monitoring the quality, efficacy, and safety of animal health supplies (VMPs, Vaccines, and Biologicals). It is also accountable for verifying the quality and safety of commercial animal feeding stuff and primary animal source foods to protect the health of animals and consumers from unwanted chemical residue and biological contaminants.

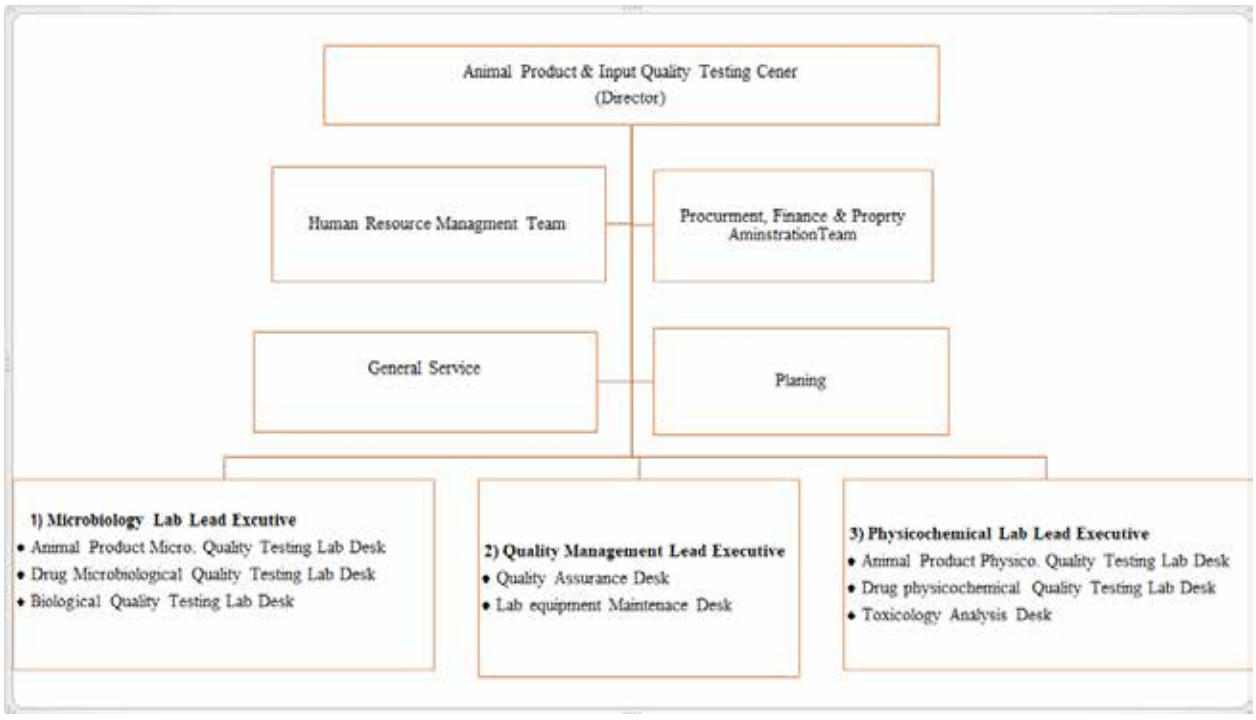

Figure 3: Organizational Arrangement of API-QTC

Regional Veterinary Laboratories (RVL)

In Ethiopia, there are 17 regional veterinary laboratories located in Addis Ababa (Sholla), Mekele, Bahir-Dar, Kembolcha, Semera, Jigijiga, Dire Dewa, Hirna, Yabello, Asella, Sidama, Soddo, Jinka, Mizen Teferi, Bedele, Gambella and Asossa. In fact, most of them have been in service for several years, and some of them have been established recently. Most laboratories were established by a government budget

supported by the regional state. A few of them were funded by non-government organizations like FAO, the United Nations Development Program (UNDP), the Swedish International Development Agency (SIDA), the Ethio-China government joint venture, the Ethio-British government joint venture, Taiwan Veterinarians and Fourth Livestock Development Project (FLDP).

Mandate and Organizational Set up of Regional Veterinary Laboratories

The main functions of the regional veterinary laboratories were to investigate diseases, provide diagnostic aid to field veterinarians, refer problems beyond their scope of work to the national veterinary research institute, and recommend measures for prevention, control, or eradication of diseases of economic and social importance in their areas.

Some of the mandates and responsibilities of regional laboratories include;

- Conduct disease surveillance and outbreak investigation activities
- Deliver routine diagnostic services to the community.
- Participate in disease control and eradication programs in line with the national program.
- Conduct research works either alone or in collaboration with universities, national and regional research centers
- Conduct awareness creation on animal disease control and prevention, disease reporting
- Provide training for district animal health experts.

Organizational structure of Regional Veterinary Laboratories (RVLs)

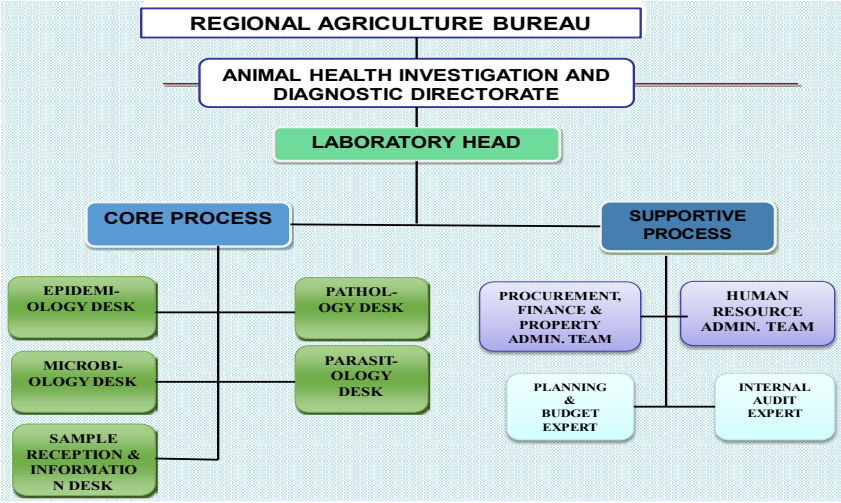

Figure 4: Organizational Structure or Regional Laboratories

Vision statement of RVLs

The goal is to see the improved health status of the livestock by providing accredited diagnostic services to enhance the benefit of the livestock resource.

Mission of RVLs

To achieve measurable changes to the livestock health status through disease survey, surveillance, diagnostic services, and outbreak investigation, enabling farmers, pastoralists, and agro-pastoral communities to earn satisfactory income from their livestock and livestock products and ensure their livelihood.

Diagnostics capacity of federal and regional veterinary laboratories (including equipment and facilities)

Diagnostic and other capacities of AHI

AHI has well-developed and structured working desks, which enhance the institute's overall capacity and effectiveness in fulfilling its core functions and achieving its strategic objectives in the animal health sector. Some of the desks that maximized their capacity in terms of skilled personnel and laboratory equipment include: -

The bacteriology laboratory: This has three BSLII laboratories dedicated to the isolation and identification of bacterial and fungal organisms from animal or environmental samples. The presence of advanced diagnostic equipment like Biology and PCR, especially the MALDITOF (Figure 5), and trained lab personnel who run these machines makes AHI very comprehensive not only in the region but also in Africa.

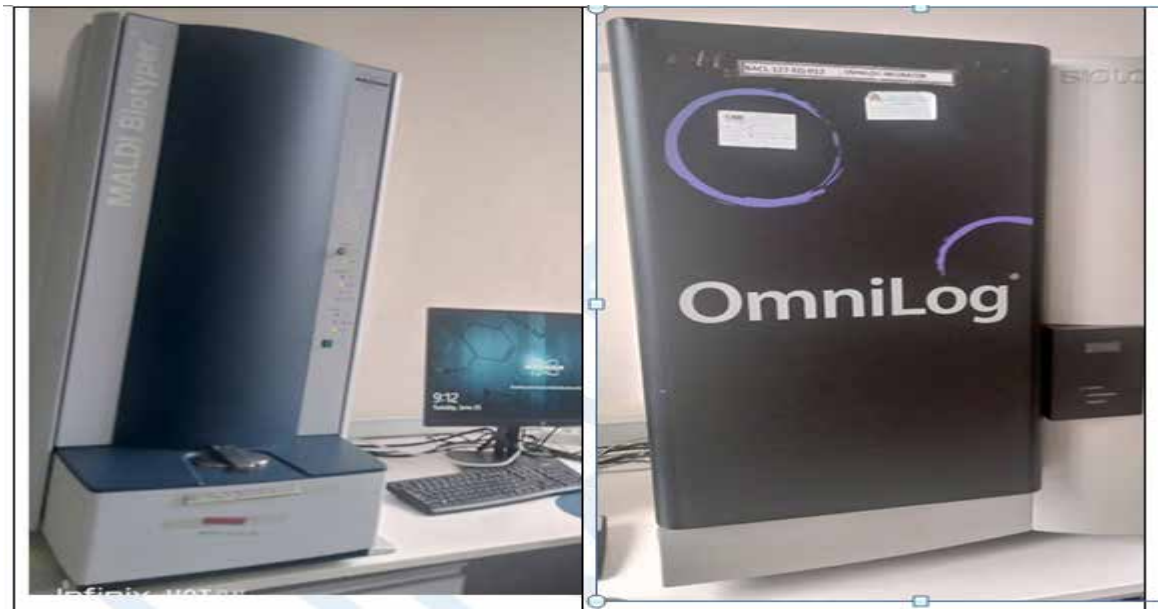

Figure 5: The MALDI-TOF Mass Spectrometry Technology; The Biolog's Omnliog System

Biosafety level III (BSL-III): Under this desk, AHI has the facilities of a Biosafety level III (BSL-III) laboratory to handle highly pathogenic and zoonotic diseases, which include avian influenza, bovine tuberculosis, anthrax, brucellosis, Rabies, Rift Valley Fever, Middle East Coronavirus, Ebola, Covid 19, etc. This laboratory was used to diagnose human samples during the Ebola and COVID-19 pandemic occurrences. This capacity makes AHI very competent in the country as well as in the region.

Figure 6: BSL – 3 Zoonoses diagnostic laboratory

The serology laboratories are also organized to conduct serological tests using different test methods, such as ELISA, AGID, HA/HI, RBPT, CFT, and LAT, for surveillance, export animal, farm certification, and research activities.

Cell culture laboratory: This laboratory works for virus isolation and identification through cell culture technology using different cell lines depending on the viral species under investigation. The virus neutralization test (VNT), embryonated egg inoculation technique, and immuno-fluorescent antibody techniques (IFAT) are the most widely used diagnostic techniques in this unit.

Figure 7: BSC III and Ultracentrifuge and cell imaging system, Inverted Microscope

Molecular diagnostic laboratory: AHI has a laboratory mainly engaged in molecular diagnostic techniques like targeted PCR (both gel-based and real-time PCR) (figure) for confirmatory testing of diseases that are important to economic and public health. Under this laboratory, there is a Sequencing and bioinformatics laboratory designated to provide sequencing services. The sequencer machine is Next Generation Sequencer (NGS), Illumina Next Seq 550, which enables whole genome sequencing and amplicon, including environmental samples. The presence of this equipment will enhance the diagnostic scope of AHI to the next level in the detection and characterization of emerging and re-emerging diseases.

Figure 8: Next Generation Sequencer (NGS), Illumina Next Seq 550

Rabies Laboratory: EPHI was the only laboratory diagnosing animal and human rabies. However, recently, AHI established a new rabies diagnostic laboratory to focus more on the prevention and control of rabies diseases in line with the Ministry of Agriculture's strategy to eliminate rabies in 2030.

Fish Disease and Honey Bee Disease laboratories

The recent establishment of these laboratories is another capacity of AHI to focus more on honey bee and fish diseases. These laboratories are well organized and full of necessary laboratory equipment that can be used to diagnose fish and honey bee samples. Samples are received for surveillance and research of fish and honey bee diseases, which are mainly caused by bacteria, parasites, fungi, and vectors.

Lab Equipment Maintenance and Calibration Desk

AHI has also established an equipment maintenance and calibration desk responsible for monitoring equipment performance through regular follow-up and monitoring. The desk maintains laboratory equipment in case it is broken or malfunctions and outsources if the malfunction is beyond the desk's capacity. There is an annual calibration program for major equipment that determines the validity of the test result.

Laboratory management system implementation

AHI is implementing different laboratory systems to ensure the delivery of high-quality, reliable, and safe diagnostic services. These services enhance the institute's credibility and competitiveness, ultimately supporting the prevention and control of animal diseases.

Laboratory Quality Management System (QMS): AHI has been implementing QMS since 2012 and currently accredits 12 tests. AHI can keep sustainability at AHI, coordinate and expand to regional laboratories, and assess and monitor the implementation as per the ISO 17025/2017 requirements in the veterinary laboratories. AHI organizes internal audits by trained and competent auditors, provides training by certified experts, develops and reviews SOPs and Forms, and conducts assessment and consultancy services that enhance the implementation and sustainability of the system.

Biosafety and Biosecurity (Biorisk) Management System: AHI is implementing the Biorisk Management system, and to enhance the implementation of this system, an agreement was made with DTRA in 2018, and then to identify the existing gaps, AHI was initially assessed by external assessors supported by DTRA. Since then, the institute has assigned staff to coordinate and assist the implementation of the system. Currently, AHI has organized it as a Biorisk Management Desk since 2022, and the desk has developed different SOPs and forms as per ISO 35001/2019. To enhance the implementation of the system

and maintain sustainability, different training sessions were delivered to AHI and regional laboratory staff on various issues.
In addition to the training, experts from Inspirion Bioscience (Black and Veatch) prepared Biorisk management documents (manuals), which AHI revised and adopted. Moreover, 14 regional veterinary laboratories were twice assessed for Biosafety and biosecurity capability using the FAO-LMT module. Now, AHI is working towards certification as per the requirement of ISO 35001/2019 in the near future.

Figure 9: Bio-risk management system training for AHI staff

Laboratory Information Management System (LIMS): AHI has been implementing LIMS, which is known as SILAB, since 2019. The implementation of this system has enhanced AHI testing laboratories to generate quality, reliable, and rapid test results that are deliverable to customers as feedback. AHI, in collaboration with FAO, is working to expand the system to regional veterinary laboratories and to integrate with ADNIS. Regional vet Laboratories such as Asella, Herna, Yabello, Jigjiga, Semera, and Kombolicha regional laboratories have trained on SILAB but have not yet implemented the system.

Experimental Animals

AHI has experimental animal facilities that help keep different experimental animal species, such as poultry, rabbits, mice, and large animals, used for research and diagnostic purposes. These facilities were built by AHI or with the financial support of AHI partners.

Figure 10: Large animals' experimental facility

Kality Tsetse Fly Research Center Facility

The tsetse fly mass rearing facility at Kality Tsetse Fly Research Center is the largest in Africa, and millions of different tsetse fly species have been reared in the past five years. Two big Celtic cold rooms are used to store blood by maintaining its quality to meet as good feed for flies. Each can store more than 1000 liters of blood. There are also two cell radiators (Cobalt 60 gamma cell irradiator) (figure 11), which serve as energy sources and to decontaminate the blood prepared for flies feed and to sterilize male tsetse flies to be released to the selected tsetse-infested areas of the country. The one radiator (industrial radiator) is a category one radiator and can decontaminate 192 liters of blood at once. To safely secure this advanced and costly equipment, there is strong security in the facility, including computerized keys, security cameras, hazard wire fence, special manual keys, and highly thickened walls surrounding the equipment in order to detect, delay, and take action when there is a problem like a thief. There is also an alarm planted around the equipment, which is directly connected to the American embassy in Addis Ababa, to forward a notification signal of any problem happening around these high-tech machines.

Figure 11: Cobalt 60 Dry cell radiator *Wet cell radiator (industrial)*

Training and Conference Hall

AHI is mandated to provide training and consultancy for national animal health experts who work in regional veterinary laboratories, abattoirs, quarantine and fieldwork, and experts from countries in Eastern Africa. To enhance the delivery of these services, AHI has built a training centre involving a main conference hall (figure 12), several side-meeting rooms, catering facilities, and relevant audio-visual facilities. The main hall can host 512 participants, which enables AHI to organize more significant national and international conferences, trainings, workshops, and other professional events.

Figure 12: AHI training and conference hall

Figure 13: Vitek XLSystem for Microbial Identification and AST

Diagnostic Capacity of API-QTC

API-QTC is capacitated with extraordinary facilities like:

- Six testing laboratories with dedicated testing rooms and offices for technical and administrative staff
- Dedicated rooms to perform different activities such as sample reception, storage, test sample preparation, testing labs, washing and sterilization rooms, laboratory-grade water production facilities, dedicated warehouses, documentation rooms (Lab QMS), conference/training room, and staff canteen;
- Access to telephone, electricity (UPS), Water supplies, and broadband internet and WiFi access
- Standard ancillaries (Standby powerhouse, Cafeteria, incinerator).

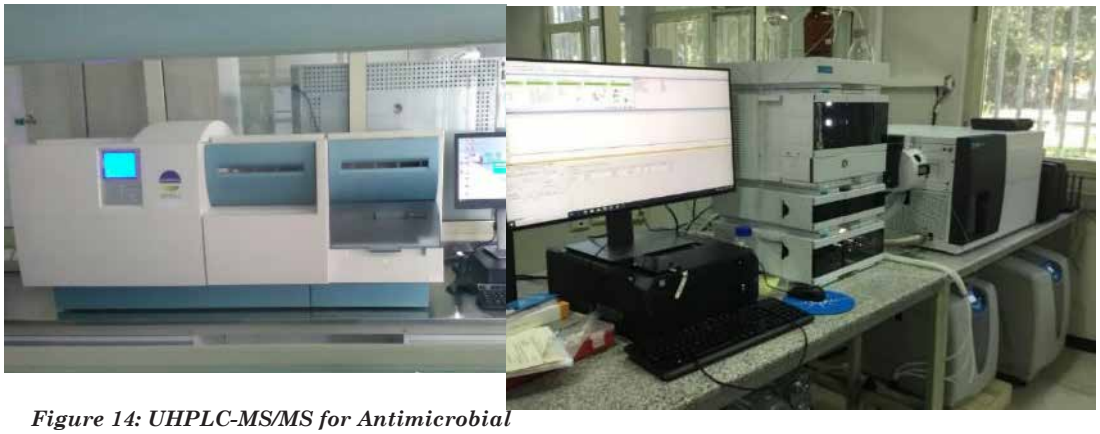

Figure 14: UHPLC-MS/MS for Antimicrobial Residue Analysis

Diagnostic Capacity of Regional Veterinary Laboratories

Although the structural arrangement of regional veterinary laboratories slightly varies, their diagnostic capacity, range of laboratory tests, laboratory equipment, and laboratory personnel are almost similar.

Parasitology laboratory: As in most regional veterinary laboratories, this unit is classified into three sections.

Helminthology sections: In this case, sedimentation and flotation are the most frequently used techniques to identify trematodes, cestodes, and nematodes parasites, although few laboratories use the Baer-

man technique and coprological culture. The Macmaster egg count technique is also used in some regional veterinary laboratories to determine the egg load of internal parasites.

Protozoology section: This section conducts wet film, Giemsa stain, thin and thick smears, determination of packed cell volume (PCV), and a buffy coat test to detect the presence of protozoan parasites like Trypanosoma, Babesia, Anaplasma, Theleria, and other vector-borne hemo-protozoan parasites. Fecal samples are also tested to detect the presence of Eimeria Oocytes when samples are suspected of coccidiosis.

Acarology and Entomology section: This section morphologically identifies ticks, biting flies, mange mites, mosquitos, and other vectors.

Bacteriology laboratory: regional laboratories have well-organized bacteriology laboratories equipped with necessary laboratory instruments which enable them to conduct bacteriological tests like staining, culture, and biochemical tests for isolation and identification of bacterial species and anti-microbial sensitivity test to measure the susceptibility of the isolate for the disk of antibiotics. Some laboratories have also separated serology sections to run serological tests like ELISA and RBT. Currently, veterinary laboratories are conducting sero-surveillance activity for PPR control and eradication programs using the I-ELISA test.

Pathology laboratory: Some regional laboratories have the setup for histopathological tests with postmortem rooms and autopsy facilities. Although the laboratory setup and postmortem facilities are available, the laboratories are not actively engaged in doing histopathological tests because of either a lack of competent personnel, some of the equipment not functioning, or a lack of input.

Epidemiology Unit: Most regional laboratories have established epidemiology units in their structure to handle the epidemiological activities of their lab. This unit is engaged in designing and planning protocols for disease surveillance and outbreak investigation activities, to fill monthly disease outbreak and vaccination activity reports from districts to the DOVAR system and prepare biannual or annual laboratory reports and deliver them to those they need Despite having this unit, some regional laboratories lack skilled manpower, computers, printers & ICT facilities.

Consumables and Supplies of Veterinary Laboratories

Consumables and supplies, which include kits, reagents, chemicals, media, and materials used during test processes, are very important inputs to veterinary laboratories to produce laboratory test reports. Almost all consumables and supplies for national and regional laboratories consumptions are obtained by purchasing from companies abroad through government procurement systems and budgets. However, there are situations where different NGOs and development partners can do procurement. National and regional laboratories suffer from a lack of consumables and supplies either because of insufficient budgets or because of a lack of suppliers and foreign currency. The national laboratories have a better supply of consumables and supplies compared to regional laboratories.

API-QTC is committed to fulfilling its testing laboratories' annual demand for different types of running consumables like

- Certified Reference Materials for chromatographic comparison testing (Drug Quality Analysis, Vet Drug Residue Testing, Pesticide Residues, Environmental and Toxic contaminant testing like Heavy Metal and mycotoxins) Standard Microorganisms (like ATCC Strains);
- Chemicals, reagents & Microbiological media;
- Glassware and Plastic wares;
- Spare parts for Hi-tech analytical instruments

Major Activities and Salient Outputs of Federal and Regional Veterinary Laboratories

AHI

Research

National Veterinary Laboratories have been engaged in research activities for the last decades. Even though it is not their primary focus, in addition to surveillance and diagnostic activities, regional veterinary laboratories have also been involved in conducting applied research that brings practical solutions to the community in their operational areas. Over the last 20 years, AHI has contributed more than 610 published articles to the scientific community. Research activities are oriented to solve animal health problems and benefit animal owners or the community as a whole. Most research initiatives are conducted in collaboration with technical partners within the country and abroad. Currently, there are ongoing research works on bovine tuberculosis, PPR, Brucellosis, CBBP, FMD, BVD, IBR, AMR, Trypanosmosis, Infectious bronchitis, Laboratory supplement production, and others. Every year, veterinary laboratories host more than 200 undergraduate and postgraduate students from universities in the country to conduct their research work under the supervision of the hosting laboratories.

Active disease surveillance

Undertaking active surveillance is among the mandates and responsibilities of AHI. The priority for surveillance focuses on diseases of economic and public health importance.

Surveillance of exotic diseases (RVF, ECF, and HPAI): These diseases still need to be reported in Ethiopia; however, due to the risk of introduction, a surveillance program is conducted regularly twice a year on selected high-risk areas for early detection and immediate response. Risk analysis documents are prepared and regularly updated to consider high-risk surveillance areas and epidemiological risk factors.
Surveillance on endemic diseases: Surveillance has also been performed on endemic diseases, which have different levels of prevalence and cause high economic loss and public health concerns. Surveillance undertaken for major diseases includes FMD, Brucellosis, CBPP, CCPP, PPR, NCD, AHS, bovine Tuberculosis, Coccidiosis, IBR, BVD, Marek's Disease, IB, Colibacillosis, Bluetongue, Salmonellosis, IBD, internal and external parasites. In addition, so-monitoring is done to evaluate the seroconversion rate after vaccination. Surveillance outputs are regularly delivered so that decision-makers can take action.

In the past five years, AHI tested more than 54,654 samples for surveillance in general. Surveillance activities done at the national level for common endemic diseases (FMD, CBPP, CCPP, Bluetongue, Brucellosis, IBR, and NCD) are summarized (Table 4). A total of 12209, 4206, 13009, 7008, and 18222 samples were collected for surveillance during 2023, 2022, 2021, 2020, and 2019, respectively, from different species of animals to understand the level of various diseases (figure 1).

Table 2: Surveillance data of major endemic diseases (2019 – 2023)

Diseases/activities	Animals sampled	Total sample	No of positives	Prevalence (%)
CBPP	Cattle	2167	623	28.75
FMD	Cattle	5181	857	16.54
Brucellosis	Cattle, shoats, camel	5786	111	1.92
IBR	Cattle	1833	989	17.09
Bluetongue	Shoats	2008	922	45.92
CCPP	Shoats	2865	595	20.77
PPR sero-surveillance	Shoats	3530	649	18.39
PPR sero-monitoring	Shoats	12333	8886	72.05

Surveillance on Trypanosoma and its Vectors: AHI also executes active surveillance of Trypanosome parasites and their vectors (tsetse flies) in tsetse belt areas of the country. The five centers (Addis Ababa, Arabaminch, Bedele, Assosa, and Finoteselam) situated in different regions of the country undertake this activity. Around 77642 blood samples (table 3) were collected and processed in the past five

years, during which *Trypanosoma evansi, T. vivax, T. congolense*, and *T. brucei* species were reported.

Table 3: Annual total blood samples collected for trypanosome surveillance

S/N	Year	Total samples collected	Number of positives	Prevalence (%)
1	2019	19024	997	5.24
2	2020	7809	501	6.42
3	2021	13979	567	4.06
4	2022	19270	888	4.61
5	2023	17560	764	4.35
Total		77642	3717	4.79

Similarly, tsetse fly surveillance was also conducted, and about 86286 tsetse flies (figure 6) of different species (*Glossina morsitans morsitans, G. tachnoids, G. fuscipes, G. pallidipes, and G. longipennis*) were collected and identified during the past five years.

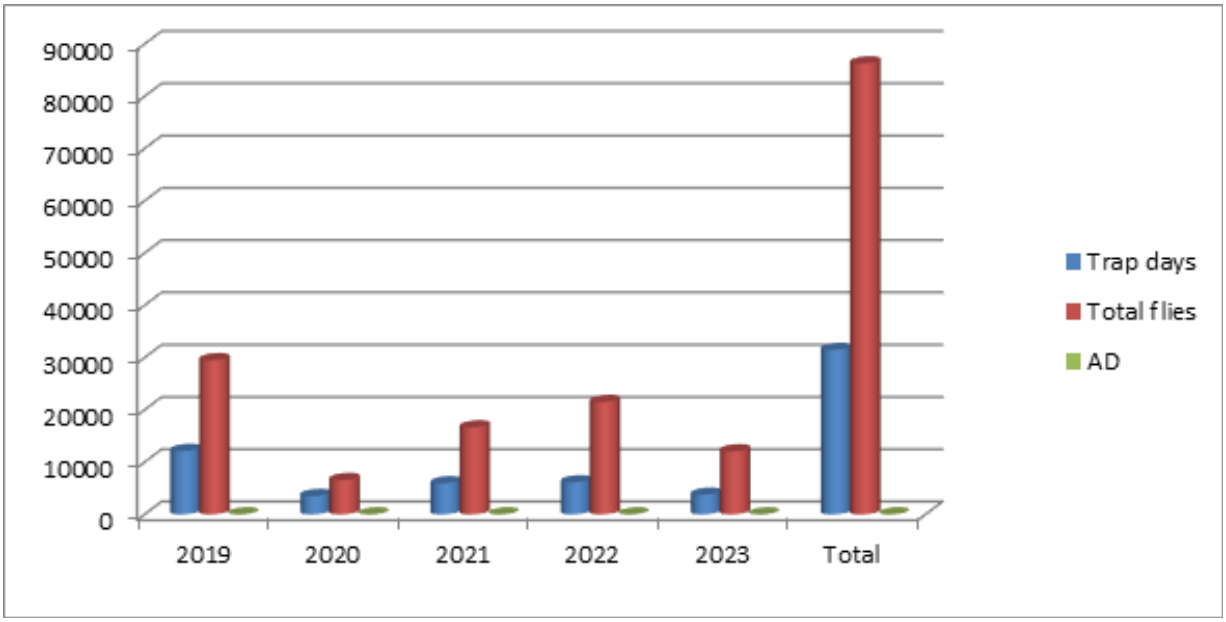

Figure 15: Summary of tsetse flies trapped during 2019 – 2023

Disease Outbreak Investigation

AHI undertakes disease outbreak investigations together with regional veterinary laboratories and district animal health offices. Currently, there are 17 regional veterinary laboratories, each with a designated operational area. Whenever a disease outbreak occurs in any corner of the country, the respective regional laboratory either conducts an investigation and laboratory tests themselves or sends samples to AHI for confirmation. If the nature of the outbreak is complex and beyond its capacity, AHI gets involved in the investigation of the disease outbreak. During the investigation, on-the-spot measures are taken to contain the spread of the outbreak. After laboratory testing, a report containing laboratory findings with suggested recommendations is delivered as feedback to the community and other relevant stakeholders.

In the past five years, about 436 outbreaks have been investigated in different regions of the country together with regional laboratories, and 4,906 samples have been processed for confirmation at AHI, as shown below annually (figure 2). AHI diagnosed the majority of the outbreaks, but a few have been sent to OIE Reference Laboratories for confirmation. Most of the frequently reported and confirmed disease outbreaks in Ethiopia are PPR, FMD, LSD, CBPP, IBR, Q-fever, Anthrax, Brucellosis, CCPP, AHS, NCD, MD, IBD, Salmonellosis (poultry), Colibacillosis (bovine and avian) and Coccidiosis.

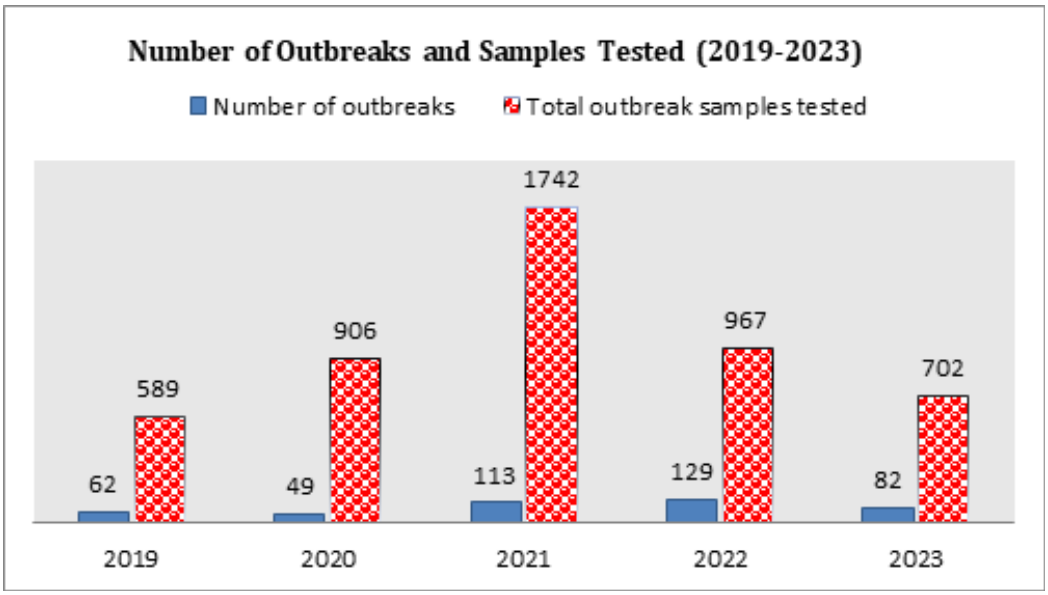

Figure 16: Number of outbreaks and total samples tested during 2019 – 2023

Export animal testing

The primary mandate of the then **NAHDIC** was export animal testing**.** The test was conducted on live animals exported to different Middle Eastern countries, and tests were carried out depending on the agreements made with importing countries. All tests are performed while animals are either in quarantine (Adama, Zeway, Mile, Jigjiga, and Dire dawa) or prior to slaughter at export abattoirs (Elfora, Asheker, Mojo Modern, Halal, Luna, and Organic Abattoirs). The most frequently requested diseases for testing by importing countries are Brucellosis, Foot and Mouth Disease (FMD), and Rift Valley Fever (RVF), and less frequently for CBPP, Bluetongue, Trypanosomiasis, Salmonellosis, and Bovine Tuberculosis. AHI applies the OIE-recommended test methods to test animals for international trade. In general, in the past ten years (2010-2021), about **1,776,543** head of animals from quarantines and export abattoirs were tested at AHI. In those years, Ethiopia earned a foreign currency of $ 308,523,922.4 from live animals and meat exports. Nowadays, Mile quarantine is privatized to Sudanese companies, and in the past two years, there has yet to be a flow of samples to AHI for export animal testing.

Table 4: Diseases and test methods used for export animals

S/N	Disease	Test used	Animals Tested
1	RVF	C- ELISA	Shoat, Cattle
2	FMD	3ABC ELISA	Shoat, Cattle
3	Brucellosis	RBPT, CFT	Shoat, Cattle
4	Bluetongue	I-ELISA	Shoat
5	CBPP	C-ELISA	Cattle
6	Salmonellosis	Culture and Omnilog	Tortoise
7	Trypanosmiasis	Smear test	Camel
8	Tubercullosis	CIDT	Camel

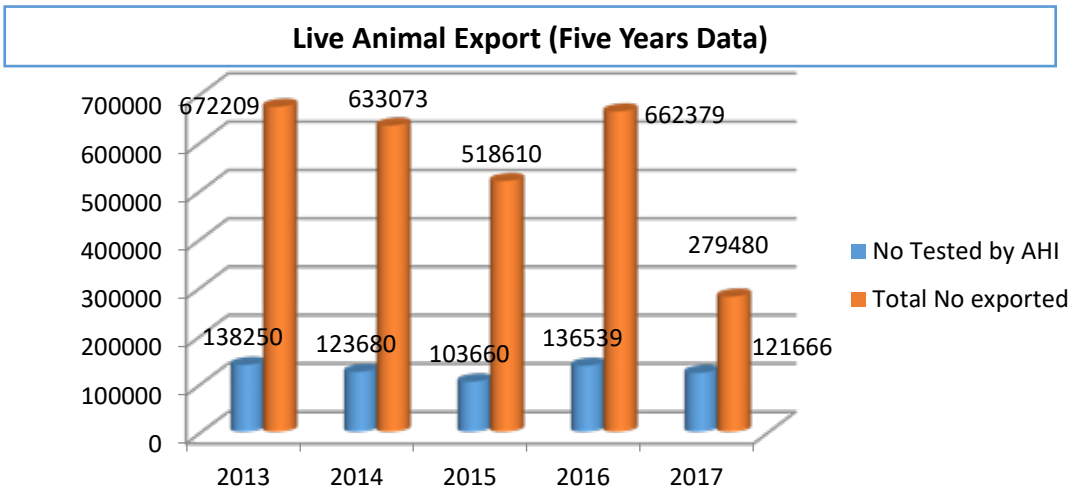

Figure 17: Total live animals exported in Five years

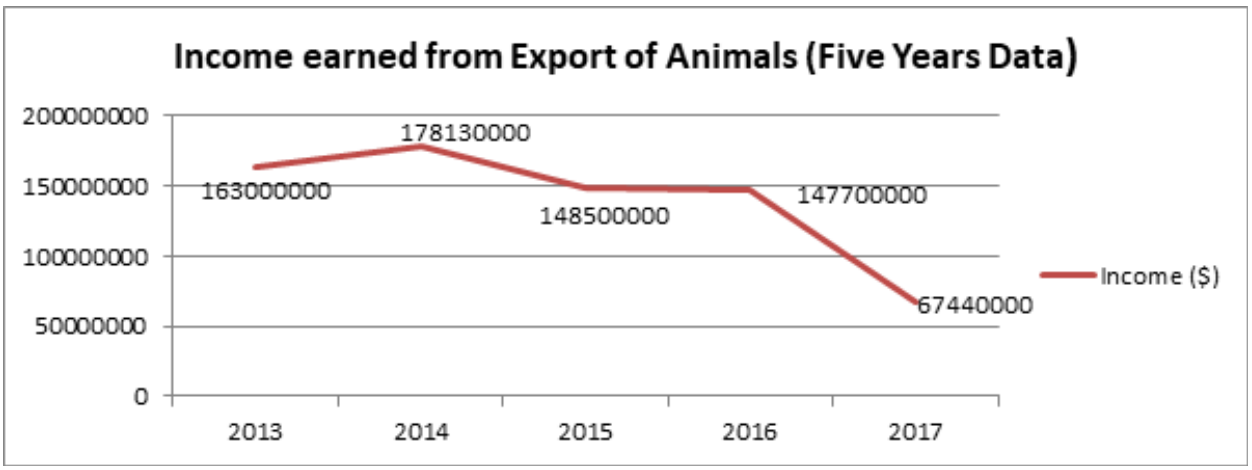

Figure 18: Currency ($) earned from live animal export in five years

Animal certification

AHI and regional laboratories carry this out to check the health status and breeding soundness of animals, mainly in dairy farms, with the purpose of creating a disease-free farm. Animal certification and advice services are delivered based on the request of the animal/farm owners. They are carried out for common farm diseases such as Bovine TB, Brucellosis, IBR, and BVD. In the past ten years (2014-2023), AHI alone has tested about 28,015 individual animals (8267 for bovine TB, 11355 for Brucellosis, 6020 for IBR, and 2373 for BVD), and 681 farms for at least one of these diseases based on the request and interest of farm owners (Table 4).

Table 5: Five years of animal certification samples for four selected Production diseases

S/N	Diseases Tested	2019	2020	2021	2022	2023
1	Bovine TB	149	530	181	968	516
2	Brucellosis	328	651	1117	648	1542
3	IBR	1261	504	833	383	402
4	BVD	114	326	52	326	382

Control and Eradication of Diseases

Rinderpest control and eradication

Ethiopia was recognized as a free country from Rinderpest by the World Organization for Animal Health (WOAH) in May 2007. In this case, veterinary laboratories played a significant role in reaching that stage with proactive involvement in sero-monitoring, seroepidemiological surveillance, and outbreak investigation activities. AHI used to work in a coordinated manner with ten other regional veterinary laboratories (Sodo, Assella, Diredawa, Bahirdar, Kombolicha, Mekele, Herna, Sholla, Mizan, and Bedelle) where the regional laboratories were primarily engaged in samples collection.

During the seroepidemiological surveillance (1997-2005) carried out by AHI and regional laboratories, about 69,219 sera samples from rinderpest-free designated areas were collected and tested at AHI to demonstrate the absence of circulating PPR virus. Similarly, in the Rinderpest outbreaks investigation (1989-1993), AHI, together with regional laboratories, investigated about 73 outbreaks and collected clinical specimens for confirmation of the virus. As a result of the enormous efforts and commitments, Ethiopia declared provisional freedom from Rinderpest on zonal bases in May 1999. After years of sero-epidemiological efforts, the country achieved OIE recognition for freedom from Rinderpest. To this end, OIE certified Ethiopian veterinary service as a country free from Rinderpest in May 2008 (Figure 19).


Certificate

Rinderpest status of Ethiopia

Figure 19: Certificate of evidence for freedom from Rinderpest

Peste des petits ruminants (PPR) control and eradication

AHI, being the major stakeholder in the national control and eradication program of PPR, has been actively engaged in PPR sero-surveillance, sero-monitoring, outbreak investigation activities, and delivering training to regional and woreda veterinary staff. So far, about 54,142 samples have been processed for sero-surveillance (n=21794), sero-monitoring (n=31,123) (table 5), and outbreak confirmation (n=1902 from 89 suspected outbreaks) collected from different regions. Positive samples (swab + tissue) have been submitted to the World Reference Laboratory for linage characterization. As part of capacity building, AHI, together with MoA, has delivered training for more than 400 people animal health experts from the Regional veterinary Lab, zones, and districts. The eradication program was financially supported by the FAO-European Union and currently with LSDF-World Bank.

Table 6: PPR samples processed for the Control and Eradication Program (2018 to 2023)

S.N	Purpose	Sample type	2018	2019	2021	2022	2023	Total
1	Sero-Monitoring	Serum	2126	5015	3697	6559	7041	24438
2	Seo-surveillance	Serum	2003	3348	2820	2569	1594	12334
3	Outbreak	Swab & tissue	179	214	344	251	237	1225
4	Total		4308	8577	6861	9379	8872	37997

Figure 20: Participants of PPR training at Adama in 2022:

Tsetse fly and trypanosomosis control and eradication.

An area estimated to be 200,000 to 240,000 km2 (18% of the total land surface area) is affected by tsetse flies in Ethiopia, as indicated below (Fig 21). The former National Institute for Control and Eradication of Tsetse Fly and Trypanosomosis (NICETT) has worked on the control and eradication of Tsetse fly and trypanosomosis for more than a decade. AHI strengthened this work by reinforcing animal health research centers situated in different corners of the country for this specific purpose. There are five animal health research centers established in different regions of the country (Fig 21). These are Arba Minch Animal Health Research Center, Asosa AHRC, Bedelle AHRC, Finote Selam AHRC, and Kality Tsetse Fly Research Center.

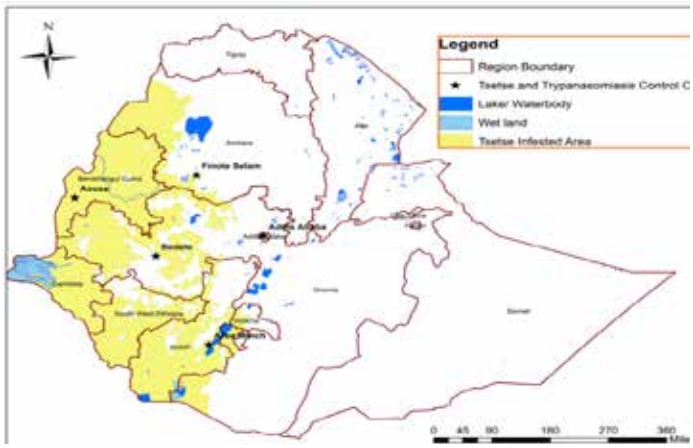

Figure 21: Distribution of tsetse and tryp in Ethiopia, and Centres established to combat the disease

Some of the tsetse fly and trypanosomosis prevention and control activities are shown as follows (Fig 22).

Figure 22: Tsetse fly control and prevention activities (Target deployment, Ground spry, Oder bated trap)

As other methods of tsetse fly and trypanosomosis control and eradication measures are used, the sterile insect technique (SIT) is also applied in limited areas of the country. *Glossina fuscipes* and *G. pallidipes* are the two tsetse fly species currently rearing at the Kality tsetse fly research center, Addis Ababa, for the release of sterile male tsetse flies (packed into carton box (figure 23)) at Deme Valley of Wolayita Soddo zone. During the past five years (2012 – 2016 E.C), 900065 and 1424911 female *G. fuscipes* and *G. pallidipes* species, respectively, were reared. During the same period of years, 1173630 sterile male *G. fuscipes* and 1517644 *G. pallidipes* (Figure 23) were released in selected areas of the country.

Figure 23: Irradiated sterile male tsetse flies ready for release

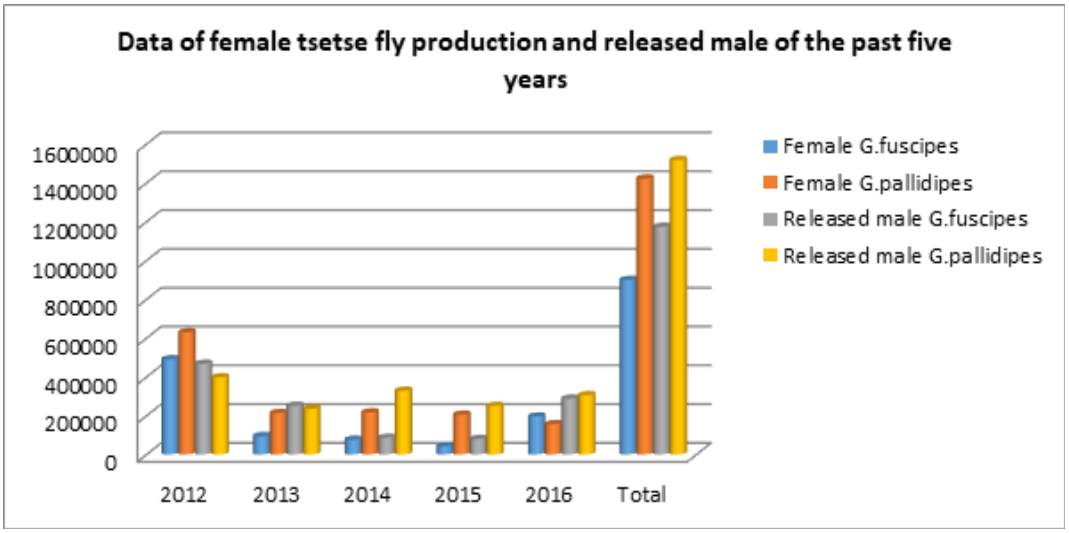

Figure 24: Five years of data on the production of female and released male tsetse flies (2012 – 2016)

Rabies control and Elimination

As rabies is the top priority zoonotic disease in Ethiopia, the country is implementing an Integrated Rabies Control and Elimination Strategy with a focus on 'Zero rabies in 2030. To support this program, different activities have been carried out so far, which include; -

- The establishment of the National Rabies Prevention and Elimination Technical Working Group
- The development of the National Rabies Control and Elimination strategic document
- Capacity enhancement with rabies twinning project and establishment of a new rabies laboratory at AHI.
- Implementation of the strategy through Awareness creation, mass dog vaccination, the Stepwise Approach for Rabies Elimination (SARE) evaluation, and resource mobilization

Table 7: Total dogs vaccinated per region in the past two years

Regions	Cities	Vaccinated canines in two campaign years			
		2022	2023	2024(9mont)	Total
Sidama	Hawassa	6,176	11,847	410	18,433
SNNPR	Arbaminch, Hosanna	14,158	22,285	4795	41,238
South West	Bonga, Mizan	10,333	11,000	8110	29,443
Oromia	Adama, Jimma & zones	15,848	50,000	50,000	115,848
Gambella	Gambella	2,840	1,250	3000	7,090
Benishangul Gumuz	Assosa & zones	10,839	9,710	7804	28,353
Amhara	Bahirdar, Gondar, zones	54,000	59,924	27052	140,976
Addis Ababa	Addis Ababa	35,504	34,701	34701	104,906
Dire Dawa	Dire Dawa	5,202	2,000	5000	12,202
Total		154,900	202,717	140,872	498,489

Capacity building

Capacity building is another activity performed by veterinary laboratories through providing technical and material support, which helps strengthen the diagnostic capacity and technical competence of personnel working in the laboratories. The capacity-building activities mainly focus on;

Training: Training in veterinary laboratories plays a very crucial role in building skills and demonstrating competency of technical staff working in laboratories so as to deliver effective service through providing accurate and reliable test results. AHI provides training to its staff, regional veterinary laboratories, field veterinary service professionals, quarantine and abattoirs, research institutions, universities, and NGOs working closely with animal health issues. AHI has also delivered training to laboratory staff coming from eight East African countries on advanced laboratory diagnostic techniques for five months through SMP-AH projected supported by AU/IBAR. As a reference and support laboratory for eastern African countries, AHI also provides training to laboratories from different African countries at their request.

Provision of diagnostic inputs: Regional veterinary laboratories have a critical shortage of diagnostic inputs for their routine diagnostic service. To curb this problem, AHI frequently provides diagnostic inputs to regional laboratories from its stock to support and strengthen outbreak investigation and surveillance activities in their operational areas, even though AHI has no budget for such activities. AHI also searches for development partners and projects that can support AHI and regional veterinary laboratories by providing diagnostic inputs and laboratory equipment to cover the gaps that the government budget could not cover.

Twining Projects (FMD, Rabies, CBPP): In order to strengthen the diagnostic performance of testing laboratories and be a world referral laboratory through the recognition of WOAH, AHI has maximized its capacity on FMD, CBPP, and Rabies from the technical support of the Pir Bright Institute, ISZ institute Teramo, and Onderstepoort Veterinary Research Institute, Pretoria respectively, in 2 years twining projects. Now, AHI is working for certification from WOAH to be a reference laboratory for the above diseases.

Figure 25: CVOs from the Horn of Africa for CBPP workshop at AHI with Experts from IZS Teramo, Italy

API-QTC

With regard to API-QTC, the center has generated a significant number of data used for regulatory decisions, informing producers, consumers, researchers, and other stockholders about the safety, quality, and suitability of animal products and inputs produced in the country or imported from abroad.

Veterinary drug quality and safety analysis data:

From 2016 to June 2024, 1805 VMP samples were analyzed for different regulatory activities (registration, consignment checking, and post-marketing surveillance) in Ethiopia. The findings revealed that 105 (5.82%) of products failed to comply with the standard specification limit, and thus, drugs were cat-

egorized as substandard and falsified products. This indicates the need for continued strengthening of regulatory functions.

Animal vaccines

In the past seven years (2018-2024), currently, all the imported and domestically produced animal vaccine samples were outsourced and tested at the African Union-Pan African Vaccine Control Centre (AU-PANVAC). Out of 70 animal vaccine samples tested, 13 (18.57%) did not meet OIE criteria for regulation, which implies further strengthening of the regulatory functions. The authority is working on strengthening its vaccine quality control facilities, but this still needs further attention.

Animal Feed and Feeding Stuff intended for Commercial Purposes:

Feed and feed supplement testing activities have been performed since 2016 and were analyzed for different physicochemical (Proximate analysis, Environmental Contaminant testing like Aflatoxin and heavy metals) and microbiological (Bio-burden and Bacterial pathogens detection) test parameters. The labs in the center tested around 2251 feed samples. Of different quality and safety testing parameters conducted, in proximate analysis, out of 1937 Samples, 943 (48.68%) were below the standard with respect to Crude protein content, and out of 2251 samples tested for mycotoxin level, 545 (24.21%) did not comply the Ethiopian feed standards.

Animal Source Foods (ASF) Biological Contaminants & Chemical Residues Analysis (Surveillance and Monitoring Activities):

ASF [Meat (Beef, Sheep, Goat, and Poultry), Milk, and Honey] testing activities were started in 2019, and 2355 samples were subjected to bioburden /determination of contamination that indicates poor hygiene and sanitation management practices level (APC, EC, CC, STA, EB and YM counts). Detection, isolation, and identification of foodborne pathogens, including *Campylobacter* spps, pathogenic *E. coli*, *Listeria* Spps*, Listeria monocytogenes*, *S. aureus*, and *Salmonella* Spps. Some of the findings were published on "DOI https://dx.doi.org/10.4314/evj.v26i2.2".

Chemical residues and contaminants such as natural toxins, industrial, environmental, and agrochemical contaminants (Aflatoxin M1, heavy metals, pesticides, and antibiotic residues) surveillance was conducted on meat, milk, and honey samples. A total of 616 raw milk samples for proximate, adulteration, and antimicrobial residues and a total of 647 pooled milk samples were tested for Aflatoxin M1 analysis. Out of these, 50 (7.7%) were unfit for human consumption as per compulsory Ethiopian milk standard.

A survey was done on 858 meat samples collected from butcher houses, supermarkets, and abattoirs and tested for antimicrobial residence. The prevalence shows that from 250 beef samples, 13.2% were positive for antibiotic residues. Out of 180 poultry meats, 35.6% were positive for antibiotic residues. Out of 428 sheep and goat meat, 3.5% were positive for antibiotic residues. In 2020 and 2021, a total of 300 honey samples were collected from the potential honey-producing areas in the country and analyzed for five quality parameters and pesticide residues.

Surveillance and Monitoring Activities on AMR

The antimicrobial resistance (AMR) of major food-borne pathogens has become an increasing public health problem worldwide. Though AMR is attributed to multiple factors, the contribution of the expanding use of antimicrobials in food animals has been considered the main reason for the worldwide rapid increase of AMR. AMR survey was conducted from 2019 to June 2024 by collecting 2837 samples from potential meat and dairy products and commercial animal feed supply chain areas of central Ethiopia. Out of 2837 investigated, a total of 677 nationally prioritized bacteria (495 *E. coli,* 149 *S. aureus*, and 33 *Salmonella* Spps) were isolated and subjected to antimicrobial susceptibility tests (for more than 22 different types and categories of antibiotics designed for veterinary AMR panels) by using VITEK 2XL System. The lab findings demonstrated multidrug resistance against some of the tested antimicrobials, which are of public and veterinary importance.

In-Service Applied Veterinary Epidemiology Training (ISAVET) Program

The In-service Applied Veterinary Epidemiology Training (ISAVET) Program was designed to build applied epidemiology skills and competency of the national veterinary services of the Ministry of Agriculture (MoA). With financial support from USAID and assistance from FAO Ethiopia, this capacity development effort focuses on the implementation of the Frontline ISAVET program that targets field veterinarians and para-veterinarians. To implement the program in the country, six animal health staff were trained in the pilot phase program in October 2018 in Kampala, Uganda, with the help of. FAO Ethiopia. So far, about 78 animal personnel have graduated from three cohorts and are serving their community in disease outbreak investigation and timely reporting of DOVAR activities. In addition, 49 experts, 24 trainers, and 25 mentors were trained to support the program.

Status of Quality Management System in Veterinary Laboratories

AHI has been implementing the laboratory quality management system (LQMS) as per ISO/IEC17025:2005 since 2008 and accredited in 2012 for the first time. The implementation of the quality management system started by creating awareness training for staff on ISO 17025:2005 requirements by experts from Israel through the German Agency for International Cooperation GIZ/and Germany's National Metrology Institute PTB project. Then, documents like SOPs, forms, Test methods, and work instructions were developed by organizing a group of experts as a committee. The first quality manual document was developed with the support of GIZ/PTB consultants in 2009 and passed through a series of reviews and revisions to reach the current 10th version. AHI Applied for accreditation to the South African Accreditation System (SANAS) in 2010 and was accredited for the first time for six molecular and six serological tests in 2012, then extended the scope to 14 more tests.

However, as a result of the establishment of the Ethiopian National Accreditation Office (ENAO), AHI shifted to get accreditation from ENAO, applied in 2018, was assessed in 2019, and became accredited for nine test methods in February 2020. Since then, it has stayed under the accreditation of the then ENAO and the now Ethiopian Accreditation Service (EAS). Currently, AHI is accredited for 12 test methods and has applied for two more test methods to extend its scope. AHI also has 18 technical signatories. To maintain the sustainability of the system, continuous improvement activities and follow-ups are ongoing on a daily basis.

QMS in regional veterinary laboratories

Awareness training on ISO/IEC 17025 was delivered by AHI and ENAO experts. This was followed by practical training through benchmarking of the AHI-accredited laboratories along with diagnostic test method training. Training on ISO 17025 for 14 regional veterinary laboratory heads was conducted by ENAO experts organized by AHI through the financial support of the LFSDP project. AHI, in collaboration with the African CDC, has delivered a ToT for one person from each regional veterinary laboratory. As a result of the repeated training, regional veterinary laboratories have tried to implement QMS by developing documents, assigning quality managers, and document reviews. However, the level of implementation is at various stages; some are at an advanced level and ready for accreditation with minimal support, while others still need time and more support.

QMS at API-QTC

Since its inception, the center has been working on its product and input quality testing activities by implementing a laboratory quality management system, starting by providing quality management system training for all staff. The center re-evaluated the implementation of laboratory QMS in 2022 and restructured its QMS documents as per EAS requirements. In 2023, the center planned to attain accreditation on 16 different testing parameters, submitted the required documents, and is currently waiting for an on-site assessment.

Implementation of Laboratory Information Management system (LIMS)

LIMS implementation is an essential component of any veterinary diagnostic laboratory service, which significantly enhances laboratories' ability to generate quality, reliable, and rapid test results. Ethiopian veterinary laboratories have been using paper-based systems to manage samples and associated data. However, this was an inefficient and outdated system and has posed significant challenges in data and sample management, traceability, sample turnaround time, and work efficiencies.

Despite many failed efforts, the LIMS, known as SILAB for Africa, was installed at AHI in July 2017 in the framework of an agreement among AHI, IZSAM institute (an Italy laboratory institute), and FAO. Following the installation, AHI technical staff was trained by IZSAM experts to facilitate the implementation. Then, SILABFA has been fully implemented at AHI since 2019, replacing the paper-based system. Currently, AHI, in collaboration with FAO, is working to expand the system to regional veterinary laboratories and link with other systems like ADNIS.

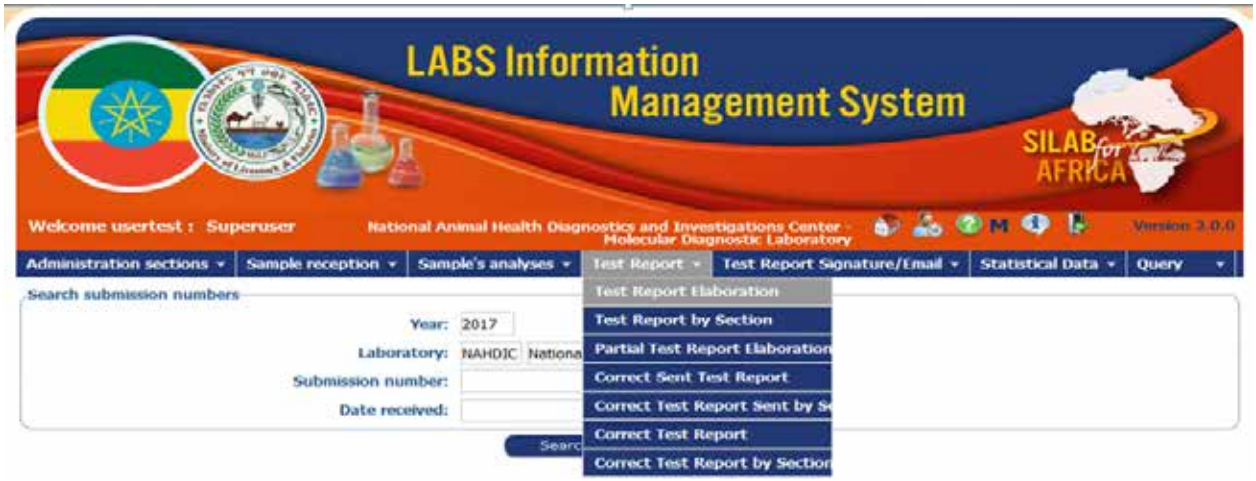

Figure 26: SILAB interface at AHI

LIMS/SILAB at API-QTC

The center has tried to implement the LIMS known as SILAB since 2019. Unfortunately, after one year, the system could not be functional due to many reasons, such as its system integrity (failure to be operated between two separate QC labs on one sample), maintenance problems, and confidentiality issues. Currently, API-QTC is working to have a LIMS that can resolve all the problems associated with the drawbacks of using SILAB.

Coordination of Veterinary Laboratories and their linkage with veterinary field Service

There needs to be centralized coordination between national and regional laboratories. Regional laboratories receive the budgets from their respective regional states and obligatory report to the regional government. The only linkage between them is through MoU. Despite this, the cooperation between them is very smooth and efficient. The common areas of coordination and cooperation between veterinary laboratories observed include Collaborative Research and Knowledge Sharing, Standardized test procedures, Documents (SOPS, Forms, and guidelines), Data Sharing and reporting: surveillance and disease outbreak investigation work through the implementation of management systems (QMS, LMS, BMS), carrying out of PT and ILCT tests, Workshops as Epi-Lab network, and capacity building.

Even though it is not strong, there are many areas where veterinary laboratories, especially regional laboratories, are linked with veterinary field services, which include monthly reporting of passive surveillance through DOVAR and ADNIS systems, referral diagnostics, capacity building, surveillance, and outbreak investigation works.

Challenges and opportunities in the delivery of Diagnostic veterinary services.

- Power shortage, which affects the quality of stored samples and test kits.
- Inadequate budget to carry out disease surveillance, outbreak investigation, and research works.
- Staff turnover, especially in regional veterinary laboratories.
- Lack of laboratory supply (test kits, consumables & reagents),
- Lack of maintenance of laboratory equipment.
- Socio-political instability
- Lack of timely calibration, installation, and maintenance of laboratory equipment.
- Lack of foreign currency account to purchase laboratory test kits
- Lack of transport (Field vehicle & staff service)

Opportunities

- Strong government commitment to support the livestock development sub-sector and implementation of the 'Yelemat Trufat' initiative.
- Comprehensive animal health legislation, "Animal Diseases Prevention and Control Proclamation no. 267/2002";
- AHI Regulation No.503/2022 to harmonize, coordinate animal health research, and lead campaigns against T&T.
- Global attention to emerging and reemerging health threats/pandemics could provide a better opportunity to secure funds to enhance capabilities in early pathogen detection and response.
- Global one health initiative strategy for sustainable development goals.
- Challenges of T&T in the affected regions and continuous requests from the community for sustainable control and elimination of the problem;
- Good awareness of T&T in all regions and availability of technologies to alleviate the problem;
- Strong willingness of international organizations
- Continuous demand for livestock products due to various driving factors.

Surveillance

Organization and purpose of the Epidemio-Surveillance system in Ethiopia

Epidemiological surveillance in Ethiopia encompasses both passive and active surveillance systems. It is organized and structured to monitor and detect animal diseases, assess their impact, and facilitate timely response measures. The system involves multiple stakeholders, including government organizations, veterinary professionals, livestock keepers, and international partners. Here's an overview of the organization and purpose of the **Epidemio-Surveillance** system in Ethiopia:

The Ministry of Agriculture (MoA): is primarily responsible for animal health management and disease surveillance in Ethiopia. Within the MoA, the Animal Health and Veterinary Public Health Executive oversees disease surveillance activities, policy development, and regulatory enforcement related to animal health. The Epidemiology unit, which is under the Animal Health and Veterinary Public Health Executive, coordinates surveillance activities across the country. At this level, the passive surveillance data is mainly collected through DOVAR and ADNIS systems and stored in the Ministry of Agriculture

server.

AHI Level: AHI is mainly engaged in carrying out active disease surveillance. Diagnostic tests support surveillance data (samples) collected from the field, and disease prevalence is determined to monitor their patterns. AHI is equipped to conduct diagnostic tests for a wide range of animal diseases, including viral, bacterial, and parasitic infections. Laboratory results inform disease surveillance activities and guide the implementation of control measures.

Regional level: Regional laboratories and regional bureaus of agriculture and livestock agencies at the regional, Zonal and district levels also play key roles in Managing, coordinating, and overseeing the overall animal health surveillance activities. Regional bureaus of agriculture and livestock agencies facilitate data collection, analysis, and reporting on animal diseases, enabling timely response to emerging and re-emerging animal health threats. Regional veterinary laboratories are involved in carrying out both active and passive surveillance.

International level: Ethiopia collaborates with international organizations, such as the Food and Agriculture Organization (FAO), the World Organization for Animal Health (WOAH), the African Union Intergovernmental Bureau of Animal Resources (AU-IBAR), the Intergovernmental Authority on Development (IGAD), and others, to strengthen its animal disease surveillance capacity. These partnerships provide technical assistance, training, and support for capacity building, laboratory strengthening, and disease control initiatives.

The information generated from epidemosurveillance through both active and passive surveillance systems is used for early detection of outbreaks, disease monitoring and trend analysis, disease prevention and control, evaluation of interventions, resource allocation, and planning, as well as for further research and epidemiological studies. Surveillance data are also used to support international reporting requirements and inform policy formulation in an effort to stop the cross-border spread of infectious diseases.

Passive surveillance

National Passive Surveillance System Components (ADNIS and DOVAR)

The Animal Diseases Notification and Investigation System (ADNIS) and the monthly Disease Out break and Vaccination Activity Reporting System (DOVAR-II) are the two complementary passive surveillance systems that makeup Ethiopia's National Animal Health Surveillance System (NAHSS), which is instrumental in gathering and reporting data passively on animal health.

DOVAR-II

DOVAR-II is mainly designed to collect animal disease outbreaks to estimate the country's disease burden. It has a standard data collection format that is filled out at the district level and sends data to Reginal Veterinary Laboratories (RVL). Then, the data is forwarded electronically to the MoA animal health database. It, therefore, is a partially web-based system used for recording, storing, and managing monthly disease outbreaks and vaccination activities for notifiable diseases.

The surveillance system's performance can vary depending on various factors, including the system's design, the quality of data sources, and the effectiveness of data processing. Districts do not equally and timely send their reports for different reasons, and coverage varies from month to month. In 2023, the overall national coverage was 92.3%, and 820 out of 888 districts were actively involved in reporting. The remaining 68 (7.7%) districts were non-reporting (Figure 29).

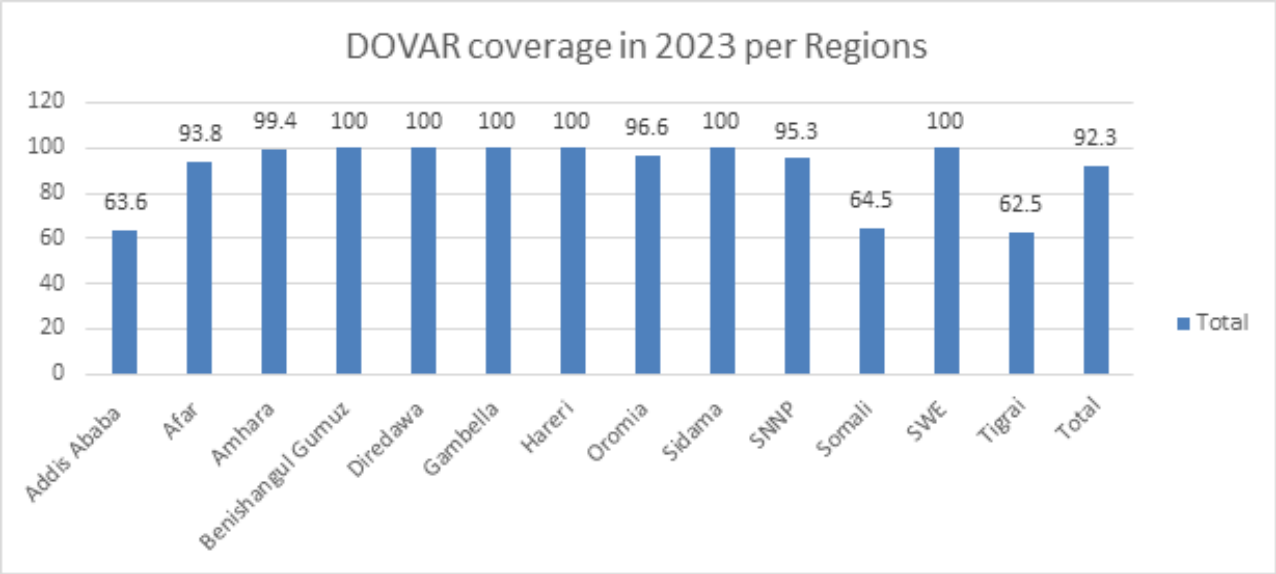

Figure 27: DOVAR coverage per region

As shown in Figure 27 above, Addis Ababa, Somali, and Tigray had coverage of below 80% as recommended by WOAH, B. Gumuz, Diredawa, Gambella, Harari, Sidama, and South West Ethiopia (SWE) had 100% DOVAR coverage. DOVAR completeness, which is the number of reports expected from a district per year, is another performance on which districts show variation, as indicated below (Figure 28).

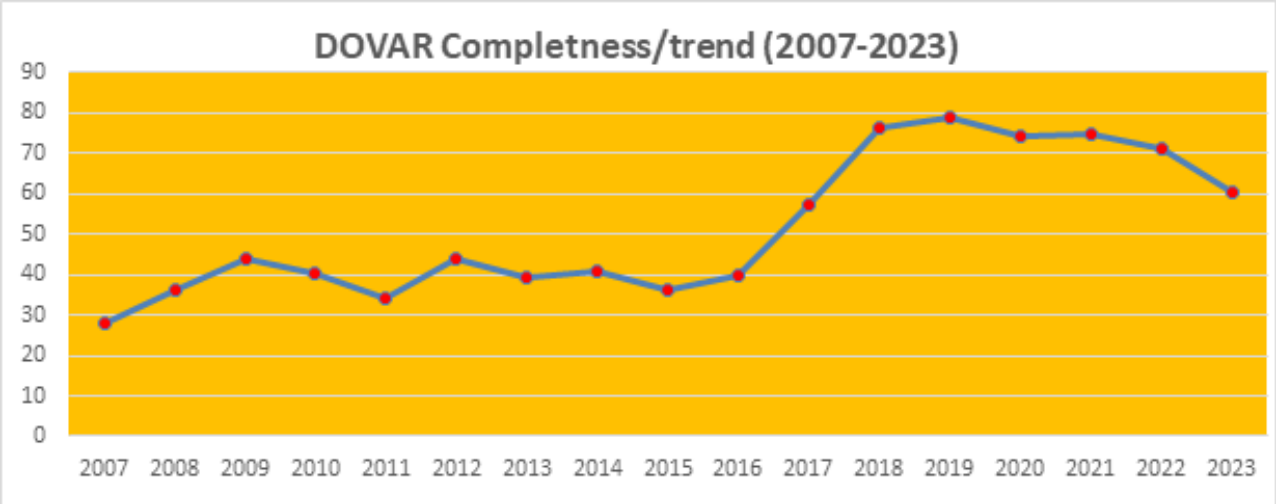

Figure 28: DOVAR Completeness/ trend from 2007 to 2023 in Ethiopia

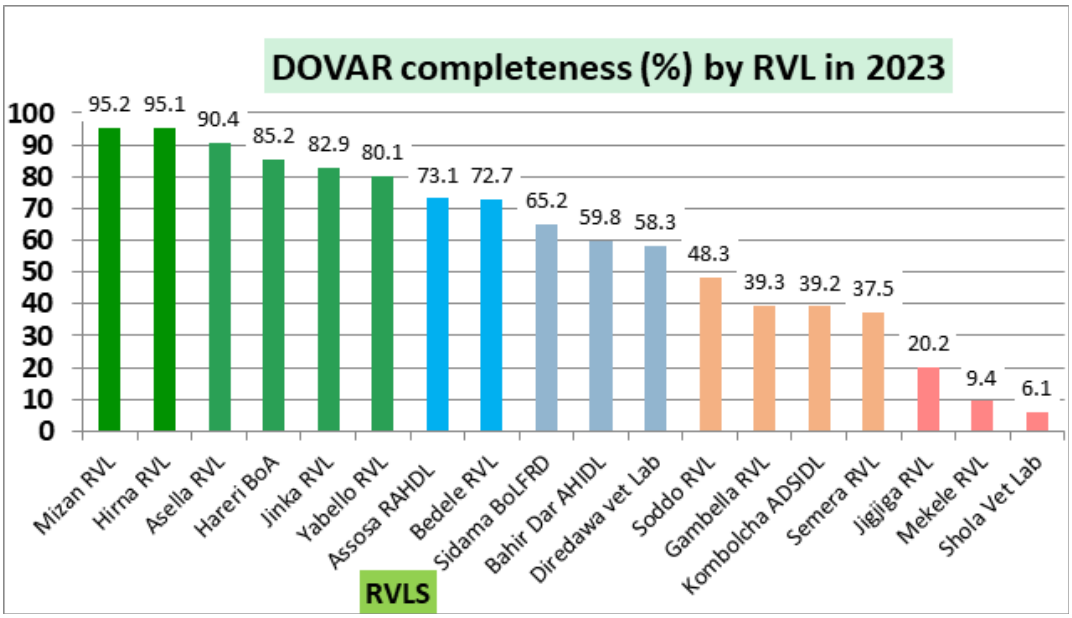

Figure 29: DOVAR completeness per regional veterinary laboratories in Ethiopia 2023

Understanding the status and spatial distribution of diseases is essential. DOVAR II reported 23 different diseases from different parts of the country. Most diseases impact the socio-economy, public health, and trade.

ADNIS

Using the ODK application for data collecting and reporting, the Animal Disease Notification and Investigation System (ADNIS) is a smartphone-based, nearly real-time disease notification system. Field data is transmitted to the central server through the internet. When an outbreak is reported, the system immediately creates an alert message and delivers it to the designated recipients. This facilitates quick action in the form of disease-controlling investigations or interventions. The four main parts of the system are N-collect, N-server, N-web, and N-alert. Currently, not all regions are implementing the ADNIS.

The system is almost a real-time daily disease notification tool that alerts users to the incidence of 22 prioritized transboundary diseases with a significant impact on trade and public health. The 22 prioritized diseases reported through ADNIS are shown in Table 6 below.

Table 8: The 22 Nationally notifiable diseases through ADNIS

No	Bovine	Shoats	Equine	Avian	Camel	Multiple spp.
1	ECF	PPR	AHS	HPAI	CPOX	FMD
2	LSD	CCPP		ND	UCD	RVF
3	CBPP	SGPX		Marek's		ANT
4	RP			IBD		BT
5	HS					GW
6	BSE					RAB

Surveillance Implementation Structure and Information Flow

The surveillance system's structure and information flow use the existing administrative hierarchy and veterinary service governance, starting from the kebele to the federal level (Figure 33).

A district will compile and collate all outbreak reports collected from kebeles and commercial farms and submit them to their respective zones from the 25th to 30th dates of the reporting month. Zones will collect reports from all of their districts, check the validity and completeness of the report, and submit them to the regional vet laboratory (RVL) within five days of the following month. The RVLs should check the quality of reports and enter the outbreak data into an online web-based DOVAR database within a week or 5-12th date of the following month.

Surveillance information flow and feedback

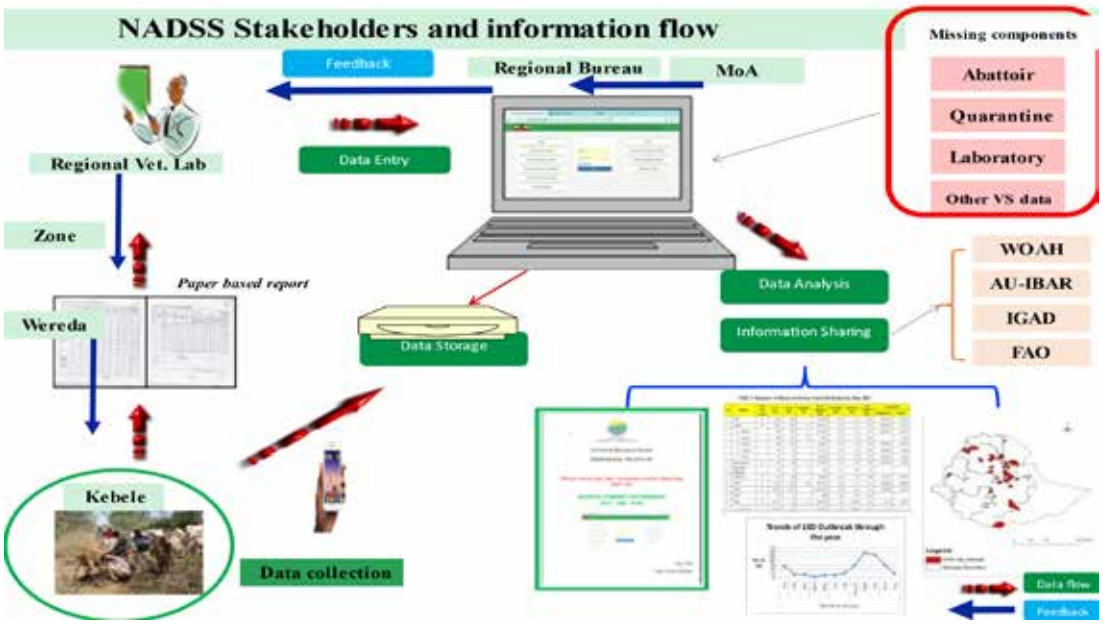

Figure 30: Surveillance information flow and feedback

Compliance with international disease notification requirements

Is the surveillance system Compliant with international disease notification requirements?

Ethiopian animal disease surveillance compliance with international disease notification requirements is crucial for global health security and trade in animal products. Here are some key aspects to consider regarding Ethiopia's compliance:

- WOAH Membership: Ethiopia's compliance with international disease notification requirements is primarily governed by its membership in the World Organization for Animal Health (WOAH). As a member of the WOAH, Ethiopia is obligated to report certain animal diseases to the organization in accordance with its guidelines and standards.
- Disease Notification Obligations: The OIE's Terrestrial Animal Health Code outlines specific requirements for member countries regarding the notification of certain animal diseases. Ethiopia is expected to promptly report outbreaks of WOAH-listed diseases, such as foot-and-mouth disease, avian influenza, and African swine fever, to the WOAH through its national focal point.
- Surveillance System Infrastructure: Ethiopia's ability to comply with international disease notification requirements depends on the strength and functionality of its animal disease surveillance

system. This includes the capacity for early detection, diagnosis, and reporting of animal diseases through a network of veterinary laboratories, field veterinarians, and other relevant stakeholders.

Additionally, there are a number of evidence/indicators that Ethiopia is compliant with international disease notification requirements. Overall, Ethiopia's compliance with international disease notification requirements relies on the establishment of robust surveillance systems, adherence to WOAH guidelines, and collaboration with international partners to enhance capacity and ensure timely reporting of animal diseases.

How the outputs of passive surveillance inform national disease prevention, control, and eradication policies and strategies.

The outputs of passive surveillance play a vital role in informing national disease prevention, control, and eradication policies and strategies by providing valuable insights into disease occurrence, trends, and distribution. Here's how these outputs contribute to shaping animal health policies and strategies:

Early Detection and Response: These passive surveillance systems often serve as early warning systems for disease outbreaks and emerging health threats. By monitoring data from various sources, such as health posts, vet clinics, and laboratories, the surveillance has detected unusual patterns or increases in disease incidence, enabling prompt response measures.

Risk Assessment and Prioritization: The data collected through the system helps the veterinary service to assess the risk posed by different diseases and prioritize their efforts and resources accordingly. By analyzing trends in disease occurrence and understanding factors such as geographic distribution and population demographics, professionals and decision-makers can identify high-risk areas and populations, as well as prioritize diseases with the most significant public health impact for targeted intervention.

Evaluation of Control Measures: Passive surveillance data have been allowed to evaluate the effectiveness of disease control measures and interventions. By monitoring changes in disease incidence or prevalence following the implementation of control strategies, decision-makers have assessed whether interventions are achieving their intended outcomes and made adjustments as needed to optimize their effectiveness.
Policy Development and Guidelines: The insights gained from passive surveillance inform the development of national policies, strategies, and guidelines for disease prevention, control, and eradication.

International Collaboration and Reporting: Surveillance data are often shared with international organizations such as the World Organization for Animal Health (WOAH), the Food and Agriculture Organization (FAO), the African Union Intergovernmental Bureau of Animal Resources (AU-IBAR), and the Intergovernmental Authority on Development (IGAD) to contribute to global disease surveillance efforts. By participating in international reporting mechanisms and sharing data with other countries, policymakers can contribute to a better understanding of global disease trends, facilitate early warning of potential pandemics, and coordinate response efforts across borders.

The role of the private sector in animal health information systems

The private sector plays a significant role in animal health information systems by contributing diverse expertise, resources, and capabilities to enhance disease surveillance, prevention, and control efforts. Here's how various entities within the private sector contribute to animal health information systems:

1. **Private Practitioners:** Veterinary clinics, animal drug retailers, and individual veterinarians in private practice are often frontline actors in animal health surveillance. They interact directly with animal owners and caregivers, diagnose and treat animal diseases, and collect valuable health data during patient consultations. Private practitioners can contribute to passive surveillance by reporting unusual disease patterns or outbreaks to relevant authorities and participating in surveillance programs.

2. **Non-Governmental Organizations (NGOs):** NGOs involved in animal welfare, conservation, and

public health initiatives often collaborate with government authorities and local communities to support animal health information systems. They may implement surveillance programs, provide training and capacity-building support to local stakeholders, and facilitate data collection and reporting efforts.

3. **Livestock Keepers and Farmers:** Livestock keepers and farmers are key stakeholders in animal health information systems, as they have firsthand knowledge of the health status and management practices of their animals. By actively participating in surveillance activities, such as reporting sick or dead animals, farmers can contribute valuable data to inform disease detection and control efforts.

4. **Agribusinesses and Industry Associations**: Agribusinesses, including livestock producers, feed manufacturers, pharmaceutical companies, quarantines, and abattoirs, often collaborate with government authorities and other stakeholders to support animal health information systems. They may provide technical expertise, financial support, and logistical assistance for surveillance activities, research projects, and capacity-building initiatives. Industry associations also advocate for policies and regulations that promote animal health and welfare.

5. **Technology and Data Analytics Companies:** Private sector companies specializing in technology and data analytics contribute to the development and implementation of innovative solutions for animal health information systems. These companies may develop surveillance tools, data management platforms, and analytical software to streamline data collection, analysis, and reporting processes. By harnessing technologies such as mobile applications, geographic information systems (GIS), and artificial intelligence (AI), they help improve the efficiency and effectiveness of animal health surveillance efforts.

Overall, the private sector's involvement in animal health information systems complements government-led initiatives and enhances the resilience and sustainability of surveillance, prevention, and control efforts. Collaboration between public and private stakeholders is essential for building comprehensive and robust animal health information systems that protect animal populations, safeguard public health, and support sustainable livestock production and management practices.

Strengthening the animal disease passive surveillance system in Ethiopia presents both challenges and opportunities. Addressing these factors can improve disease detection, response, and overall animal health management in the country. Here are some key challenges and opportunities:

Challenges and opportunities to strengthen the passive surveillance system.

Challenges:

- Limited Resources
- Underreporting and Data Quality
- Fragmentation and Coordination
- Limited Access to Veterinary Services
- Livestock Mobility and Trade

Opportunities:

- Capacity Building and Training
- Integration of Technology
- Community Participation
- Public-Private Partnerships
- Policy and Institutional Support

Active disease surveillance

Active surveillance is the systematic, ongoing collection and analysis of animal health data designed and initiated by the national and regional veterinary laboratories, which are the prime users of the data/information. It is undertaken for diseases of economic and public health importance as well as diseases of a transboundary nature.

Generally, in the Ethiopian context, active surveillance is conducted with the aim of:

- Determining the rate of endemic diseases and their distribution
- For early detection and immediate response of exotic diseases with a high risk of introduction
- Identifying the causative agent during disease outbreaks
- Determining the status and progress of diseases under the control program
- Assess heard immunity after vaccination
- Declare freedom for eradicated or absent diseases

Types of active surveillance implemented

The following types of active surveillance are executed at the country level

- Outbreak investigation
- Participatory disease surveillance
- Syndromic surveillance
- Serological surveillance
- Risk based surveillance
- Vector/entomological surveillance
- Sero-monitoring
- Sentinel surveillance

Disease outbreak investigation*:* Disease Outbreak investigation has been conducted by national and regional veterinary laboratories on different livestock diseases. Most of the frequently reported and confirmed disease outbreaks in Ethiopia are PPR, FMD, LSD, CBPP, IBR, Q-fever, Anthrax, Brucellosis, CCPP, AHS, NCD, MD, IBD, Salmonellosis (poultry), Colibacillosis (bovine and avian) and Coccidiosis. FMD outbreak investigation has been conducted to understand circulating viral serotypes and to determine a vaccine matching, and the currently circulating FMD serotypes in Ethiopia are A, O, SAT1, and SAT2. However, serotype C has yet ever to be reported since 1984.

Participatory disease surveillance (PDS): PDS is a method of disease surveillance where participatory appraisal (PA) approaches, and methods are used to combine local veterinary knowledge with conventional methods to establish the presence or absence of a specific disease in a particular area. The approach taps into community knowledge systems and leads to more effective engagement of livestock owners in disease surveillance. PDS involves semi-structured interviews, ranking and scoring, visualization, and triangulation of relevant information. This kind of surveillance has played a significant role in the eradication of Rinderpest and is currently used for PPR control and eradication programs. It is also used to search for diseases underestimated by veterinary services, disease prioritization, and disease epidemiological pattern clarification.

Syndromic surveillance: Syndromic surveillance is a kind of active surveillance that actively looks

for groups of symptoms, signs, or patterns of disease rather than specific diseases. It is designed to assist in the early detection of emerging diseases or outbreaks of disease and adds versatility to livestock disease detection schemes. Analysis of disease signs patterns in space and time may detect an increase in a specific syndrome that would trigger an epidemiological investigation to diagnose the actual cause. The surveillance system in Ethiopia mainly relies on reports of Animal diseases based on observations of clinical signs. E.g., Pneumo-enteritis syndrome.is a sign characterizing a group of diseases like PPR, CCPP, and FMD in small ruminants during syndromic surveillance?

Serological surveillance: Serological/sero-surveillance is a systematic collection and testing of serum for antibodies/antigens against a specific pathogen on a periodic or ongoing basis to assess changes in sero-prevalence over time. It could be sero-survey or sero-monitoring. Sero-survey provides estimates of antibody levels against infectious disease, while sero-monitoring provides estimates of antibody levels or immunity following vaccination. Nationally, the majority of economically selected disease surveillance (CBPP, FMD, Brucellosis, CCPP, etc.) is implemented by using sero-surveillance. In contrast, sero-monitoring is currently applied to estimate the herd immunity level against PPR after vaccination. In general, sero-monitoring is currently used to evaluate the effectiveness of the PPR vaccination program.

Risk-based surveillance: Risk-based surveillance has been conducted following the identified risk factors of the disease of interest on exotic diseases that have a high risk of introduction into the country or endemic diseases. In Ethiopia, there is regular risk-based surveillance mainly implemented for exotic diseases like RVF, ECF, and HPAI. The risk areas for RVF and ECF are Somali, Oromia, Southern, and Gambella regions, which border Somalia, Kenya, and South Sudan, as there is a risk of introduction from these neighboring countries.

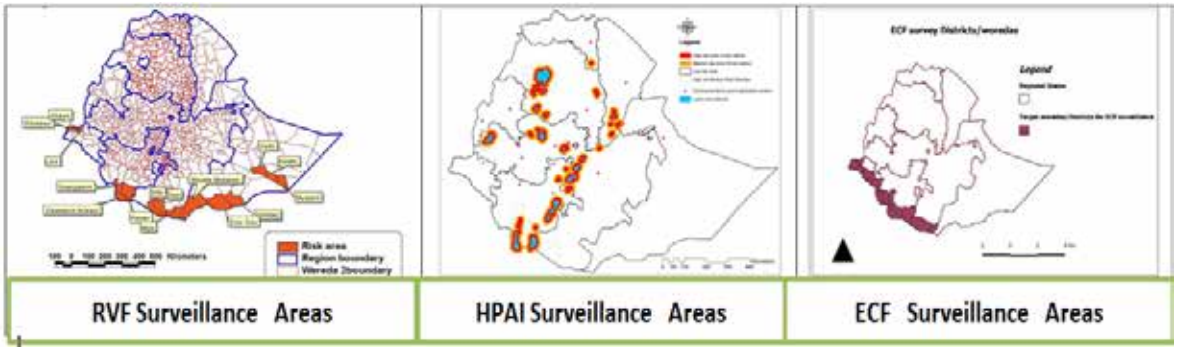

Figure 31: Map of risk surveillance areas

Vector/entomological surveillance: Vector surveillance is used to determine changes in the geographic distribution and density of vector populations and inform decisions on possible control measures for vector-borne diseases. Vectors are arthropods, such as mosquitoes, ticks, flies, fleas, and lice, that transmit an infectious agent from an infected animal to another animal or human. This kind of surveillance is nationally implemented for the surveillance of vectors such as mosquitoes, ticks, and tsetse flies, which are vectors for RVF, ECF, and Trypanosomosis, respectively.

Sentinel surveillance: Sentinel surveillance is also a type of active surveillance that involves monitoring a selected group of animals called 'Sentinel animals' within a population to serve as early warning indicators for the presence of diseases. Sentinel animals are systematically chosen based on different factors, such as their acceptability to the disease of interest and proximity to high-risk areas. In the Ethiopian context, the primary purpose of sentinel surveillance is to detect the introduction of exotic diseases (like RVF) or detect the circulation of endemic diseases before they become widespread or cause significant damage. This surveillance is designed in the RVF surveillance plan to be carried out in the border areas to monitor RVF introduction.

Activities and outputs of active surveillance

Analysis of the active surveillance data results has short-, medium- and long-term effects. Some of the

standard outputs (short-term effects) include

- Estimating the magnitude (level) of existing diseases,
- Early detection and confirm the presence/absence of exotic diseases for decision-makers.
- Generate evidence for actors of disease control and prevention strategy
- Monitor disease trends
- Support for research and epidemiological studies
- Essential for describing health hazards and for contributing to the planning, implementation, and evaluation of risk-mitigation options and seeing the effects of interventions
- Empower the community in order to participate in disease-searching activities and share their knowledge about the disease
- Assess the status of disease-transmitting vectors. For example, nationally available *Trypanosoma* species (that causes African Animal Trypanosomosis, Nagana, and Human African Trypanosomosis, and Sleeping sickness) and tsetse flies are identified.
- Essential to early detection of disease outbreaks
- Disease mapping and trend analysis
- Timely reporting and communication of disease information.
- Measure the level of immunity developed after vaccination

How the outputs of active surveillance inform national disease prevention, control, and eradication policies and strategies.

Active surveillance provides the most accurate and timely information to de
tect animal health problems early and break the chain of transmission. Policy and decision-makers mostly use the evidence of active surveillance outputs for their action to develop animal health-related policy, strengthen surveillance and monitoring, collaborate with stakeholders, Resource and funding allocation, public awareness, design control and prevention strategies, evaluate the effect of interventions and policies, and to promote research and innovations.
The following are some of the active surveillance outputs that specifically notify or inform the national disease prevention, control, and eradication policies and strategies:

- Inform the magnitude of the disease, indicating whether it needs more attention than other diseases or not to control the disease
- Prioritize disease incidence across the country in order to implement control and prevention measures
- Identify economically significant diseases to
    - Produce evidence about the introduction of exotic diseases and eradicated diseases
    - Evaluate the status of the disease on which the eradication program is implemented and forward the result/findings to the responsible body
    - Notify the result of the disease outbreak investigation to take appropriate action for control and prevention of the disease, including vaccination (for endemic diseases), quarantine, movement control, ring vaccination, and culling of the diseased animal as necessary (for non-endemic diseases).
    - Indicate the status of vectors that are responsible for vector-borne diseases

Active Surveillance at API-QTC

Since 2019, API-QTC has been conducting surveillance activities on:

- Surveillance and monitoring of biological hazards, chemical residues, and environmental contaminants in animal-source foods provide safety and quality data for the national regulatory authority, which implements appropriate control and prevention strategies and makes evidence-based decisions.
- AMR Surveillance and monitoring activities on Animal Source Foods and Feeding Stuffs;
- Post Market Surveillance on VMPs

Communication of output of surveillance for mitigation strategies and decision-making

- The findings of the surveillance activities were communicated to different bodies via
    - Official report to EAA respective departments mainly as a complement for regulatory decisions (Certificate of Analysis);
    - Consolidated technical reports for potential stakeholders during annual review meetings (Surveillance Findings);
    - Awareness creation platforms (Quality and safety analysis report and Surveillance findings)
    - Publication to reputable journals (Surveillance and Monitoring findings)

Challenges and opportunities to strengthen the active surveillance system.

- Challenges
- Limited capacity of national and regional veterinary laboratories.
- Financial/budget scarcity
- Challenges in establishing robust communication networks, timely reporting systems, and data-sharing platforms.
- Shortage of laboratory consumables, test kits, and chemical reagents.
- Security issues
- Shortage of logistics (staff service and field vehicle)
- High rate of trained laboratory staff turnover due to lack of incentive and retention mechanisms
- Weak network between national and regional laboratories
- Socioeconomic factors such as low awareness and cultural practices may influence the reporting of disease outbreaks, sampling, and vaccination activities.

Opportunities

- Attention is given to the sector by the government
- Availability of clear policy, proclamations, regulations, and directives;
- Availability of regional laboratories across the country
- Advanced diagnostic equipment is present at the national level.

- Opportunities to work in collaboration with national/regional/international organizations;
- The presence of communication technologies and information exchange platforms;
- High demand for quality and safe supply of agricultural products and inputs, services, and technologies at the global supply chain system

References

Worku Mekasha (1972: A review of animal Health and Livestock Productivity factors in Ethiopia (1965-1971): The Department of Veterinary Services Imperial Ethiopian Government, Ministry of Agriculture Addis Ababa (1972).

Zelleke Dagnatchew, Oct 1979: A workshop report on the structural organization and the strategy for the veterinary laboratory Development in Ethiopia, held at the Institute of for Animal Health Assistant Debre-Zeit from Oct 25-27, 1979.

PART 5:Veterinary Education in Ethiopia: History, achievements, challenges and opportunities

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Executive summary

Research suggests that knowledge is a key driver of economic growth in developed countries. Universities and research institutions play a crucial role in enhancing a nation's global competitiveness. Countries that invest heavily in higher education and research and development are better equipped to thrive in the knowledge economy. While Ethiopia's expansion of higher education institutions gives unprecedented opportunity to the generation and is a positive step, it is essential to uphold quality education to avoid producing graduates who lack the skills needed for national development. Indeed, there has been significant growth in higher education over the past three decades; nevertheless, access remains relatively low compared to other sub-Saharan African countries. Besides, the quality and relevance of education and research in these institutions are also the subjects of concern**. Expanding and reforming higher education and research is instrumental in addressing issues like slow social and political progress and economic marginalization.** Such transformation is indispensable for achieving sustainable development and improving the livelihoods of the Ethiopian people. In a nutshell, in today's knowledge-based world, higher education is no longer a luxury but a necessity for survival. The veterinary program in Ethiopia, however, has focused on increasing the number of veterinarians rather than addressing the country's specific needs and the importance of high-quality veterinary education. This failure to adapt to a changing world resulted in joblessness for many graduates. Unless stakeholders intervene, the future of the veterinary profession and its societal standing are at risk.
Keywords: Education, Ethiopia, Knowledge economy, Research, Veterinary program.

Background

Ethiopia has a rich history of elite traditional education. Still, modern higher education only began in 1950 with the establishment of the University College of Addis Ababa, later known as Haile Selassie I University (World Bank, 2003). By the early 1990s, the country had just two universities and a few colleges, with one of the lowest enrollment ratios in sub-Saharan Africa (Yizengaw, 2005). Presently, about 42 public universities are offering various academic programs (MoE, 2024). Notably, the figures mentioned exclude Civil Service and Defense universities, which do not enroll students through the Ministry of Education's channel. Additionally, the number of private higher education institutions (HEIs) has grown significantly from none in 1996 (Yizengaw, 2005).

Despite the substantial expansion of higher education institutions in Ethiopia over the past three decades, access remains relatively low, even compared to sub-Saharan African standards. The gross enrollment ratio (GER) increased from 0.8 in 1990 to 2.0 in 2000 and then to 5.0 in 2010, but it is believed to be lower than the regional average of 7.0 up until a decade back (Varghese, 2013). Furthermore, concerns persist regarding the quality and relevance of education and research activities in higher education institutions (Yizengaw, 2005; Mayen, 2006; Swan and Kriek, 2009). Expanding and reforming higher education and research in Ethiopia is seen as crucial for addressing issues related to slow social and political progress and economic marginalization. This transformation is viewed as a vital step towards sustainable development and enhancing the livelihoods of the population. In today's global knowledge-based era, higher education is no longer a luxury but a necessity for survival.

Research indicates that knowledge plays a central role in driving economic growth in developed countries

(OECD, 2000). It is now widely acknowledged that universities and research organizations significantly impact the economic competitiveness of nations in a globalized world. Countries that invest in an extensive higher education system and prioritize research and development (R&D) are better positioned to thrive in the knowledge economy. Therefore, the ongoing expansion of higher education institutions in Ethiopia is a positive move. Still, it is essential to ensure that the focus remains on delivering quality education to ensure graduating adequately skilled individuals that could hinder the country's development efforts.

Historical Development of Veterinary Education in Ethiopia

Ethiopia's veterinary education journey can broadly be divided into three phases. The first phase was in Pre-1979, when there were no colleges/ schools to train veterinarians in the country. Ethiopians seeking veterinary training had to go to countries like the Soviet Union, East Germany, Cuba, France, or the UK. Even the opportunities in Africa were minimal (Mayen ,2006). The second phase started in 1979 with the opening of the Faculty of Veterinary Medicine at Addis Ababa University at Debre Zeit Campus. In fact, at that point in time, the School for Animal Health Assistants was operational in the diploma program. This school was established in 1963 by the agreement between UNDP-FAO and MoA of the Imperial Ethiopian Government (Abebe, 2013). Both institutions shared the same campus, which finally became one faculty in 1989, with two programs running in parallel until the diploma program was phased out in 2002. The faculty remained to be the only veterinary education institution in the country until 2003. The third phase began in the year 2003, when an additional five new veterinary faculties were opened at Mekele, Gondar, Jimma, Hawassa, and Haramaya.

Currently, 26 veterinary colleges/schools throughout the country provide DVM programs (21), 16 BVSc, seven Veterinary Laboratory Technology, and one in Veterinary Pharmacy (Annex 1). Some of the senior faculties have graduate programs, including MSc and PhD level studies in various fields. In this regard, AAU College of Veterinary Medicine and Agriculture, Gondar College of Veterinary Medicine and Animal Science, and Mekele Faculty of Veterinary Medicine are the pioneers. The faculty of veterinary medicine at Hawassa, Jima, Haramaya have MSc programs. Among the new ones, Arbaminch, Ambo, and Wolita-Soddo veterinary faculties have started graduate-level programs. The growing number of vet schools has brought a massive increase in the number of Doctor of Veterinary Medicine (DVM) graduates per year from every institution. Prior to 2007, the Faculty of Veterinary Medicine (FVM), Addis Ababa University, graduated an average of 20-25 DVM graduates annually, with a total of 1012 graduates in 33 years. Currently, each of the institutions enrolls an average of 50 veterinary medicine students annually. The average number of graduating students now stands at 450-550 annually (Temesgen, 2013).

The expansion of veterinary medical education in Ethiopia has been remarkably rapid and unprecedented in Africa and possibly worldwide. While thirteen African countries in Western Francophone Africa typically rely on a single regional veterinary faculty (École Inter États des Sciences et Médecine Vétérinaires in Dakar, Senegal) (DeDeken et al., 2004), and even a relatively more developed country like the Republic of South Africa, which established its first veterinary school in 1920 at the University of Pretoria, could not sustain a second one opened in 1980 at the Medical University of South Africa (MEDUNSA) and had to close it in 1999 due to the high costs associated with veterinary education (Swan and Kriek, 2009). In contrast, Ethiopia, which had only one veterinary faculty since 1979, managed to establish ten new veterinary education institutions in just eight years between 2003 and 2010. As more and more faculties are coming in recent years, the trend seems endless. These institutions were created from scratch, involving processes such as adopting or adapting curricula from the Faculty of Veterinary Medicine at Addis Ababa University, recruiting staff, and allocating classrooms despite the absence of the necessary veterinary infrastructure and accreditation from any veterinary statutory body, which was itself non-existent. Literally, the veterinary program in Ethiopia has followed the politics of extension and production of veterinarians instead of reflecting upon its role, the needs and realities of the country, and the importance of establishing veterinary education programs with the essential level of quality (Mayen, 2006). Failure to respond to expectations in a changing world and its needs has started costing the country and graduates as more and more of them are jobless after spending six years on campus. Unless intervened by stakeholders, the future of the profession and its position and acceptance by society is at a greater risk.

Minimum requirements in Veterinary Education

The DVM training program should provide each veterinarian with general professional skills and attributes underpinning veterinary scientific knowledge and understanding, as well as prerequisite clinical competencies and skills. Professional attributes such as leadership and interpersonal skills, together with the development of adequate communication abilities, teamwork, an inculcation of ethical responsibilities, and a thorough knowledge of the national legal and statutory requirements and obligations affecting the profession, should form part of the standard training of all veterinarians. Comparative veterinary medicine, a feature that distinguishes the veterinary profession from all other health professions, must be retained (OIE,2013). To this end, there are various college/school entry requirements throughout the world:

- Undergraduate studies: While many vet schools prefer a bachelor's degree, some may accept students with a specific number of science credits after high school.
- Veterinary college: The DVM program itself is a rigorous 4-year professional degree program following undergrad studies.

There are also some variations depending on the location:

- US: In the United States, most students complete at least two years of undergraduate studies, fulfilling science prerequisites before entering a DVM program.
- Other countries: Some countries, including Ethiopia, allow students to enter veterinary school directly after high school, with the veterinary program lasting five or six years. The curricula of veterinary faculties in East and Southern African countries that extend for about five or six years are primarily discipline-based and cover the traditional preclinical and clinical subjects in producing a "generalist veterinarian" (FAO Workshop on harmonizing the curricula of veterinary faculties in East and Southern Africa 2004).

The future educational requirements are anticipated to be dictated by major environmental, demographic, political, disease, technological, and economic needs (Willis et al., 2007). Emphasis will increasingly be placed on the contributions made by the profession in the fields of globalization of animal and public health, international trade in animals and animal products, food safety, emerging diseases, changes in the relationship between veterinary medicine and the environment, bioterrorism, biomedical research, and changes in the relationship between animals and humans within the context of a one-health approach. A responsive and flexible veterinary education system has been proposed to meet the challenges of the future (Willis et al., 2007).

The relevance of veterinary Education and Manpower Planning

The relevance of the veterinary profession internationally is currently subject to profound scrutiny. Its contributions are assessed against major environmental, demographic, political, disease, technological, and economic needs. The scope of veterinary training in the future will have to emphasize veterinary public health, food safety, emerging diseases, international trade, bioterrorism, and biomedical research within the context of a one-health system focusing on the interface between wildlife, domesticated animals, humans, and their environment (Swan and Kriek,2009). Thus, the veterinary education program needs to fulfill the necessary technical and legal requirements to get its graduates accepted in the global market. In this regard, the partnership approach among faculties in research and teaching, student exchange programs, and curriculum harmonization are of great relevance. When it comes to manpower planning, the specific context in the country (economy, technology, livestock resource, environmental focus…) and global factors such as trade, SPS, zoonosis, and one health platform are vital in dictating the trend.

Veterinary education (Principles, Key requirements for different roles)

Veterinary science and practice have evolved from the initial focus on horses in the 1800s to livestock through to the 1950s, where the emphasis of the profession shifted towards companion animal medicine in many parts of the world (Willis et al. 2007). Over the past decade, the emphasis of veterinary practice has shifted from the traditional role of treatment and care of individual animals and the protection of

human health to mass therapies, the implementation of plans for the eradication of animal diseases, the development of animal nutrition, and the shift from pathological control of abattoir animals to the concept of the abattoir as an epidemiological observatory where the results of farming activities may be verified (Marabelli, 2003). Food safety has been placed at the forefront through the tools of hazard analysis and critical control points (HACCP).

With this growing trend, veterinary education today encompasses a diverse range of roles, each playing a vital part in shaping future veterinarians. The key principles include teaching for attitudinal change on animal welfare and anticipating that a veterinarian should be compassionate and capable of providing ethical treatment to the animal. Be sides He or she should commit themselves to Life-Long Learning. In this regard, the graduates need to take more responsibility for their development by providing sufficient opportunities for self-learning in the curriculum and the use of new innovative stimulatory teaching methods and approaches. The clinical service delivered must reside in evidence-based practice, where knowledge and skill work together. Last but not least, effective communication with animals (through observation and behavior) and with clients is essential for successful veterinary care. In general, professional attributes such as leadership and interpersonal skills, together with the development of adequate communication abilities, teamwork, an inculcation of ethical responsibilities, and a thorough knowledge of the national legal and statutory requirements and obligations affecting the profession, should form part of the future standard training of all veterinarians (Swan and Kriek.,2009).

When it comes to the Roles and Requirements, veterinarians as Educators (Professors, Clinical Instructors) must have the necessary qualifications: a DVM degree, specialty certification (desirable for specific courses), teaching experience, and strong communication and critical thinking skills are mandatory. They take responsibility for Delivering lectures and practical training, mentoring students, conducting research, and contributing to curriculum development. The Veterinary Technicians/Technologists, on the other hand, as educators, need to have qualifications: Veterinary Technician/Technologist (VT/VMT) credential, experience in a clinical setting, effective communication, and demonstration skills. These people will take the responsibility of providing hands-on training in laboratory procedures, animal handling and assisting with clinical instruction.

The training also requires curriculum developers with the necessary qualifications and Expertise in veterinary medicine or education, an understanding of learning theories, and the ability to collaborate effectively with various stakeholders. They are responsible for designing and updating the curriculum to ensure it aligns with current veterinary practices, educational standards, and national needs. The veterinary medicine training also requires clinical preceptors with qualifications and experience clinical skills, and a passion for teaching. They are responsible for providing students with supervised clinical experience, offering career guidance, and evaluating student performance. Remember, these are general guidelines. Specific requirements may vary depending on the institution and its educational philosophy.

DVM Graduate Profile: Competences (Knowledge, Skill, Aptitude, Attitude)

DVM Professional Profile

The DVM program aspires to produce competent veterinarians who can deliver quality service to society in various capacities, ensuring the health and welfare of animals, safeguarding public health, and contributing to the agricultural and economic development of the country in:

- Diagnosis and treatment of various ailments in animals
- Prevention and control of animal diseases
- Research in animal health and biomedical sciences
- Teaching/training in the area of veterinary medicine

- Involve in control of hygiene of foods of animal origin
- Prevention of zoonosis
- Reporting of notifiable animal diseases

Competency Profile

At the time of graduation, a veterinary graduate must have the fundamental scientific knowledge, skills, and values to practice veterinary medicine independently.

- Clinical Skills: Ability to diagnose, treat, and prevent diseases in animals.
- Surgical Proficiency: Competence in performing basic surgical procedures.
- Medical Knowledge: Understanding of animal physiology, pathology, pharmacology, and nutrition.
- Public Health: Knowledge of zoonotic diseases and the ability to promote public health and food safety.
- Ethics and Professionalism: Adherence to ethical practices and professional standards.
- Communication: Effective communication with clients, colleagues, and the public.
- Critical Thinking: Ability to analyze and solve problems in a clinical setting.
- Lifelong Learning: Commitment to continuous education and professional development.
- Research Skills: Basic understanding of research methodologies and the ability to contribute to veterinary science advancements.
- Animal Welfare: Commitment to the welfare and humane treatment of animal

Accordingly, the graduates of the DVM program are expected to attain the following competencies in terms of:

Knowledge:

- Normal and abnormal biological structures and functions of domestic and wild animals
- Behavior, welfare, management, breeding, feeding, and housing of different species of domestic animals
- Knowledge of the epidemiology, prevention, and control of major national and international animal diseases
- Pharmacological and toxicological principles and veterinary biological promoting and maintaining human health through the application of veterinary public health principles in the provision of safe, sound, and wholesome foodstuffs of animal origin, and the control of zoonoses
- Knowledge of livestock economics, entrepreneurship, and business management.

Skills:

- Handle, diagnose, treat, control, and prevent the common disease conditions of domestic animal species
- Collect and interpret clinical and research information, advise and teaching on animal health and production, welfare, and ethics
- Select and collect specimens for laboratory tests and interpret the results
- Present ideas and evidence orally and in writing

- Perform clinical, surgical, and theriogenology procedures
- Design and conduct scientific research independently

Attitude

- A person of higher creativity, social consciousness, and professional ethics with a sense of responsibility to work towards national goals and development.
- Conduct productive professional activities in accordance with ethical and legal codes for the well-being of animals and the benefit of society.

OIE competences OIE recommendations on the Competencies of graduating veterinarians ('Day 1 graduates') to assure National Veterinary Services of quality

Established in 1924, the World Organization for Animal Health (OIE) is the intergovernmental organization responsible for improving animal health worldwide. Its motto is "Protecting animals, preserving our future." To safeguard animals from disease and prevent the spread of zoonoses to humans, the OIE directs significant energy and resources toward helping its Member Countries strengthen their national veterinary services (VS). OIE recognizes that a strong VS is built on well-qualified and capable professional staff and that veterinary professionals and paraprofessionals must possess the necessary knowledge, skills, and attitudes to perform effectively and efficiently.

Early in the implementation of the OIE Performance of Veterinary Services (PVS) Pathway, OIE's platform for supporting Member Countries in strengthening veterinary services, PVS Evaluation mission assessments revealed that the training of veterinarians in many countries needed to be improved. In response, the OIE organized the 1st Global Conference on Veterinary Education, titled "Evolving Veterinary Education for a Safer World," in Paris, France, in October 2009. The conference addressed disparities and shortcomings in veterinary curricula worldwide and identified the need for the development of minimum competencies expected of all graduating veterinarians in both private and public sectors of the VS.

Following the recommendations adopted at that conference, the OIE convened an ad hoc group on veterinary education in 2010, supported by selected deans of Veterinary Education Establishments (VEEs) from five continents. In 2012, this ad hoc group produced the OIE Recommendations on the Competencies of Graduating Veterinarians ('Day 1 graduates'), which outline the competencies necessary for new veterinary graduates to be adequately prepared to participate in the public good functions of national VS at the entry-level. In 2013, the ad hoc group also produced the Veterinary Education Core Curriculum OIE Guidelines.

The OIE developed guidelines to complement its recommendations on the competencies of graduating veterinarians ('Day 1 graduates') to ensure the quality of veterinarians in both the public and private sectors who contribute to the public good functions of national VS. These guidelines are designed as a tool for Veterinary Education Establishments (VEEs) in OIE Member Countries to use when developing curricula to educate veterinary students to the expected level of competency.

The guidelines also aim to establish a reference threshold for veterinarians' initial training, considering the skills required, the training time expected, the quality objectives of VS, and the collective responsibilities of the profession. Since initial training periods for veterinarians vary widely worldwide, an outcomes-based approach was promoted, emphasizing the development of curricula to deliver specific competencies for graduating veterinarians.

Through this process, it is anticipated that academic staff at both "Beneficiary" and "Parent" VEEs will enhance the skills and perspectives needed to develop outcomes-based curricula, adapting to the evolving skill sets required by the VS in the future (OIE, 2013):

A cornerstone for ensuring that graduating veterinarians (Day 1 veterinary graduates) possess sound overall competencies is equipping them with the necessary knowledge, skills, attitudes, and aptitude to understand and perform entry-level National Veterinary Services tasks. This foundation is crucial for effectively promoting animal and public health.

Competencies refer to the knowledge, skills, attitude, and aptitude of a graduating veterinarian for performing tasks for the National Veterinary Services.

- **Knowledge:** cognitive abilities, meaning mental skills.
- **Skills**: ability to perform specific tasks.
- **Attitude:** effective abilities, meaning, feelings, and emotions.
- **Aptitude:** a student's natural ability, talent, or capacity for learning

To better lay out the expectations for graduating veterinarians, the OIE created a set of Day 1 Competencies that all graduating veterinary students should be competent in upon graduation. Competence is a concept that integrates knowledge, skills, and attitudes. Competence requires the acquisition of technical skills but further involves applying relevant knowledge and having the confidence and ability to transfer what has been learned to a variety of contexts (OIE, 2012):

Day One Competencies' is the minimum standard required and is the starting point for a variety of roles in the veterinary profession. After graduation, ongoing professional development will be needed in whichever field the new graduate decides to enter, and some roles may require postgraduate training and further formal qualifications. These competencies are meant to ensure that all newly graduated veterinary professionals can not only provide optimal animal care but also support their Country's National Veterinary Services.

The OIE Day 1 Competencies for Veterinary Medicine (DVM) graduates comprise 11 specific competencies, described in detail as follows (OIE,2012):

OIE Day 1 Competencies

The 11 Specific Competencies

- **Epidemiology:** Having a basic understanding of epidemiology enables veterinarians to comprehend the factors that negatively affect animal populations and use this knowledge to make informed decisions in preventive medicine and veterinary public health. To be considered competent in this field, veterinary graduates must understand the fundamentals of descriptive epidemiology, including the ability to measure and describe disease occurrence and spatial distribution. Additionally, Day 1 veterinary graduates should recognize how epidemiology aids in disease control, encompassing surveillance, understanding risk factors, and interpreting screening and diagnostic tests. Lastly, all Day 1 veterinary students should grasp the basic principles of outbreak investigation.
- **Transboundary Animal Disease**: Transboundary animal diseases (TADs) are highly contagious diseases that can spread rapidly across national borders. These diseases can have severely detrimental impacts on the global economy and public health, necessitating thorough monitoring and control. To be considered competent in TADs, Day 1 veterinary graduates should be able to describe significant diseases, the pathogens that cause them, and their current global distribution. Additionally, these graduates should be familiar with current disease surveillance programs, the agencies that monitor the most important TADs, and the proper procedures for reporting them.
- **Zoonoses (including foodborne diseases**): Zoonotic diseases are those that can be transmitted from animals or animal products to humans, including foodborne diseases. These diseases pose a significant risk to public health and global trade if not adequately regulated. Competence in this area includes the ability to describe common and important pathogens, their routes of transmission, and the diagnostic methods used to identify them. Additionally, a competent veterinarian understands the

impact of zoonotic diseases on public health, agriculture, and the economy. Veterinarians proficient in this area can also identify the appropriate national and international reporting authorities for surveillance

- **Emerging and Re-emerging Diseases**: Emerging and re-emerging diseases are pathogens that either have not been previously encountered or have evolved and spread to new geographic locations. To be considered competent in this area, Day 1 veterinarians must be able to enumerate common and high-risk pathogens. They should also be capable of identifying the clinical signs associated with these pathogens in animal populations. Moreover, veterinarians should comprehend the risk factors that increase the likelihood of emerging or re-emerging disease outbreaks and know the appropriate authorities to whom suspected cases should be reported.

- **Disease Prevention and Control Programs**: Veterinary graduates proficient in disease prevention and control programs can effectively implement preventive measures across diverse animal populations at different levels. They can also identify the appropriate regulatory authorities in their country and describe current national programs. Day 1 graduates competent in this field are also capable of implementing contingency plans to identify and trace exposed animals and conducting mass culling operations when necessary to control disease outbreaks.

- **Food Hygiene**: Competency in basic food hygiene necessitates understanding the techniques essential for ensuring the safety and wholesomeness of food derived from animals. This includes recognizing safe preharvest management practices in animal production to minimize the risk of zoonotic foodborne pathogens. Additionally, veterinarians must be proficient in conducting antemortem and postmortem examinations of animals, while ensuring that slaughterhouses adhere to humane slaughtering practices. Furthermore, veterinarians should possess knowledge of good sanitation practices and strategies to mitigate the risk of secondary contamination during food processing.

- **Veterinary Products**: To be considered competent in this area, veterinarians must understand the proper usage, application, storage, and disposal procedures for a range of products used in veterinary medicine, including drugs, vaccines, and biological items. They should also grasp the mechanisms that contribute to antimicrobial resistance and recognize the connection between antimicrobial use in food animals and the development of resistance in human pathogens. Veterinarians need to be knowledgeable about drug withdrawal times for food-producing animals to prevent residues in animal products. Lastly, proficiency in maintaining legible, comprehensive, and up-to-date records is essential for veterinary practice.

- **Animal Welfare**: Veterinarians who are competent in animal welfare can apply scientific knowledge to assess the nutritional status, health, and overall comfort of animals based on their natural behaviors. These veterinarians recognize the critical importance of animal welfare and understand the scientific and economic implications of animals experiencing fear, stress, or pain during production. Moreover, Day 1 graduates should be capable of using their knowledge to implement corrective actions during production, export, and transportation processes. Additionally, new graduates should be able to effectively communicate the significance of animal welfare to owners, producers, and farmers, emphasizing its importance in maintaining animal health, productivity, and public perception

- **Veterinary Legislation and Ethics**: Veterinarians who are competent in veterinary legislation understand and adhere to the laws and regulations established by governing bodies that oversee veterinary professionals. These regulations are designed to maintain a standardized level of care and protect animal health, public health, the environment, and the economy. Day 1 graduates should be capable of upholding high professional standards of care and demonstrating integrity when encountering ethical dilemmas

- **General Certification Procedures**: Veterinarians who are competent in general certification procedures can assess animals or animal products for signs of infectious diseases to accurately complete

health certificates or travel documentation according to national regulations

- **Communication Skills**: Veterinary graduates who are competent in this area can effectively communicate veterinary and scientific information both verbally and in writing, using clear and concise language suitable for diverse audiences.

The Eight Advanced Competencies

The OIE Day 1 Competencies for Veterinary Medicine (DVM) graduates include eight advanced competencies, detailed as follows (OIE, 2012):

- **Organization of Veterinary Services**: Competency in this field encompasses a thorough grasp of the organizational structure of both governmental and non-governmental agencies responsible for implementing OIE standards and recommendations outlined in the Terrestrial and Aquatic Animal Health Codes. This involves understanding the hierarchical framework within these agencies, from local branches to national bodies, and their roles in ensuring animal health and welfare on a global scale.
- **Inspection and Certification Procedures**: Veterinarians proficient in inspection and certification programs possess the ability to evaluate an animal's health thoroughly. They are adept at drafting accurate health certificates that comply with international and national standards and regulations. These certificates are essential for facilitating animal transportation, domestic consumption, or exportation, ensuring compliance with rigorous health and safety protocols.
- **Management of Contagious Disease**: Veterinarians who are competent in managing contagious diseases are well-versed in disease monitoring and surveillance methodologies. They possess the expertise to conduct thorough outbreak investigations, including identifying sources and routes of transmission. These professionals are also knowledgeable about implementing movement controls, quarantine measures, humane euthanasia procedures on a large scale, carcass disposal techniques, and zoning principles necessary for disease monitoring and control.
- **Advanced Food Hygiene**: Veterinarians competent in advanced food hygiene can effectively conduct drug residue testing to ensure that animal products are free from antimicrobials, pesticides, hormones, or heavy metals that can contaminate food and pose risks to human health, commonly known as adulterants. Day-1 graduates should also be proficient in evaluating food processing sanitation procedures and explaining proper preparation and storage methods for animal-based food products.
- **Application of Risk Analysis**: Proficiency in the application of risk analysis entails the ability to apply risk assessment methods and comprehend how the likelihood and severity of disease outbreaks can adversely affect human and animal health, as well as economic stability. Veterinarians skilled in risk analysis are well-versed in the four key components: risk management, risk assessment, hazard identification, and risk communication. By utilizing risk analysis, veterinarians can identify and implement effective veterinary services aimed at safeguarding the health of humans, animals, and the environment. This proactive approach helps mitigate potential risks associated with disease outbreaks and ensures comprehensive protection across various sectors
- **Research**: Day 1 graduates who are competent in research can formulate and test hypotheses, design studies or experiments using the scientific method, and collect data effectively. They are proficient in selecting and applying appropriate statistical methods to analyze the data they gather. After analyzing the data, veterinarians should be able to critically review the analysis and interpret the results accurately to evaluate the robustness of their conclusions.

- **International Trade Framework**: Veterinarians who are competent in the international trade framework understand the laws and regulations governing the safe international trade of animal products and animals. They are knowledgeable about the World Trade Organization (WTO) Sanitary and Phytosanitary (SPS) measures, which ensure that trade restrictions based on health and safety concerns are scientifically justified. Additionally, these professionals are aware of the roles and responsibilities of international organizations such as the OIE (World Organization for Animal Health) and the Food and Agriculture Organization (FAO). These organizations play key roles in developing science-based regulations and standards for international trade, ensuring the safety of animal products and animals traded globally
- **Administration and Management**: Competency in administration and management involves the ability to plan, organize, and lead projects to successfully achieve common goals or objectives. Proficiency in this area also encompasses effective written and verbal communication skills in one or more of the official languages of the OIE (World Organization for Animal Health). Additionally, veterinarians skilled in administration and management possess public communication abilities to deliver public service announcements and press releases effectively. These skills are essential for ensuring clear and efficient communication with stakeholders and the public, promoting transparency and understanding in veterinary practices and policies.

Policy issues (education policy, vision, and targets of animal health strategy)

In Ethiopia, the introduction of modern (Western-type) education occurred during the reign of Emperor Menelik II (1889-1913). Despite opposition from religious leaders and the nobility, Emperor Menelik II successfully established the first secular school in 1908 in Addis Ababa (Bishaw & Lasser, 2012). This marked the beginning of Western-dominated education spreading throughout the country, gradually marginalizing Ethiopia's indigenous knowledge from its educational framework. This trend persisted in subsequent decades.

Throughout the 20th century, Ethiopia's education system underwent significant reforms. The socialist regime (1974-1991) introduced an education reform influenced by Marxist-Leninist ideology (Bishaw & Lasser, 2012). Subsequently, the EPRDF government (1991-2018) implemented a new education and training policy in 1994 aimed at addressing longstanding educational challenges in the country (Negash, 2006). One of the primary goals of these reforms was to enhance access to education for all children, particularly those in rural areas. To achieve this objective, the government embarked on a campaign to construct additional schools to accommodate the increasing number of students.

In recent years, Ethiopia has embarked on comprehensive educational reforms aimed at tackling persistent challenges within its education system (Tena and Motuma, 2024). A primary focus of these reforms has been to enhance the quality, relevance, and efficiency of education (Tadesse & Melese, 2016). Curriculum reform has been a crucial component of these efforts. The government has been revising the curriculum to align it more closely with the needs of students and the requirements of the contemporary world. This initiative includes integrating new subjects into the curriculum to better prepare students for the workforce (MOE, 2003). Additionally, significant emphasis has been placed on implementing quality assurance mechanisms to monitor and evaluate the educational standards across Ethiopia. This involves conducting assessments and examinations to ensure that students are meeting the learning objectives and benchmarks established by the government (Molla & Tiruneh, 2023). Overall, these reforms are aimed at improving the overall educational experience for students in Ethiopia, enhancing their preparedness for future challenges, and fostering national development.

Ethiopia's education reforms have been comprehensive and multifaceted, aiming to address a range of challenges and enhance the overall quality of education in the country. Efforts have focused on expanding access, revising the curriculum, improving teacher training, implementing quality assurance measures,

and promoting technical and vocational education. These initiatives reflect Ethiopia's commitment to strengthening its education system for future generations. However, despite these reform efforts, Ethiopia's education system continues to face significant challenges (Gemeda & Tynjälä, 2015; Tadesse et al., 2022; Tadesse & Melese, 2016). These challenges affect the quality, relevance, and efficiency of education provided to students nationwide.

One of the deficiencies highlighted in the OIE PVS assessment was the absence of a veterinary council responsible for registering and licensing both public and private veterinarians and para-professionals. Establishing and maintaining robust veterinary professional standards is crucial for enhancing the credibility of export certifications and ensuring effective disease control, regulation, and licensing. Currently, Ethiopia lacks an independent statutory body empowered to regulate the veterinary profession, oversee the licensing and registration of veterinary surgeons and practitioners, and enforce standards for professional education and conduct. As an example, while new veterinary programs are being introduced in universities across the country, there is a pressing need for these programs to develop curricula that adequately prepare graduates for licensing and professional practice as veterinarians.

Strategic interventions to regulate the veterinary profession and uphold professional standards and ethics

- Establish an autonomous statutory body to regulate the veterinary profession, license and register veterinary surgeons and veterinary practitioners, and regulate professional education and professional conduct.
- Create an annual Veterinary Faculty Dean's Forum attended by all Deans to discuss the harmonization of veterinary educational standards, curriculum development, VS needs, and related issues.
- Introduce some form of international benchmarking for undergraduate veterinary education.
- Develop and enforce guidelines and code of conduct for public and private veterinary services practitioners and para-veterinarians.
- Institute a system of awarding points for continuing education and make this mandatory for veterinarians in both the government and private sectors.

Vision and targets of animal health strategy

Vision

- Enhance veterinary governance in line with the World Organization for Animal Health.
- Provide animal health services that comply with international standards, are conducive to a sustainable, globally competitive livestock industry, and contribute to the achievement of food security, poverty alleviation, public health, and socio-economic growth.

Targets

- By the year 2025, animal health service coverage will reach 80% by implementing integrated, prevention-oriented, and risk-based programs.
- By the year 2025, the veterinary service will improve its level of advancement from the current level of 2.63/5 to 4/5 in the OIE PVS evaluation.
-

Continuing Professional Development (CPD), Skill Development Programs

Continuous Professional Development (CPD) for academics in higher education is recognized as essential for both individual competitiveness and institutional effectiveness. Higher education institutions must navigate global challenges and swiftly adapt to evolving societal, cultural, and technological demands. The dynamic nature of the modern world, especially within higher education, underscores the importance of CPD in enabling academics to maintain proficiency and competence in teaching, research, and community engagement.

CPD is integral to governmental and institutional strategies aimed at operating efficiently amidst change and establishing platforms for sustainable growth. Universities, as primary higher education institutions, are founded on three core pillars: education, research, and societal contribution. Effectively delivering these services requires equipping academics with deep subject knowledge and robust pedagogical skills based on standards (Tena and Motuma, 2024; Stefani, 2005).

Continuous Professional Development (CPD) in higher education is crucial for several reasons. It addresses the complexity of modern society, enabling academics to navigate diverse challenges effectively. CPD also ensures academics remain current in their content fields, revitalizing their work with new ideas and enhancing pedagogical competence. This includes adopting transformative teaching approaches that foster students' competencies in critical thinking, problem-solving, communication, collaboration, and self-direction—essential skills for the 21st century (Darling-Hammond et al., 2017). Despite these benefits, research on the professional development of academics remains underexplored.

Harmonization of Veterinary Curriculum, Challenges and Opportunities

In the era of globalization, the challenges facing higher education are no longer confined within national boundaries. The interconnectedness of the world, facilitated by economic liberalization, the free movement of labor and capital, and advancements in communication technologies, has rendered distance largely irrelevant (Emnet, 2013). This global interconnectedness necessitates higher education institutions to adapt to international standards and compete on a global scale, addressing challenges and opportunities that transcend the national context

Ethiopia's Ministry of Education (MoE) undertakes a comprehensive review and update of the national veterinary medicine curriculum every decade, a process that was initiated in 2019 with the establishment of a National Curriculum Task Force. This task force, comprising Deans and representatives from all Veterinary Education Establishments (VEEs) in Ethiopia, along with stakeholders including the veterinary association, leads the curriculum revision efforts.
Ethiopia stands out in Africa for adopting a harmonized veterinary curriculum aligned with standards set by the World Organization for Animal Health (OIE), aimed at better preparing the next generation of veterinarians to support the National Veterinary Services and address the country's growing needs. Despite these advancements, challenges persist in translating the curriculum from theory to practice across all VEEs in Ethiopia. A recent needs assessment has identified several topics and requirements within the new 2020 national veterinary curriculum that VEEs have found difficult to implement, alongside barriers that hinder the effective incorporation of these topics.

Additionally, shortages of teaching materials essential for training students in veterinary programs are widespread. For instance, representatives from some programs highlighted difficulties in acquiring personal protective equipment necessary for conducting outbreak investigations, ante- and post-mortem examinations and collecting samples for infectious disease diagnostics. Others noted challenges related to shortages in medications, vaccines, and other biological products that are crucial for teaching them proper usage and management. Similarly, significant deficiencies were noted in laboratory materials required for diagnostics, antimicrobial susceptibility testing, and veterinary product residue testing, which are essential components of training future veterinarians.

Further inquiries during the FGDs revealed various reasons behind these materials shortages, primarily linked to challenges associated with importing necessary supplies into the country. The procurement process through the central government was described as cumbersome and lengthy. At the same time, financial constraints were identified as a persistent barrier hindering veterinary programs from providing practical or applied training. Similar challenges were reported by institutions and organizations across

the region, emphasizing a widespread lack of access to adequate financial and material resources as a significant impediment.

Benefits/Advantages of curriculum harmonization

Admittedly, there are benefits to creating a common higher education space. Some of the more apparent benefits include (Hawkins, 2012):

- greater mobility,
- widening access and choices,
- academic and research collaborations,
- enhanced collaboration on human capital investment, and
- The promotion of regions and/or nations within the fast-changing global higher education landscape.

The immediate advantage of harmonizing higher education systems includes facilitating easier exchange and mobility for students and academics across nations within different regions. In addition, member states can access systems, tools, and best practices that enhance the quality of higher education. For some countries, harmonization also acts as a catalyst for keeping pace with globalization.

Challenges of curriculum harmonization

The implementation of the harmonization idea in higher education is not without challenges (Hawkins, 2012).

- Steps should be taken in order to increase student readiness.
- barriers to language and communication must be overcome, and
- There should be serious efforts to reduce constraints that are very 'territorial' in nature

Admittedly, students participating in mobility programs may encounter adjustment challenges, particularly regarding differences in instructional practices, incomparable curricula, and cultural diversity. Additionally, language differences pose significant barriers to both inbound and outbound mobility of students at a broader level.

There is also the issue of 'territorial' constraints, where each country aims to preserve the uniqueness of its educational programs. This desire to maintain uniqueness can potentially hinder the full implementation of regional harmonization efforts in higher education.

References

Abebe, G. 2013. Animal health professional development in Ethiopia. Proceedings of the National Symposium on Enhancing Economic Growth through Livestock Development in Ethiopia. Held at University of Gondar, Faculty of Veterinary Medicine, Gondar. June 7-8, 2015. 121-127pp.

American Veterinary Medical Association Council on Education,2014

Bautista, A., & Ortega-Ruíz, R. 2015. Teacher professional development: International perspectives and approaches. *Psychology, Society and Education,7*(3), 240-251. https://doi.org/10.25115/psye.v7i3.1020

Bessler AL, Hoet AE, Nigatu S, Swisher S, Fentie T, Admassu B, Molla A, Brown M and Berrian AM 2024. Advancing One Health through veterinary education: a mixed method needs assessment for implementing a WOAH-harmonized national veterinary medicine curriculum in Ethiopia. *Front. Vet. Sci.* 11:1357855. doi: 10.3389/fvets.2024.1357855.

Bishaw, A., & Lasser. J. ,2012. Education in Ethiopia: Past, present, and future prospects. *African Nebula*, 5, 53-69

Darling-Hammond, L., et al., 2017. *Preparing teachers for a changing world: What teachers should learn and be able to do*. Jossey-Bass

De Deken, R., Obwolo, M.J., Thys, E., Geerts, S. 2004. The adjustment of curricula in veterinary faculties in sub-Saharan Africa. Revue Scientifique et Technique, Office International des Epizooties, 23:383–90.

Emnet Tadesse.,2013. *Conceptualizing Harmonization of Higher Education Systems: The Application of Regional Integration Theories on Higher Education Studies Bayreuth International Graduate School of African Studies (BIGSAS),* University of Bayreuth, Germany. Retrieved from http://dx.doi.org/10.5539/hes.v3n2p12.

Gemeda, F. T. & Tynjälä, P. ,2015. Professional learning of teachers in Ethiopia: Challenges and implications for reform. *Australian Journal of Teacher Education, 40*(5), 1-26. http://ro.ecu.edu.au/ajte/vol40/iss5/1.

Girma, M., *Melaku Girma (PhD) St. Mary's University (PhD) St. Mary's University. Proceedings of the 16th International Conference on Private Higher Education in Africa.

Gosha, K., Billionniere, E., Gilbert, J., & Ramsey, M. ,2010. *Developing a framework for teacher professional development using online social networks* (Paper presented at the Society for Information Technology & Teacher Education International Conference-SITE 2010).

Guskey, T.R. ,2000. *Evaluating professional development*. Corwin Press

Hawkins, J. ,2012. Regionalization and harmonization of higher education in Asia: Easier said than done. *Asian Education and Development Studies* Vol. 1/1, 96-108.

Marabelli, R. 2003. The role of official veterinary services dealing with new social challenges: animal health and protection, food safety, and the environment. Revue Scientifique et Technique, Office International des Epizooties, 22:363–371.

Mayen, F. 2006. A status report of veterinary education in Ethiopia: Perceived needs, past history, recent changes, and current and future concerns. Journal of Veterinary Medical Edu cation, 33:244–247.

MoE (Ministry of Education). 2024 Higher education In Ethiopia www.moe.gov.et/English/ information/ Pages/pubuni.

MoE (Ministry of Education). 2011. Public Universities. www.moe.gov.et/English/ information/ Pages/ pubuni.asp.

MOE. 2003. Teacher Education System Overhaul (TESO) handbook. Ministry of Education.

Molla, T. & Tiruneh, D. T. 2023. Ethiopia's education system is in crisis – now's the time to fix it. The Conversation. https://theconversation.com/ethiopias-education-system-is-in-crisis-nows-the-time-to-fix-it-217817

Negash, T. 2006. Education in Ethiopia: From crisis to the brink of collapse. Uppsala: Nordiska Afrika Institutet

OECD (Organization for Economic Co-operation and Development)., 2000. Knowledge management in learning society. Education and Skills. OECD Publication Service, Cedex, France.

OIE (World Organization for Animal Health). 2012. OIE recommendations on the competencies of graduating veterinarians („Day 1 graduates□) to assure Veterinary Services of Quality. 12, rue de Prony,75017, Paris, France. Accessed at http://www.oie.int.

OIE (World Organization for Animal Health). 2013. Veterinary education core curriculum: Guidelines. 12, rue de Prony,75017, Paris, France. Accessed at http://www.oie.int.

Stefani, L. ,2005. PDP/CPD and e-portfolios: Rising to the challenge of modeling good practice. [Paper presented at the Reflective Learning, Future Thinking: ALT Spring Conference and Research Seminar]. http://www.alt.ac.uk/docs/lorraine_stefani_paper.doc

Swan, G.E. and Kriek, N.P.J. 2009. Veterinary education in Africa: Current and future perspectives. Onderstepoort Journal of Veterinary Research, 76:105-114.

Tadesse, T., & Melese, W. ,2016. The prevailing practices and challenges of curriculum Reform in Ethiopian higher education: Views and responses from within. Australian Journal of Teacher Education, 41(10). http://dx.doi.org/10.14221/ajte.2016v41n10.6.

Tadesse, A., Kenea A., & Woldemariam, K. 2022. Ethiopian education reform: From tradition to nowhere, a systematic literature review. Ethiopian Journal of Education and Sciences, 17(2), 1-17. http:// journals.ju.edu.et/index.php/ejes.

Temesgen, W. 2013.Veterinary manpower in Ethiopia. Proceedings of the National Symposium on Enhancing Economic Growth through Livestock Development in Ethiopia. Held at University of Gondar, Faculty of Veterinary Medicine, Gondar. June 7-8, 2015. 128-144pp.

Tena, B., & Motuma , F. ,2024. Policy reforms and unresolved educational challenges in Ethiopia: Implications for the University of Education. Bahir Dar Journal of Education, 24(1), 147–167. https:// doi.org/10.4314/bdje.v24i1.10.

Varghese, N.V. 2013. Governance reforms in higher education: A study of selected countries in Africa. UNESCO. http//www.iiep.unesco.org/fileadmin/

Willis, N.G., Monroe, F.A., Potworowski, J.A., Halbert, G., Evans, B.R., Smith, J.E., Andrews, K.J., Spring, L., Bradbrook, A. 2007. Envisioning the future of veterinary medical education: The Association of American Veterinary Medical Colleges Foresight Project, Final Report. Journal of Veterinary Medical Education, 34:5–15

Willis, N.G., Monroe, F.A., Potworowski, J.A., Halbert, G., Evans, B.R., Smith, J.E., Andrews, K.J., Spring, L., Bradbrook, A. 2007. Envisioning the future of veterinary medical education: The Association of American Veterinary Medical Colleges Foresight Project, Final Report. Journal of Veterinary Medical Education, 34:5–15

World Bank. 2003. Higher education development for Ethiopia: Pursuing the vision. Ethiopian Ministry of Education, Addis Ababa. Ethiopian Ministry of Education. 1997. The future directions of higher education. January 1997, Addis Ababa. https:// www.usp.ac.fj/ worldbank2009/ frame/ Documents/ Publications regional/Ethio pia-HigherEd_ESW012004.pdf Accessed online June 2014.

Yizengaw, T. 2005. Policy Development in Higher Education in Ethiopia and the role of donors and development partners. A paper presented in the international expert meeting on “Formulas that Work: Making Higher Education Support More Effective” 23-24, May. The Hague, The Netherlands.

Zuber- Skerrit, O., Fletcher, M. & Kearney, J., 2015. Professional learning in higher education and community: Towards a new vision for action research. Northwest University. PALGRAVE.

Annex 1: Universities with various animal health programs and their staff profile, compiled by EVA Office[15]

No	University	Programs	PhD	MSc/ MVSc	DVM	BVSc	BSc	AHA & others	Total
1	Addis Ababa University, CVMA	DVM, VLT	27	46	5	0	11	2	91
2	Ambo University, SVM	DVM, BVSc, VLT	6	20	4	2	1	3	36
3	Arbaminch University, DVSC	BVSc	0	13	0	3	1	0	17
4	Arsi University, DVSC	DVM, BVSc	2	9	0	0	4	0	15
5	Assosa University, DVSC	BVSc	1	7	0	3	0	0	11
6	Bahir Dar University, SVM	DVM, BVSc	2	24	3	1	0	7	37
7	Bonga university, DVSC	DVM	0	7	1	0	0	1	9
8	Borana University, SVM	DVM	0	8	3	0	2	0	13
9	Bulehora University, DpVM	DVM, BVSc	0	4	1	0	2	0	7
10	Debremarkos University, DVSc	VLT, BVSc	0	8	0	0	1	1	10
11	Debretabor University, DVSC	BVSc	0	8	0	1	1	0	10
12	Gondar University, CVM&AS	DVM, VetPh	12	32	8	3	15	0	70
13	Haramaya University, CVM	DVM, VLT	3	33	2	0	0	3	41
14	Hawassa University, FVM	DVM	5	15	1	0	3	2	26
15	Injebara University, DVSc	VLT	0	3	0	0	1	0	4
16	Jigjiga University, CVM	DVM BVSC/ VLT	2	35	3	0	1	0	41
17	Jimma University School, SVM	DVM, BVSc	4	23	3	0	1	2	33
18	Jinka University, DVM, DVSc	DVM, BVSc	0	13	5	2	1	0	21
19	Kebridihar University, CVM	DVM	0	3	4	0	0	0	7
20	Mekelle University, CVS	DVM, BVSc, BSc	8	37	9	11	13	7	85
21	Samara University CVM & AS	DVM, BVSc	2	33	0	0	3	2	40
22	Wechamo University, SVM	DVM, BVSc	1	9	0	2	1	0	13
23	Weldia University, SVM	DVM	0	20	2	3	1	0	26
24	Wolaita Sodo University, SVM	DVM, BVSc	0	25	3	0	2	1	31
25	Wollega University, CVM	DVM, BVSc, VLT	6	29	3	3	5	4	50
26	Wolo University, SVM	DVM, VLT	1	22		4	4	0	31
	Total		82	486	60	38	74	35	775

15 *DVM (Doctor of Veterinary Medicine), BVSc (Bachelor of Veterinary Science), VLT (Veterinary Laboratory Technology), AHA (Animal Health Assistant), SVM (School of Veterinary Medicine), CVM (College of Veterinary Medicine), VM (veterinary medicine), CA (College of Agriculture), CVS (College of Veterinary Science), CVM &AS (College of Veterinary Medicine and Animal sciences), FVM (Faculty of Veterinary Medicine), DVSC (Department of Veterinary Science), DpVM (Department of Veterinary Medicine), VetPh (Veterinary Pharmacy)*

PART 6: Veterinary Research in Ethiopia: History, achievements, challenges, opportunities and the way forward

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Executive summary

Veterinary research offers numerous opportunities for better understanding of zoonotic, emerging and re-emerging diseases transmitted between wild and domestic animals and humans, and prevention and control technologies to curb them. It enables developing tools, prototypes and kits for rapid pathogen detection, characterization, risk analysis, and its translational applications to animal and human health, and international trade. Facing the challenges of food security and zoonosis require prior knowledge of the potential source of foodborne pathogens, hosts-pathogens interactions, the development of antibiotic resistance mechanisms and preventive measures in the food value chain. Veterinary research is also critical for the development of evidence-based policies, recommendations, introduction and enforcement of legislative measures for the prevention and control of TADs and mitigation of unforeseeable challenges. Therefore, the objectives of this work were to overview the status of veterinary research efforts, knowledge and Technology gaps in Ethiopia, highlight research-extension- development linkages in the National Agricultural Research system (NARS), level of policy support, and highlight deliverable animal health research outputs in the Agricultural development system. Animal health research activities applied by different sectors end up by producing manuals, printed communication materials, protocols, guidelines, prototypes, useable products and transferred to end users. More than 10250 technology beneficiaries have been addressed by technology demonstration domains and 6500 farmers have been given different forms of technologies such as infusion, churners, sprayers and prophylaxis. Community-based mitigation measures of Trypanosomiasis such as integrated tsetse fly control efforts (pour on, insecticide impregnated targets and spray mechanisms) and vector density management were introduced and applied to 200 farmers in the tsetse fly belt areas. Different packages of animal health technologies have been promoted to beneficiaries resulted in reducing mortality of crossbred calves from 25.6% to 4.56% and from 26.2% to 7.9% at on station and on farm scheme respectively. The implementation of these research endeavors requires coordinated and concerted effort of researchers, policy makers, service givers and strong extension system. However, the dedicated coordination and integrated efforts of all stakeholders in the strategic implementation of diseases detection, control, prevention, and technologies generation or adoption is weak. Repeated reform, restructuring and reconfiguration undervalued veterinary research contribution in the national economy. This resulted in inadequate veterinary technology generation and adoption, weak veterinary services that doesn't comply with the animal health and food safety standards needed for domestic and lucrative global markets. The presence of a high prevalence rate and widespread distribution of endemic production diseases, zoonotic and foodborne diseases resulted from weak veterinary research, poor research-extension system, insignificant research support for veterinary services, and weak support of development policy and strategies. The frequent and recurrent live animals and animal products trade ban with its economic consequence have been the result of poor collaboration and coordination modality, integration and implementation than the absence of policies, rule and regulations upholding public health safety and animal diseases control in the country. Although, this implies the existence of very high risks of drug residues associated with the marketing and consumption of unsafe foods, and different studies didn't generate policies, ideas and strategies that enable prudent use of drugs both in humans and animals. In general, the existing veterinary research efforts have been focused on describing the types of diseases and prevalence, species affected, and distribution patterns of common endemic diseases, as well as the generation of usable products, prototypes, and technologies. The research strategy for wild animal diseases was much overdue in comprehending disease dynamics among livestock and wild animal populations and generating mitigation options to protect domestic animals and human zoonotic infection. Key challenges to existing research include inadequate cross disciplinary collaborations and

integrations, institutional or corporate research, insignificant national research investment in product development (improved vaccines and drugs, diagnostic kits, prototypes), and high costs of high-tech laboratory equipment and tools. Nevertheless, existing veterinary research has been devoted to unlocking the bottleneck of animal diseases' influence on livestock production and international trade potential in Ethiopia. As a future direction, emphasis should be given to the development, formulation, and promotion of veterinary technologies and prototypes through designing collaboration, integration, and strong linkage modalities among different stakeholders and sectors.

Keywords: *Collaboration, Diseases, Research, Technology, Veterinary*

1. Introduction

Veterinary science transcends species boundaries and plays a critical role in protecting human, animal, and environmental health, as many human pathogens have their origins in animal hosts. In addition to the prevention, control, diagnosis, and treatment of animal diseases, it plays a huge role in several human-animal health interfaces such as food safety and quality, zoonotic diseases, public policy, wildlife, and ecosystem health. Moreover, recorded documents indicated that historically, veterinary research contributed significantly to the understanding of basic animal physiologic mechanisms, as well as the development of new drugs, vaccines, and medical devices for the control of diseases in animals and humans (Quimby, 1998). Today, veterinary science has advanced to include fields such as biotechnology, immunology, infectious diseases modeling and molecular diagnostics, and bioinformatics that can be applied to the identification and subsequent eradication of animal diseases - ensuring food safety through improved animal health technologies towards achieving nutritional security and improved livelihoods of the society and thus contributing to the global economy.

Ethiopia is home to a huge number of domestic (about 210 million including poultry) (CSA, 2021) and wild animals, so Ethiopia sneakily may appear as a food and nutrition-secure nation when considering the massive livestock population owned. However, Ethiopia is also endemic to a number of livestock diseases that cause a high degree of mortality and morbidity with significant adverse effects on livestock trade and national economy, food safety and public health, and the livelihood of livestock producers. Other than the reportable Transboundary animal diseases (TADs), there are less prominent diseases commonly causing afflictions and threatening the health and welfare of animals, the productivity of livestock species, and the livelihood of producers. Some diseases have a debilitating effect on production, reducing productivity and output or precluding livestock raising altogether (e.g., tsetse infested areas), while others cause drastic drops in production, either through killing animals or through costs of veterinary medications and trade restrictions (Magnusson et al., 2022). Effective control, prevention, and/or eradication of these diseases is possible only through methodical implementation of knowledge-based technologies and information generated through well-planned and systematically organized scientific research. Despite this need, veterinary research has been less prioritized in Ethiopia's National Agricultural Research System (NARS) and repeated structural reforms in the NARS (MoA and ILRI., 2013; Tsedeke et al., 2004). Currently, veterinary research has been given due emphasis to conducting animal health research in the country's different agroecologies and production systems. Research projects and activities that are conducted at the federal and regional governments and/or higher education institutes level are fragmented, disorganized, redundant, and are not implemented in proportion to the level of risks associated with a particular animal disease or the magnitude of its economic importance. Veterinary research extension linkage in NARS remains weak and left vacant due to inadvertent management of veterinary research efforts, duplicated mandates, and weak communication of research findings to the end users. Therefore, the objectives of this review were to overview the status of veterinary research efforts, knowledge and Technology gaps in Ethiopia, highlight research-extension-development linkages in the National Agricultural Research System (NARS), level of policy support, and highlight deliverable animal health research outputs in the Agricultural development system.

Historical development of Veterinary Research in Ethiopia

In Ethiopia, animal agriculture is a crucial component of agricultural production, serving as a source of food and means of income with immense economic, social, and cultural significance. However, the economic benefit derived from the livestock sector needs to be commensurate with the existing potential due to extensive and abundant livestock diseases distributed across all the agroecological zones of the

country. In cognizant of these, publicly funded Agricultural Research in Ethiopia has emerged since the early 20th century with the establishment of Ambo Agricultural School (1947), Jimma Agricultural and Technical School (1952), and Alemaya College of Agriculture (1953). Parallelly, "Institute Pasteur d'Ethiopie" (now Ethiopian Public Health Institute – EPHI) was established in 1952 to conduct research and special studies on the production of some biologicals and control of some zoonotic diseases of public health importance like rabies (https://ephi.gov.et/history-of-EPHI). The advent of an institutionally coordinated and policy-oriented full-fledged national research system (NARS) was launched in 1966 with the establishment of the Institute of Agricultural Research, IAR (Tsedeke et al., 2004). Subsequently, the control and eradication of tsetse and tsetse-transmitted trypanosomiasis research activities were launched with the establishment of Mobile Trypanosomiasis Control unit in 1971, National Tsetse and Trypanosomiasis Investigation and Control Centre (NTTICC) in 1972; Trypanosomiasis Control Service (TCS) in 1977, and Farming in Tsetse Control Areas (FITCA)" in 1998. Nevertheless, veterinary research in IAR was masked in the parasol of animal science research, and this wing was treated to render clinical service and less focused on the 1977 restructuring process (Tsedeke et al., 2004). The first foundation of veterinary research began in the mid-1980s as a research division, and in 1992, it was promoted to the Institute of Animal Health Research (IAHR) to run as an independent research entity (Tsedeke et al., 2004). In 1997, the Ethiopian Agricultural Research Organization (EARO) was established by merging some federal research centers, including the National Animal Health Research Center (NAHRC), formerly IAHR (Proclamation number 79/1997). As EARO's affiliate, the NAHRC shares the responsibility of EARO and is mandated to generate, develop, and adapt technologies focusing on animal diseases; coordinate research activities of agricultural research centers or higher education institutes and other related entities engaged in veterinary research; build up its research capacity and establish a system that makes agricultural research efficient, effective and driven by development needs. Finally, NAHRC was reorganized to provide veterinary diagnostic and investigation services in 2007, and subsequently, the National animal health research has been given less priority in the NARS. With the same mission and responsibilities, EARO was renamed as Ethiopian Institute of Agricultural Research (EIAR) in October 2005 and its accountability was transferred from the Prime Minster to Ministry of Agriculture and Rural development. Veterinary Research was reorganized at different hierarchic levels: department, division, Case team, Commodity and National Research Program from 2016 to present. Despite the ups and downs in the transition of restructuring and reforming process, veterinary research program in the country has been dedicated to research activities focusing on technology development, promotion and dissemination, awareness creation, policy advocacy and best practices in the livestock sector of Ethiopia.

3. *Vision* of Veterinary Research in Development goals

Vision statement: "Providing enhanced technologies, knowledge and information for the control of animal diseases that contributes to improved livelihoods and sustainable development" (Source: National Animal Diseases Control Commodity Research Strategy - 2016-2030)

Ethiopian livestock are adapted to a wide range of ecology and largely contribute to healthy diets of human being particularly in pastoral areas that are not as appropriate for crop production. Animal source foods provide many essential nutrients (energy, protein, fatty acids, several vitamins and minerals) in easily bioavailable form that are not commonly seen in other food types (FBDG, 2022; FAO and FHI, 2016). As a result, the livestock sector provides an employment opportunity to over 30% of the agricultural labor force, generates 16-19% foreign exchange earnings, and accounts for 12% – 16% of national and 35% of agricultural GDP (TRAIDE Ethiopia, 2021; Statista, 2022). On the other hands, livestock production systems in Ethiopia are characterized by close contact between humans, domestic animals and wildlife, factors that increase vulnerability to emerging and re-emerging diseases many of which are zoonotic. As a result, both domesticated and wild animals are known to be frequent reservoirs of animal and human diseases pathogens, and foodborne pathogens that can cause human illness (WHO, 2018). As a result, the major challenges that affect production, productivity, growth and the sustainability of the livestock development and economic contribution. Despite the large number of livestock in the country, productivity in generally is low, mainly due to uncontrolled animal diseases.

Veterinary research, therefore, plays a decisive and crucial role in understanding the bigger picture of the basic biology of pathogens, host-pathogen interaction and welfare of animals that can ensure prevention, control, diagnosis and treatment of animal diseases. The evidence-based mitigation could significantly enhance public health and food safety by improving the survival of replacement breeding stock, production, productivity and reproductive performance. Furthermore, meeting the envisioned and targeted vet-

erinary research strategy could have enhanced the country's capability for early detection, identification, and containment of emerging, re-emerging and high impacting endemic TADs, socio-economic growth and export trade. To enable compliance with international standards, a robust and reliable surveillance system should be in place to generate accurate and realistic animal health information.

National Livestock development policy frameworks and research perspectives

The field of veterinary research has a long and illustrious history of contributing to advancements in animal and human welfare worldwide. However, a scenario in Ethiopia indicates that the level of support from veterinary research has not been in balance with the challenges posed by rampant animal diseases threatening livestock potential for trade and economic development. The prevention and control of animal diseases are dependent on resources, research facilities, and infrastructure, which determine the quality and level of veterinary research. Nevertheless, research in Ethiopia went through ups and downs with less performance than its authentic power in the federal and regional research and higher education institutes. Recognizing the contribution of veterinary research, the government has formulated different policy support tools and documents for the optimal accomplishment of research and development plans.

A. Development policy documents

Agriculture Sector Policy and Investment Framework (ASPIF - 2010 to 2020) - is the policy framework that brought about substantial changes in crop productivity and natural resources management. However, this policy framework hadn't considered the livestock sector equivalent to its potential. In the ASPIF strategic objectives, priority investment area, and in the subsequent policy strategies (PSRP, SDPRP, PASDEP, GTP I), veterinary research embedded in livestock research was barely addressed (JSR Ethiopia 2014). As it was mentioned as a priority investment area in its strategic objectives, the policies framework would have installed strong bases for research-development links to ensure the livestock sector investment at large and strategic alignment and harmony of veterinary research and veterinary service to attain the bigger goal of livestock development.

Animal health strategy and vision for Ethiopia (2013)

It was a document that provided a comprehensive and coherent framework for improving the health and welfare of livestock in Ethiopia, developed by the Ministry of Agriculture (MoA) and the International Livestock Research Institute (ILRI) as part of the Ethiopia Livestock Master Plan. This policy document identified the key challenges, such as the inability to control or eradicate livestock diseases of trade and livelihood importance. The document also identified the research gaps in identifying, testing, and adopting globally available technologies to strengthen animal health services. However, veterinary research engagement to address animal health problems or animal health services was not referenced in the identified strategic interventions.

The Livestock Master Plan (2015 to 2020)

This strategic document was designed to guide the government of Ethiopia on lists of some priority areas of animal health: (i) to establish a robust animal health information system; (ii) to reduce the impact of livestock diseases; (iii) to strengthen the quarantine, inspection and certification system; (iv) to reduce the impact of zoonotic diseases on human health; (v) to improve animal welfare by raising public awareness and introducing good practices; (vi) to improve the implementation capacities of veterinary services through preparation, endorsement and implementation of various legal frameworks, and (vii) to build advanced animal health system by restructuring veterinary services in line with the 2011 WOAH PVS. Accordingly, high-priority animal diseases were identified for different levels: nationwide interest, producers' level, market actors, farm households, and intensive farming (Shapiro et al. 2015; MoA and ILRI, 2015). Although in this policy document, continuous surveillance and data up to date were shown to meet WOAH requirements, the potential contribution of veterinary research was inadequately addressed.

Animal health surveillance strategy for Ethiopia (2019-2024)

The strategy was designed for early detection and guidance of the surveillance system to generate high-quality animal health information, inform policymakers of prompt interventions, and support a trust-

ful and evidence-based agreement with importing countries on livestock and livestock product exports. However, like the policy mentioned above documents, the surveillance strategy indicated that the animal health component received considerable attention with respect to challenges and associated development goals, but research backing and support in designing disease-specific intervention options and implementation strategies needed to be improved. This document did not address specific research input options that were in place to facilitate the control and prevention of economically significant livestock diseases: TADs and zoonotic diseases.

Agricultural Extension Strategy of Ethiopia, 2017

The extension system has federal and regional dimensions, and the 'Research-Extension-Farmer Linkage Councils' as part of the system to oversee technology generation, packaging, and dissemination, but has been inefficient and ineffective primarily due to severe limitations in institutional capacity. The strategic document identified limited access of farmers and other stakeholders to modern agricultural knowledge and information from research, HEIs, and private sectors as a major gap in the extension system. It was clearly stated that even if technologies are generated, they are often not available to most farmers due to a lack of systematic and centralized technology development strategies and mechanisms to register, release, or disseminate improved livestock technologies (Stakeholder Consultation, 2012). Agricultural research centers have made several efforts to transfer animal health technologies, protocols, guidelines, prototypes, and useable products in collaboration with the existing agricultural extension system (EIAR Proceedings, 2019-2022). On the contrary, the document stated that farmers' need to research agenda setting and extension of generated/adopted technologies in the livestock sector was inadequately considered. As a result, there was a complaint that technologies generated by research did not adequately consider farmers' demands in various agro-ecologies, and the weak link between research-extension-farmers further exacerbated the problems.

B. Research Strategy /policy documents

Animal Health Research Strategy (2015-2030) and Animal Health Research Perspective plan (2020-2030) (EIAR)

These strategic documents were developed as working documents of EIAR to direct veterinary research in its mandate areas. However, the structural organization of the veterinary research program under the Livestock Research Directorate has emphasized the potential risks of rampant animal diseases, but the level was not parallel to the contribution of veterinary research on the disease's dynamics, host-pathogen interactions, trade impact, and economic consequences. The document was well emphasized the situation analysis of animal diseases' impact on agriculture development, public health and environment, and socio-economic importance. Strengths, Weaknesses, Opportunities, and Challenges from the perspective of the identified research themes (disease prevention, disease detection, epidemiology, and surveillance, vector and vector-borne diseases, socioeconomic, research extension, and climate change) were discussed. However, this strategic document lacks alignment with other national strategic policy issues and stakeholders' contributions. The high-priority diseases identified (diseases of TADs, zoonotic and food safety importance) in the animal health service policy documents mentioned above have given emphasis for their identification, diagnosis, control, and prevention in terms of the risks they posed at the herd or individual animals, trade and public health. The modalities for institutional coordination, collaboration, and integration among institutes in the NARS (Federal institutes like EIAR, AHI, NTICC, NVI, and HEIs) in terms of problem identification, product development, technology adoption, and sharing the meager resources were weak. The verification, demonstration, and implementation of research findings inform of technologies and products through research extension were adequate to complement the livestock development and ensure optimum health services. Here one best model with optimal linkage and collaboration worth mentioning and the project on the Control of Bovine Tuberculosis (EthiCoBoTS), a collaboration between research institutions in Ethiopia, the UK, and Switzerland, working to investigate, map and propose control strategies that reduce the prevalence and, transmission of Bovine Tuberculosis (bTB) in the Ethiopian dairy cattle population is the best model for strong linkages among stakeholders (Adam et al., 2018).

Nevertheless, veterinary research program of EIAR, as mandated National research coordinator, has been providing financial support from the "National Agricultural Research Funds" (NARF) to collaborative research projects of National importance with AHI (FMD, IBR and calf mortality); AAU, CVMA

(bTB); Semera University (Reproductive Health Problems, Brucellosis), Haramaya (Ruminant Reproductive Disorders, Brucellosis, Calf Diarrhea of Dromedary Camel, calf mortality, and Camel Trypanosomosis in Somali and Oromia Regional States); JigJiga University (Camel Respiratory Disease Complex in Somali Regional); Mekele University (Evaluation of Cattle vaccine and Antimicrobial Sensitivity); Yabelo Agricultural Research Center (kids and lambs morbidity and mortality in pastoral areas, indigenous knowledge on zoonotic disease management); and Arba Minch research center (Bovine trypanosomiasis, animal health service delivery system), Andassa Livestock research center, PPR vaccine efficacy evaluation).

Furthermore, the National program has been and is conducting research activities on priority diseases such as LSD, FMD, bTB, Brucellosis, NCD, IBD, hide and skin, PPR, Some fishery diseases, Bee health and residues in its federal research centers. Research results were used to develop guidelines, protocols, prototypes, useable products and manuals on the control and prevention of these diseases. Though, not to the extent of their significance, diseases of transboundary, trade and zoonotic importance identified in the National Animal Health Strategy, LMP and Animal Health Surveillance strategy (FMD, LSD, Brucellosis, CBPP and bTB) were considered. As is seen from the five consecutive years of research directories, the federal research centers and regional institutes have been doing research on these diseases with great efforts bottlenecked by resource limitations and inadequately addressed integration and collaboration (Livestock Research Directories 2012, 2013, 2015, 2016). Inheriting a bigger vision, the EIAR veterinary research program has developed a commodity-oriented Ten-in-Ten research perspective plan (Animal Health Research Perspective plan (2020-2030) and National Animal health research strategies (2015-2030) to enhance the quality and delivery of animal health technologies, knowledge, and services in line with National standards.

Agricultural Extension and Communication Research, 2017-2030, *EIAR*

The Research-Extension Division of IAR was established in 1985 and restructured as the Research-Extension and Farmers' Linkage Department in 2008 to increase the knowledge available in the public domain, strengthening partnership and research communication to policymakers, and research-extension-farmer linkage (Revised Extension Research Strategic Plan, 2017-2030). It was promoted to Technology Transfer and Commercialization Research Directorate in 2016. Nevertheless, low uptake and technology adoption were identified to be the consequence of the inadequacy of livestock and natural resource technologies on-farm demonstrations and knowledge sharing. Despite the recognition of the previous weakness in policy advocacy towards the crop sector, the livestock sector is still barely covered, which further confirms the nationally weak linkage between research and extension in most livestock development policy documents and actual implementation. Moreover, within the livestock technologies extension, the issue of veterinary research and technology transfer, alignment with the national policy and strategies on livestock at large and animal health in particular inadvertently has been given moderate consideration. Limited communication and documentation of technology adoption and impacts that are critically needed for decision-making at both the institutional level and policy level are seen as major gaps (ASPIF 2010-2020). To fill the identified gaps, the TTC of EIAR has planned to intervene in the linkage and partnership, and communication and documentation as a strategic issue whereby the issue of veterinary research and extension can be solved. A limited amount of work has gone into improving animal health technologies, such as mitigation of mastitis, calf health management practices and demonstration, communication, and mitigation options for poultry diseases, NCD vaccination practices, and communication and demonstration that has been distributed and practices have been communicated by the extension system.

Pastoral, Agro-Pastoral and Special Support Regions Research and Capacity Building (Year), *EIAR*

An overview of Pastoral, Agro-Pastoral, and Special Support Regions Research in EIAR states that it contributed to the development of Ethiopian agriculture by importing and adopting technologies from different countries, generating and improving local technologies, and scaling up improved technologies and information. The beneficiaries of this special support were mentioned to be Afar, Somali, Gambella, Mizan Tepi, Borena Benishangul Gumuz, and other new regions. Nevertheless, these regions didn't optimally use their livestock and rangeland resources due to a number of limiting factors, including livestock diseases (http://www.eiar.gov.et/index.php/en /Pastoral, Agro-Pastoral and Special Support Regions Research and Capacity Building). Limited efforts were made to enhance animal health technologies such as FMD vaccination practices, NCD vaccination and demonstration practices (Pawe research center), and

acaricide evaluation and demonstration, which has been promoted by PAP in afar (Werer R. center in the areas). There are also a number of committees for pastoral affairs, including the House of Representatives, Ministry of Federal Affairs, and the special coordination offices of the PAP areas, but none of these has a formal mandate and responsibilities for the development of the veterinary research for technology generation /adoption (ASPIF 2010-2020). Besides, the early institutions that are the foundation of the PAP systems endowed with deep-rooted animal disease management, early warning systems, and natural resources management were given little attention in the extension system.

Institutional mandate of Veterinary Research in Ethiopia

Ethiopian Institute of Agricultural Research (EIAR)

(Council of Ministers Regulation No. 527/2022)

In Ethiopia, Veterinary research was launched as a research division under the Animal sciences department in strategically located IAR research centers at Holeta, Bako, Debre Zeit, Adami Tulu, and Werer research centers in the 1980s. This affirms the eminent need for veterinary research in the livestock and livestock product trade, as well as zoonosis and public health importance. Consequently, the Institute of Animal Health Research was established to do veterinary research. EARO (Established by Proclamation **No. 79/1997**), inheriting the IAR mission, was given the power and duty to formulate national agricultural research guidelines and strategies, coordinate the National Agricultural Research System (NARS) of Ethiopia, and undertake research in the various agro-ecological zones.

Although, concomitantly, a number of IAR research centers transferred to the regional governments and became independent research centers, NARS have rearranged to include the Federal Research Institutes, including IAHR, NVI, other Federal Research Institutes like HEIs, and the RARIs. Accordingly, NAHRC, under EARO, had been functioning for limited years with substantial contributions to animal disease control and prevention, enhancing live animal and livestock product trading, controlling zoonotic diseases, and protecting public health. After NAHRC reconfigured to other branches, the Veterinary Research in the EIAR (Proclamation **No. 382/2004)** was organized into the National Veterinary Research program and continued to coordinate Veterinary research in Ethiopia at Harc, Asosa, Pawe, Tepi, Jima, Welkitie, Aboboa, Kulumsa, Debremarkos, Mehoni, Ambo, Werer, Warra Ilu, Adea berga and Debrezeit research centers that are found in the different regions of Ethiopia. Presently, Veterinary research is carried out in different federal institutes like EIAR, NVI, AHI, EPHI, Bio and Emerging Technology Institute, HEIs, and CGIAR Center (ILRI). All the federal and regional research institutes had redundant, overlapping, and duplicated roles and responsibilities with unsystematic and competitive striving for meager and unshared resources, as indicated below with proclamations and regulations.

Animal Health Institute, AHI

(Established by the Council of Minister Regulation No. 503/2022)

AHI is currently composed of the previously National Animal Health Diagnostic and Investigation Center (NAHDIC) and the National Institute for Control and Eradication of Tsetse fly and Trypanosomosis (NICETT) and functions with the following objectives. These are to ensure the competitiveness and benefit of the country from domestic and international livestock resource market through conducting research and diagnostics relevant to the prevention and control of animal diseases before causing significant consequences on the economy, public health, and environment; to enhance livestock production and productivity by applying prevention, control and eradication measures in areas affected by tsetse fly and trypanosomosis; and to develop the capacity of stakeholders involved in the sector through provision of training and consultancy services on animal health. It also conducts development activities and coordinates research on animal health problems that cause negative impacts on the economy, public health, and environment; evaluates and promotes research outcomes; and provides policy ideas. Moreover, the institute is mandated to identify animal disease control strategies based on research and diagnostic findings and provide recommendations; adapt animal health research technologies and conduct research and diagnostic services; and create awareness of zoonotic diseases. Developing veterinary laboratory diagnostic inputs, innovating technology, conducting validation, ensuring their utilization, encouraging others involved in input development and production, and conducting laboratory tests and issuing internation-

ally acceptable test results as per a request for certification of export or import of animals were included in its responsibility. However, the link and modalities of AHI with other federal and regional research institutes have been more of a collaborative relation than the coordination and guidance role.

National Veterinary Institute (NVI)

(Proclamation No. 25/1992 and Council of Ministers Regulations No. 52/1999),

NVI was established at Bishoftu /Debre Zeit in 1964 under the Ministry of Agriculture for biological production and vaccine-related research. NVI has been responsible for the production and supply of vaccines for domestic markets and PTA (Preferential Trade Area) countries of Eastern, Western, and Southern Africa under the quality control of the Pan African Veterinary Vaccine Control Center (PANVAC) of the African Union. NVI was graded as the biggest vaccine-producing center of all veterinary laboratories in Tropical Africa, with well-developed infrastructure and state-of-the-art equipment and technologies. The National Veterinary Institute was organized as a public enterprise (Proclamation No. 25/1992 and Council of Ministers Regulations No**. 52/1999**) and purely dedicated to the Development, Manufacture, Sales, and Distribution of veterinary vaccines, and actively takes part in vaccine-related problem diagnosis and identification, developing and promoting research products to protect animal welfare and the environment. The institute works harmoniously with the EIAR, national veterinary service-delivering institutions, and national and international institutes on vaccine development and improvement, vaccine production, pathogen identification and characterization, and other related technology transfer activities (https://www.nvi.com.et/).

National Tsetse and Trypanosomiasis Investigation and Control Institute (NTTICI)

NTTICI was established in 1972 (https://www.gfar.net/) with a mandate to conduct surveillance of tsetse and non-tsetse-borne trypanosomiasis and develop appropriate tsetse and trypanosomiasis control and eradication strategies. The main objective of the Institute was to identify areas affected by tsetse fly and trypanosomiasis and organize them to make them suitable for work, work in collaboration with the relevant bodies, and carry out research and activities for the eradication of the tsetse fly. Additionally, the National Institute for Control and Eradication of Tsetse Fly and Trypanosomiasis is the third federal institute specifically mandated to conduct veterinary research (Council of Ministers Regulation No. **304/2013**). Under the new proclamation, it was given a mandate of exercising more collaborative works than coordinating research in the specified area.

The Ethiopian Wildlife Conservation Authority (EWCA)

EWCA was established under Proclamation number 163 -575/2008 having the responsibility to undertake appropriate conservation and development of wildlife for its sustainable use, conduct research and training programs, and collect, process, and provide users with up-to-date information on the conservation, development, and utilization of wildlife. Besides, it is responsible to prevent and control incidents of wildlife diseases within or outside of conservation areas. However, EWCA has no regular surveillance plan but undertakes a sort of opportunistic survey during outbreak occurrences (e.g., from dead birds and animals) for diagnosis and establishes formal research strategies to protect the wildlife itself and/or the transmission of animal diseases toward or from the wildlife. Nevertheless, the intention of scientifically developing and conserving Ethiopia's wildlife resources for ecological, economic, and social benefits has been realized only through competent veterinary research-based disease control and policy decisions.

Bio and Emerging Technology Institute (BETin)

(Established by Council of Ministers Regulation No. 388 /2016)

The current BETin, formerly Ethiopian Biotechnology Council and Biotechnology Institute was established with the objectives of establishing a system that coordinates research and research infrastructures on bio-technology and emerging technologies dispersed in various sectors to contribute to the Develop-

ment of the country and coordinating and leading biotechnology research and through transfer, adaptation, and promotion of appropriate technology, creation of conducive environment for local development of indigenous new technologies by building enabling capacities. Besides, it has the objective to establish, strengthen, lead, and coordinate research and development support centers to strengthen biotechnology research and development needed for rapid progress in agriculture and create opportunities and an enabling environment for researchers. The Institute was mandated to establish a system to coordinate the dispersed biotechnology researches and research infrastructures of the country in a manner that can contribute for the development of the country; and coordinate the national biotechnology research and development system through coordination, collaboration and synergy for enhanced effectiveness. The institute was also authorized to strengthen, coordinate, and make accessible specialized research and service centers to be established to strengthen biotechnology education, which it modestly exercises in relation to agricultural biotechnology with institutes engaged in agricultural research, including animal health.

Research in Ethiopian Higher Learning institutions

(Higher Education Proclamation No. 650/2009)

Research in higher education institutions in certain countries plays a vital role in promoting and resolving the nation's problems by engaging its faculty members in different demand-driven research by prioritizing various thematic areas (Giday and Saragni, 2019). According to a report from the Ethiopian Ministry of Education in 2014, Universities in Ethiopia are mandated to conduct research that focuses on addressing the country's national and regional development needs (FDRE, 2009). In 2000, there was only one Veterinary Education Institution in Ethiopia - Addis Ababa University Faculty of Veterinary Medicine, and this number increased to four in 2003 and to 14 in 2022. Accordingly, research conducted by HEIs is performed without being limited to specific areas or geographical mandates for external projects but with a limited geographic location for government-funded projects. Hence, facing many challenges, such as resource limitations, insufficient funding, limited collaboration or linkage with industry/relevant stakeholders, and a lack of research-oriented teaching (Weldemichael, 2014; Ranganathan and Brian, 2018; Alemu, 2023). Furthermore, in second-generation universities, less integration between research and teaching, a hazy understanding of the significance of undergraduate research, less commitment from students and research advisors, and inadequacy of research leadership affected the effort to boost the quality of undergraduate research (Endalu, 2017). The inefficient use of available resources, the lack of experience, and the limited scope /focus on specific issues that mainly occur in the central parts of the country are some of the additional challenges affecting animal health research (Yizengaw, 2005). Moreover, many of the research findings remained unused on the shelf and did not address the real problems of the communities. Moreover, the country does not have a veterinary council or stature-body to establish standards and credential procedures qualified to address the special needs of the country and animal health research ethics, and hence, it is not focused on applied research that makes changes in development endeavors. Currently, Ethiopia has eight universities that are designated as Centers of Excellence in research by the Ministry of Science and Higher Education: Addis Ababa, Haramaya, Jimma, Hawassa, Bahir Dar, Gondar, Mekelle and Arba Minch Universities (FBC, 2020). Although the research focus of these universities varies depending on the institution and its specialization, all of them have an animal health research component managed by the Office of Research and Technology Transfer that coordinates and supports internal or externally funded research projects (Giday and Sarangi, 2019).

Regional Research Institutes

The federal agricultural research underwent significant reform in 1993 following the declaration of a decentralized political system (The respective regional states' proclamations). Accordingly, a number of IAR research centers were transferred to regional governments and became independent research centers to address diseases of high priority for the region. Although RARIs are authorized to set their own priority, there has been great variation in veterinary research practice in different RARIs: some developed well-defined strategies, adequately guided and budgeted, while the progress in some regional research institutes has been weak and underfunded. Nevertheless, the number of RARIs engaged in veterinary research with respect to the vast livestock number, species, distribution, and rampant livestock diseases in the country is too small and very limited in capacity. Most RARIs are bureaucratically truncated to establish clear links and lines of collaboration between the institutes and stakeholders /partners. A well-

functioning updated veterinary research strategy and collaboration across institutions and sectors are required to manage diseases of zoonotic and public health importance, trade and TADs, diseases of production and productivity that are even more complex and require coordination and collaboration across institutions, sectors, and development partners.

Challenges and opportunities of Veterinary research in Ethiopia

Research as a driver of economic development through the generation of information, knowledge, and technology, and transfer consistent with the priority areas of the country is not arguable. Moreover, currently, the existence of the Ethiopian Agriculture Authority, the availability of policy and strategy documents on livestock development, the Expansion of colleges and universities to produce skilled human resources in veterinary professionals, the High demand for food of animal origin, the Availability of advanced cutting-edge technologies for veterinary research in the global market, and Huge livestock potential in the country can be used as invaluable opportunities for veterinary research endeavor. On the contrary, uncontrolled animal movement within and along borders, Increased incidence of Emerging and re-emerging zoonotic diseases due to climate change, natural and manmade hazards, Prevalence of trade-limiting TADs in the country and/or in the neighboring countries, Wide access to wildlife with livestock, and Lack of animal registration, identification, traceability, and certification system in the country are undeniable challenges. To convert these challenges into opportunities and meet the intended goal, a robust and well-resourced institution with qualified staff and a solid commitment to research is crucial. These institutions should have well-coordinated and organized leaders with similar efforts and commitments to contribute to the national hub for coordinated research activities. By developing a research system with a clearly articulated research agenda, policy, and strategies, it would be much easier to access research funding and to further enhance the country's research capacity through engagement with international partners. Overall, although it illusively looks at the overlap of responsibilities and duplications of duties, the actual fact on the ground is the effect of staggering or poorly organized coordination and/or very weak and inconsistent links. The restructuring and reforming of the organizational structure further complicated the challenges and hindered the achievement of the envisioned goals. The improvement effort in veterinary research is, therefore, entrapped in the vicious circle and more often goes through restructuring and reformation, change of proclamation and authorization, and reshuffling of duties and responsibilities.

Research capacity profiles in the research system

The federal agricultural research underwent significant reform in 1992 following the declaration of a decentralized political system, thus establishing regional state proclamations. Accordingly, a number of federal research centers were transferred to regional governments and became independent research centers. Before this structural reform, the number of researchers engaged in the research system was very low, as indicated in the table. This number was significantly increased after structural research reformation due to the fact that RARIs are authorized to set their priority and capacity in terms of physical and human research capacities. Nevertheless, the number of researchers engaged in conducting veterinary research both in the federal and regional research centers in line with the vast livestock potential and animal disease distribution in the country is very limited. In order to address emerging demands, research on human capacity building needs to be enhanced to meet the country's overall envisioned goals.

Table 1: Research capacity profile in the federal (EIAR) & regional (RARIS) research centers

Year	Research Centers	No of animal health researchers (PhD)	No of animal health researchers (MVSc, DVM)	No of Animal Health Research (assistants)	Total
Before 2005	EIAR	NA	<20	<15	<35
	RARIS	NA	<15	<10	<25
From 2005 -2024	EIAR	12	34	28	74
	RARIS	4	41	22	67

Grand Total	16	110	75	201

(Source: HR report, 2024)

Deliverable Animal health research outputs and technologies

Animal health research findings can help farmers, pastoralists, agro-pastoralists, producers, handlers, processors, importers, exporters, policymakers, NGOs, and consumers to understand the types of animal diseases better, how diseases are transmitted, and how to prevent, diagnose, and treat it with the final goal of protecting **human health and welfare, animals and** the **environment.** The ultimate goal of research findings is to improve services and/or minimize challenges through the dissemination and utilization of applicable technologies, prototypes, and usable products in the form of manuals, guidelines, products, technologies, prototypes, or information. Accordingly, veterinary research in the NARS has been producing protocols, prototypes, useable products, manuals, printed communication materials, and guidelines and has been transferred to mid- and end-users. These included community-based mitigation measures of Trypanosomiasis, such as integrated tsetse fly control efforts (pour-on, insecticide-impregnated targets, and spray mechanisms) and vector density management in the tsetse fly belt areas. As a result, the overall prevalence of trypanosomiasis and the overall relative density of tsetse fly were decreased from 12.14 % before intervention to 3.61 % and 84.1 % from mean catch of 1.13 fly/trap/ day before intervention to 0.18 fly/trap/day, respectively, after intervention. Different packages of animal health technologies that have been promoted to beneficiaries have resulted in reducing mortality of crossbred calves from 26.2% to 7.9%, and the application and demonstration of other practices resulted in reducing the incidence of subclinical mastitis from 44% to 11%, respectively, at on-farm intervention. The pre-intervention infection rate of bTB (46.4%) in cattle was reduced to 0.072 after intervention based on the standard OIE tuberculin test and other protocols in the selected dairy farms of Ethiopia. The Efficacy of Newcastle Disease 12 Vaccine (ND12) delivered via oral and spray route under smallholder producers after booster vaccination had produced 90% and 93% of antibody titer in chickens. Similarly, chicken vaccinated with live HB1 and inactivated oil adjuvant vaccine at seven days and subsequently revaccinated at 8 and 17 weeks of age showed relatively higher hemagglutination inhibition (HI) antibody titer that gave 96% protection. Moreover, the development and formulation of products from different ethno-veterinary herbs and practices were used as alternative treatments. *P. senegalensis* was therapeutically efficacious for treating dermatophytosis in dairy calves, whereas *L. sativum* product was effective in treating coccidiosis in poultry farms. About 95.2% of crossbred calves with ringworm infection were cured when whit-field ointment, povidone Iodine tincture, and ketoconazole were used in combination. In the PPR-affected areas where goat PPR virus seroprevalence was 28.12%, the antibody and protective percentage level elicited following vaccination was 91.3%. Different diagnostic outputs and services were rendered and disseminated to beneficiaries. Additionally, manuals, guidelines, and training materials have been produced and distributed to several beneficiaries.

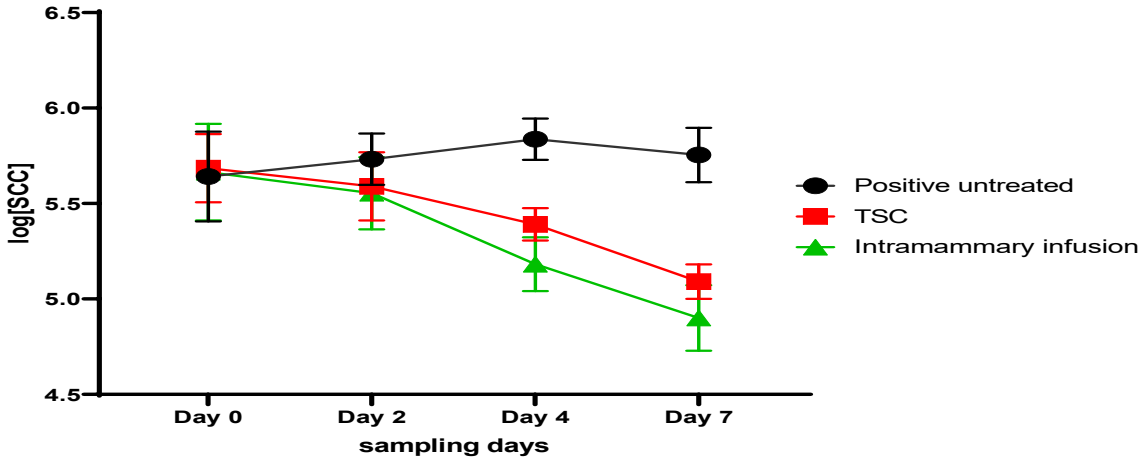

Figure 1: Therapeutic efficacy of TSC infusion in Mastitic cows

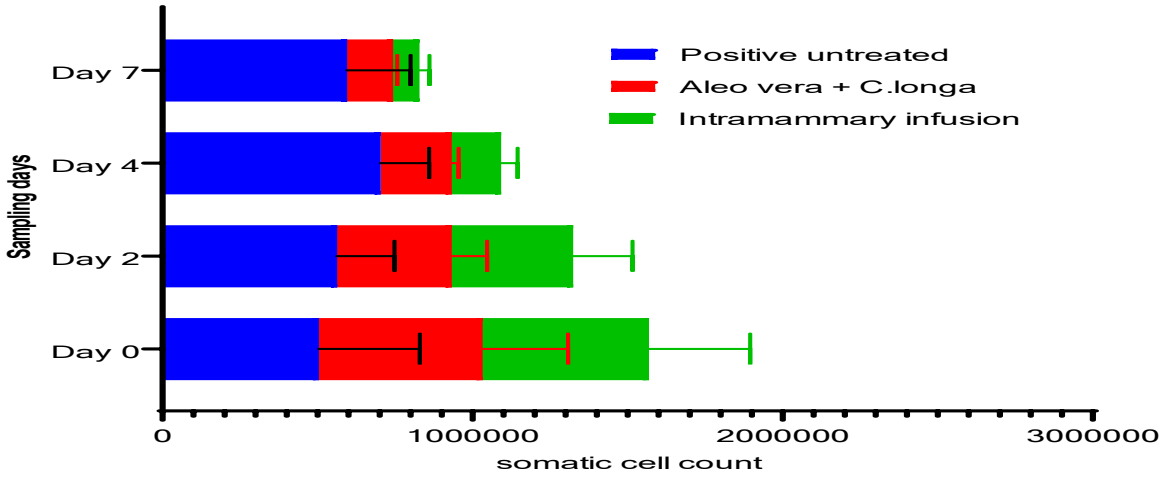

Figure 2: Combination of Aloe vera, curcuma longa and intramammary infusion

Table 2: Pre and post-intervention occurrence of morbidity and mortality in dairy calves (N=140)

Location	Events	Pre-intervention [No. (%)]	Post-intervention [No. (%)]
	Morbidity	42 (30)	19 (13.6)
On-farm	Mortality	11 (26.2)	3 (7.9)

Source: On-farm study - NAHR (2021/22, 2015/16).

After intervention, the incidence of mastitis decreased from 44% to 11.1% at the on-farm MTV scheme due to practical demonstrations and enhanced knowledge of farmers.

Table 3: Mastitis incidences in crossbred dairy cows at different schemes

Location	Mastitis Infection	Pre-intervention [No. (%)]	Post-intervention [No. (%)]
On-station	Clinical	6 (3)	2 (0.01)
	Subclinical	116 (58)	62 (31)
	Clinical	10 (5)	6 (0.03)
On-farm	Subclinical	145 (72.6)	92 (46)

Source: A prospective study - EAAPP (2011-2015/16, 2021/22).

2. Animal trypanosomiasis and Tsetse control technologies

In Ethiopia, different efforts have been made in the past couple of decades to control and eradicate AAT. Some reports (Girmay *et al.,* 2016) indicated that, in some areas, Community-based tsetse fly control significantly reduces fly density and trypanosomosis prevalence. In some areas, medicinal plants used for the prevention of animal trypanosomiasis havealso been identified (Shilema *et al.,* 2013). Thus, research needs to focus on the development of new and potent technologies that could control the Tsetse vector and its ecology or the Trypanosoma parasite.

- Mitigation and control intervention for Trypanosomosis in the Tsetse fly belt areas introduced and demonstrated to 110 farmers in the Asosa, Bambasi, and Homosha districts of Benishangul Gumuz Region. Community-based mitigation measures such as integrated tsetse fly control efforts (pour on, insecticide-impregnated fly trap targets and spray mechanisms) and vector density management were introduced and applied in Arba Minch, Bench Maji, Semen Bench, and Metekel zones of Ethiopia. Community-based tsetse fly and trypanosomosis control using targets has been distributed and demonstrated to Pawe, Dibate, and Dangur districts of Metekel zone, Benishangul gumuz areas of Ethiopia.

- A total of 1010 deltamethrin impregnated targets (503, 281, and 226 for Pawe, Dibate, and Dangur, respectively), of which 70 % were developed and deployed in the selected 22 villages and ten districts from Pawe, seven from Dibate, and five villages from Dangur were chosen as tsetse fly intervention areas.
- The overall prevalence of trypanosomosis was decreased from 12.14 % before control to 3.61 % after control in the intervention sites. The overall relative density of tsetse fly (*G. tachinoides*) declined by 84.1 % from a mean catch of 1.13 fly/trap/ day before control to 0.18 fly/trap/day after control. The use of deltamethrin-impregnated targets can significantly reduce the tsetse fly population in the intervened villages.

Table 4: Site-based before and after control tsetse fly catch

Sites	Intervention	Tsetse fly caught per year	Average tsetse fly/trap/day
Village 28	Before	768	1.28
	After	135	0.23
Village 30	Before	924	1.54
	After	148	0.25
Village Zigh	Before	336	0.56
	After	43	0.07
Total	Before	676	1.13
	After	109	0.18

Table 5: Overall prevalence of Trypanosomosis before and after control of tsetse fly

Intervention	Cattle number examined	Positive animals	Prevalence (%)
Before control	1260	153	12.14
After control	4870	176	3.61
Total	6130	329	5.37

Table 6: Site-based prevalence of trypanosomiasis before and after control of tsetse fly

Sites	Time	Cattle number examined	Number of infected	Prevalence (%)
Village 28	Before	436	46	10.55 a
	After	1259	65	5.16 A
Village 30	Before	492	74	15.04 b
	After	1332	49	3.68 AB
Village zigh	Before	332	33	9.94 b
	After	2279	62	2.72 B
Total	Before	1250	153	12.14
	After	4870	176	3.61

Major Research achievements and outputs delivered to beneficiaries

Table 7: Types of dairy cattle health technologies and practices generated so far in Ethiopia

Type of technology and innovation	Breakthroughs/ Achievements
Evaluation and promotion of Antifungal activity of P. *senegalensis* against Bovine Dermatophilosis in crossbred Animals	*P. senegalensis* was therapeutically efficacious for treating dermatophilosis and this product could be applied as an alternative medicine to antifungal agents
Antibacterial efficacy of *Vernonia amygdalina* crude extract against Staphylococcus aurous causing cases of mastitis in Dairy farms	The inhibitory effect of *Vernonia amygdalina* against staphylococcus aurous determined, and its leaf crude extract can treat cases of mastitis

Type of technology and innovation	Breakthroughs/ Achievements
On-farm acaricide resistance evaluation and response of cattle ticks in central Ethiopia	Acaricidal efficacy of diazinon against induced tick infestation evaluated, resistance ticks known and, the therapeutic efficacy of acaricides on tick species evaluated, and concentration that induced mortality recommended for wider use
Acaricidal potency and effects of Calpurnia Aurea against dairy cattle ticks	Inhibitory effect and efficacy of Calpurnia Aurea against ticks investigated and recommended for use
Evaluation of Antibacterial Therapeutic activity *of P. senegalensis* as alternative medicine against Salmonellosis in crossbred dairy calves	*P. senegalensis* was efficacious as herbal agent for treating salmonellosis, and this technological product is recommended as therapeutic agent
Enhancing of soda Test, Surf Test, and combined MD-19 Technology as alternative California Mastitis test for the diagnosis of Mastitis cases in Dairy cows	Therapeutic doses of soda and surf test at different preparations validated as an alternative to CMT for the diagnosis of mastitis cases in dairy animals Pen side MD-19 Mastitis detection Technology (MAS-D-Tech) evaluated and demonstrated for use.
Protective efficacy of combination of Fungicidal agents as Therapeutic and chemical regimens in treating ringworm-infected crossbred dairy calves	The combination of whit-field ointment, conventional povidone Iodine tincture, and ketoconazole agents resulted in a curing rate of 95.2% and complete recovery in ringworm-infected crossbred calves & the treatment regimens recommended for broader use
Anthelmintic Drug evaluation and response of GIT Nematodes through Fecal Egg Count Reduction Test in Jersey breed of Dairy Cattle	Percentage reduction in mean fecal egg count information and protocols for Albendazole (95.51%) and Tetraclozan (98.18%) against worms availed
Occurrence of Parasites and Subclinical Mastitis on Crossbred Dairy Cows under different Feeding regimens in Girar Jarso and Muka Turi districts	On-farm interventions to reduce external and gastrointestinal parasites and sub-clinical mastitis in cross-breed lactating dairy cows were determined. The efficacy of intervention options demonstrated and adopted under the user farmers
On-farm outbreak and Genetic characterization of FMD virus isolated from clinical cases in the dairy farms in central Ethiopia	Serotypes circulating in the area known and molecularly characterized, Potent serotype matched vaccines against field strains recommended for use. Outbreak information is delivered to farm owners to inform them when an outbreak occurs
Identification of dairy calf Health problems and optimization of management packages	Newborn calf diseases and disorders identified and their intervention methods demonstrated under smallholder farmers
Factors and defects causing hide and skin quality deterioration in Ethiopia	Factors and defects caused hide and skin quality downgrading investigated and interventions recommended for use
Anthelmintic drug quality, knowledge and management practices in milk belt of Adea Berga district	Incorrect dosage and exclusive use of drugs of the same mode of action identified. Substandard quality drugs and inappropriate handling information & handling methods determined for use
Evaluation and demonstration of mastitis mitigation technologies in crossbred cows distributed to smallholder farmers	Major novel drugs used to treat mastitis identified and mitigation methods evaluated, demonstrated, and adopted under farmers' condition
Infestation of Ectoparasite in Dairy Calves Reared by Smallholder Farmers in Central Areas of Ethiopia	Higher infestation rate during wet and dry seasons known and appropriate prophylactic spraying and dipping technologies recommended and adopted
Louscidal effect of *Calpurnia aurea* against lice in crossbred dairy calves	Inhibitory effect of Calpurnia Aurea against Lice of crossbred calves evaluated and recommended for use
Introducing and enhancing Biosecurity practices in the Dairy farms	Disease mitigation mechanisms that reduce the introduction of disease between farms developed and delivery modalities adopted in the dairy farms

Type of technology and innovation	Breakthroughs/ Achievements
Detection and characterization of drug resistance patterns of mastitis-causing pathogens isolated from clinical cases and promotion of alternative Protocols	Organisms causing intramammary infection identified & antimicrobial susceptibility profiled, and protocols applied and recommended for use
Evaluation of test and segregation control intervention of M. Bovis in the dairy farms	Pre-intervention infection rate of bTB in the dairy farms of Ethiopia (46.4%) was reduced to 0.072 after intervention based on the standard OIE tuberculin test and other protocols. bTB mitigation measures introduced and adopted to reduce disease risk in the intervened dairy farms
Trypanocidal Drugs Resistance and Their Utilization Practices inBenishangul-Gumuz Region, Ethiopia	Trypanosome-infected Sheko (12.5%) and Boran (37.5%) cattle breeds treated with ISMM had infections on day 28 post-treatment, and DIM-treated Sheko (25%), and Boran (75%) breeds had persistent trypanosomes on day 14 post-treatment. Treatment failure was higher in Boran breeds, and trypanosomosis relapse occurred at different times. Shifting the type of drugs to relapsed cases, treatment of cases with DIM first and with ISMM after two weeks was found to be better and applied to minimize relapse of the infection.
Community-based tsetse fly control significantly reduces flydensity and trypanosomiasis prevalence in Metekel Zone, Northwest Ethiopia.	Trypanosome species identified were *T. congolense* (66.7%) mixed *T. vivax* and *T. congolense* (19.4%), T. vivax (9.3%) and T. brucei (4.6%). Overall average tsetse fly (*Glossina tachinoides*) density decreased from 1.13 to 0.18 fly/trap/day after control, and the overall prevalence of trypanosomosis decreased from 12.14 % before to 3.61 % after control coincides with the tsetse fly reduction in the areas. Integrated insecticide pour-on, odor-baited, and insecticide-impregnated targets and traps kindred with curative and prophylactic treatments of trypanocidal drugs appropriate for riverine tsetse species recommended to be scaled up widely
Epidemiology and Control Options of Bovine Trypanosomiasis in Bench Maji Zone	Trypanosoma infection rate determined (12.9%), *T. condolence (55.2%), T. vivax (36.2%),* mixed infection (5.2%), and *T. brucei* (3.4%) identified. Integrated vector and parasite control measures are recommended in the study areas
Milk Antibiotic Residues Detection and Evaluation of the Consumers' Knowledge in Milk Belt Areas of Ethiopia	Oxytetracycline, Penciline-streptomycin, intramammary infusion, and sulpha drugs were the most commonly used drugs, and the occurrence of Pencillin G and oxytetracycline residues in raw bulk milk were 10% by Delvotest SP assay. Proper use of milk quality and safety standards are essential to provide the community with safe and wholesome milk and milk products.
Protective therapeutic efficacy of the combination of *Aloe vera, Vernonia amygdalina* and *Ajuga Intergrifolia* against cases of mastitis	The combination of *Aloe vera, Vernonia amygdalina* & *Ajuga Intergrifolia* against cases of mastitis validated as alternative teat dip formulations and agents

Table 2. Types of Poultry Health Technologies and Practices

Type of technology and innovation	Major outputs/achievement
Promotion of l. sativum crude product as alternative prophylaxis for the protection of chicken coccidiosis in poultry farms	Protective efficacy of Lepidium sativum against coccidiosis as an alternative prophylactic agent for use in the farms.
Maternal antibody transfer to the pathogen in dual-purpose Koekoek breeder chickens	Percentage of maternal antibody transfer determined on the ratio of chicken antibody titer to maternal antibody titer and the rate of maternal antibody transfer to chicken against infectious bursal disease (100%) and for Newcastle disease (79.2%) determined for broader application

Protective Effects of Moringa stenopetala leaf supplemented diets on Eimeria tenella Infected Broiler Chickens	Protective effect of M. stenopetala against E. tenella infection of chickens evaluated; chickens supplemented with M. stenopetala dry leaf powder showed increased body weight gain, reduced oocyst counts and cecal lesions, and the product was found to be better than the action of Amprolium agent
Introducing and promoting biosecurity practices in poultry farms	Disease mitigation mechanisms that reduce the introduction of disease between farms developed and delivery modalities recommended in the poultry farms
Vaccination of layers against NCD using inactivated oil adjuvant and live vaccines.	Chicken vaccinated with live HB1 and inactivated oil adjuvant vaccine at seven days and subsequently revaccinated at 8 and 17 weeks of age showed relatively higher hemagglutination inhibition (HI) antibody titer that gave 96% protection. Chicken vaccinated with HB1 and Lasota subsequently attained antibody peak titer after the second vaccination and 84% protection
Molecular Characterization of IBDV Strain Circulating in Commercial Poultry Farms	About 72.73% of clinical samples were positive for infectious bursal disease virus RNA by RT-PCR and IBD of chicken control and prevention options based on the availability of potent vaccines against the IBD strains recommended
Spray and Oral Delivery of Newcastle Disease 12 Vaccine under Smallholder Farmers	The efficacy of the ND 12 vaccine was delivered via oral and spray routes under smallholder producers. After booster vaccination, 90%, 90%, and 93% of chickens had antibody titers that exceeded the vaccinated group through the delivery of oral, eye drops, and spray routes, respectively. ND12 vaccine delivered via the oral route and spray method provoked protective antibodies similar to the eye drops technique under smallholder producers recommended for wider areas

Table 8: Types of Small ruminant health technologies and intervention practices

Type of technology and knowledge	Major Outputs/Achievements
Clinical and Abattoir based study on Female reproduction disease of small ruminants	Reproductive health problems in Ewes (61.6%) and Does (38.4%). Collected samples from lesions of reproductive organs were cultured positive for gram-positive bacilli, non-chained cocci, Enterobacteriaceae and chained cocci, and filamentous GPB Integrated disease management practices recommended
Causes of Abortion in Small Ruminants of Afar Area	Serum collected from aborted animals indicated 63.5% seropositive for Brucellosis, *Coxiella burneti,* and Chlamydia abortus. The c-ELISA seroprevalence of *C. burnetii, C. abortus*, and *Brucella* spp was 10%, 8.33%, and 5%, and in ewe and 39%, 13%, and 10.71% in does, respectively Intervention mechanisms explored and developed for use
Incidence Rate of Trypanosomosis in Small Gumuz, Agew, and Felata Goat Breeds	The overall incidence was 3.3%. The incidence of infection was 1.1% in Gumuz, 2.2% in Agewu and 0.0% in Fenetale. Intervention mechanisms along with conventional treatment methods were demonstrated and recommended
Epidemiology and Evaluation of PPR antibody level after vaccination regimes in Goats at model Goat breeding villages	Scientific information on the overall seroprevalence of the PPR virus was generated (28.12%) Protective percentage level or immunity to PPR infection after vaccination was (91.3%) and PPR vaccination strategies recommended for use

Table 9: Types of camel herd health technologies and intervention practices generated in Ethiopia

Type of technology and innovations	Breakthroughs/Achievements

Parasitological and serological study of camel trypanosomosis in the Gabi Rasu zone of the Afar region	Overall camel trypanosomosis infection (5.15%) with Wool's method and 23.77% with card agglutination technique. The prevalence rate in Awash Fentale was 7.5%, and 2.88% was in the Amibara district. Disease and vector management integrated packages are recommended
Determination of reproductive health problems of She-Camels in Fafan Zone	E. coli (62.9%), coagulase-negative staphylococcus species (57.1%), staphylococcus aurous (42.9%), streptococcus species (25.7%), and salmonella species (17.1%) were isolated from reproductive cases. Targeted intervention options recommended for use in camel-rearing communities
Drug Sensitivity of Awash Fentale Isolates of *Trypanosoma evansi* in experimentally infected mice	'Trypanocidal activity of Diminazene Di aceturate and Isomethadium sodium conducted against *Trypanosoma evansi* isolated from naturally infected camels Mice treated with the recommended dose of Diminazen Di aceturate showed a relapse after 20 days post-treatment with peak parasitemia on the 25th dad, and Mice treated first with the recommended dose of Isomethadium chloride showed relapse after 21 days, and peak parasitemia was observed at 27th days post-treatment. *T. evansi* is sensitive to Diminazen Di aceturate and Isomethadium sodium drugs, and the disease can be cured by increasing the dose, and this was recommended for scaling effort
Determination of Bacterial Causes and Risk Factors of Camel Respiratory Disease Complex in Somali Regional State	70.8% of the cultured samples from lung tissues harbored *S. aurous* (18.75%), *P. multocida (15.2%),* and *K. pneumoniae* (10.7%), whereas *E. coli* (17.1%), S. aureus 10 (14.3%) and CNS (10%) were recovered from tracheal samples and the majority of camel respiratory pathogens, were susceptible to norfloxacin, streptomycin, gentamicin and Kanamycin but resistant to ampicillin and tetracycline. The use of vaccine and potent drugs are recommended
Major Microbial and Parasitic Pathogens Causing Calf Diarrhea of Dromedary Camel in Selected Areas of Eastern Ethiopia	Occurrence of camel calf diarrhea in the herd (54.4%), E. coli (65.9%), Coccidia (47.3%), and Cryptosporidium oocysts (46.1%) were identified Use of effective treatment, three liters or 10% bodyweight of colostrum provision, and a combination of potent drugs recommended in the areas.
Camel Ectoparasites in Different Districts of Afar Region	Majority of the camels harbored single or mixed parasites, and the infestation rate was 77.4% in Afar Camel Externally applied conventional chemicals recommended
Epidemiology, Vector Ecology, and Intervention Methods of Camel Trypanosomosis in Somali and Oromia Regional States	The infection rates in camel 13.5%, 5.1%, and 8.73% of *T. evansi* were detected in the sera by BMC and CATT/*T. evansi* tests, respectively. Intervention approaches decreased disease prevalence and vector density and integrated vector and parasite control measures are recommended for use by camel-rearing communities

Table 10: Major findings generated on honey bee health and management challenges

Type of technology and innovations	Major Outputs/ Achievements
Wax Moth and Risk Factors in Arsi Zone	The overall prevalence rate of wax moth in modern bee hives was 22%, and the occurrence of wax moth was higher in box hives than in transitional and traditional hives Interventions were recommended to mitigate wax moth challenges
Pests and significant honey pathogens bee diseases	Honey bee brood diseases were known Adult bee diseases (Nosema, and amoeba) were detected and diagnosed Wax moths, ants, Beetles, Bee lice, and mice were identified, and intervention practices recommended

Outreach domains (AMR, Zoonosis, and other diseases of production)

Demonstration and pre-scaling up of Animal health deliverables (Technology, Prototypes)

Newcastle Disease virus vaccine: ND12 vaccine administration routes (drinking water, eye drop, and spray method) were demonstrated and applied under smallholder farmers to provoke a protective antibody level. Chicken mortality due to ND was 56.25% in the surrounding farms of Holeta town, and this case was reduced to 10.7% in the smallholder villages that adopted chicken health packages from HARC in the two to five years.

Rabies prevention practices: Public awareness on methods of transmission, source of disease, prevention and control system was created by farmer training

Brucellosis: More than 6,000 smallholder dairy cows in different regions were screened for brucella infection, and farms infected with the disease were advised to remove and replace infected animals.

Figure 3: ***Screening and Diagnosis showcase***

Tuberculosis: bTB testing was conducted on different farms over the last six to ten years. About 1850 crossbred and 1250 local breeds, including Borena heifers, were tested & screened using the intradermal tuberculin test (CIDT-PPD). Accordingly, tuberculin reactor animals were segregated, re-tested & finally removed to maintain TB-free herds. The knowledge of animal owners & consumers was upgraded through training and other mechanisms

Figure 4: Tuberculin skin Testing in heifers

Mastitis: - The incidence of mastitis in lactating cows decreased from 44% to 11.1% in the on-farm scheme after the intervention.

Figure 5: Mastitis screening and demonstration

- Different technologies for the diagnosis and screening of mastitis were generated (SODA, MADI, and SURF) as alternatives to CMT. About 240 mastitic cows were treated with TSC and ALCU technologies & get cured from these cases.

Figure 6: Treating Mastitis cases using medicinal herbs

Dermatophytosis: *P. senegalese* was evaluated in-vivo and in vitro against dermatophytosis. The product inhibits the growth of the fungus at 0.78mg/ml. In-vivo evaluation of the product on infected calves showed healing of the lesion within a very short time post-application.

Figure 7: Treating skin disease by using medicinal herbs

Mothering units (out growers)

- Raise the chicks for 45 days and distribute them to other nearby communities and or smallholders. Domains of technological interventions such as vectored immune vaccines that can protect NCD and Marek's disease and Transmune IBD vaccine against Gumboro /virulent strains were demonstrated. The mortality rate of chicken in the mothering unit was 2.16%. The delivery of vaccine protocols was adopted in the nearby villages.

Figure 8: Mothering unit

Figure 9: Handling of sick birds and demonstrate how to use particular products

Figure 10: Recovery after intervention

Figure 11: NCD occurrence & sick birds on the farm

Outreach Technology showcases and efforts delivered to end users

- More than 10250 Poultry producers have been demonstrated by different domains of technologies in Welmera, Anedid, Adea berga, EJere, yaki, Shey Bench, and Pawe districts of Oromiya, Amhara, Benishan Gulgumu, and Southern Regions of Ethiopia. churners, infusions, and sprayers were delivered to technology sites, and more than 6500 farmers were addressed on how to use particular products**.** Camel Brucellosis and parasite management options were demonstrated and delivered to 850 pastoralists of Bonta, Badamo, and Sadagafa of the Afar Region.

Figure 12: Outreach efforts

Figure 13: Demonstration of Mas-D-Tech (MAD-19) Technology for the diagnosis and management of mastitis

Technology and prototype Demonstration for the mitigation of tsetse fly & Trypanosomiasis

- community-based practices, including integrated tsetse fly control efforts (pour on, insecticide-impregnated targets & spray) & vector density management mechanisms were introduced & applied in different areas

Figure 14: Community based delivery & demonstration of Trypanosomosis & Tsetse fly control options (spray mechanisms)

Figure 15: Demonstration of Tsetse fly Control methods (Targets) in selected districts of Benchi Maji areas

Status of Ethno-Veterinary Research in Ethiopia

Farmers and pastoralists practiced traditional ways of treating and preventing animal ailments. Validation and transfer of this knowledge to users through different methods, observation, and practical demonstration has been underway to promote, protect, or restore the health and well-being of animals and humans and to further substitute imported commercial drugs.

- Evaluation of potential ethnoveterinary medicine (efficiency and efficacy for treatment of different ailments and health problems and development and formulation of products from the identified ethnoveterinary practices

Figure 16: Multiplication of different Medicinal herbs

Figure 17: Extraction process

Formulation of alternative products

Prototype generation steps include pre-formulation before product processing, efficacy, and toxicity testing in vitro and in vivo, and on condition, host, and cell responses, standardization of products, and development of delivery methods.

Figure 18: Processing step

Figure 19: Application of herbal medicine by farmer

Antimicrobial Resistance (AMR) The isolated pathogens were tested against different antibiotic discs.

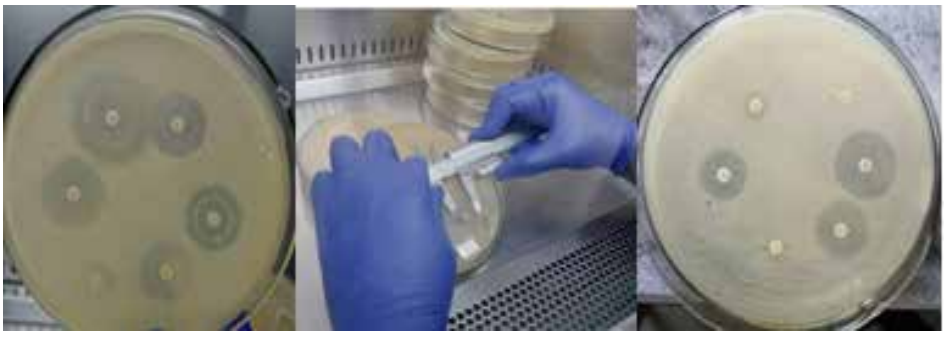

Figure 20: Isolated bacterial pathogens and AMR tests

Technology User Training efforts

- A total of 12510 livestock keeping farmers, 3500 pastoralists and Agro pastoralists and 620 experts drawn from Oromiya, Southern Nation and Nationalities, Amhara, Benishangul gumuz, afar regions and Addis Ababa have been given trainings on livestock health and disease management options in the past decade. Health and disease management manuals, guidelines and training materials have

been produced and distributed to more than 1000 beneficiaries.

Pawe

Werer

Jimma

Figure 21: Beneficiaries Training

Figure 22: Beneficiaries Training

Figure 23**: Training on vaccination and Biosecurity (Holeta)**

Figure 24**: Training on vaccination and Biosecurity (Assosa)**

9. Adoption of Animal Health Technologies and practices

About 94% of the livestock producers adopted to take sick animals to veterinary clinic and 26% of farmers practiced to treat sick animals using ethno-veterinary knowledge.

Company Profile

Alema Koudijs Feed PLC is a joint venture between Dutch, family-owned, De Heus Animal Nutrition and Ethiopian, family-owned Alema Farms PLC. De Heus has over 100 years of experience in international agriculture. Alema Farms, since 1993, has almost 30 years of experience in the poultry business in Ethiopia. Alema Koudijs Feed was established in 2009 in Bishoftu, Ethiopia. The two companies combine vast knowledge of feed milling, raw materials, and animal husbandry from De Heus Animal Nutrition with the local knowledge of Alema Farms; together, this makes Alema Koudijs Feed (AKF) a professional organization with deep knowledge about farming in Ethiopia. We are known for providing feed for high and efficient production, improved farm management support, and on-farm advice for Ethiopia Poultry and Livestock Farmers.

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6.Oxyclozanide 1400mg + Levamisole 1000mg Blisters
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9.Triclabendazole 900mg
10. Tetramisole 600mg
11. Oxy-tetracycline (powder)

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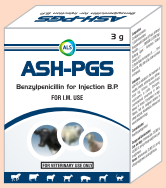

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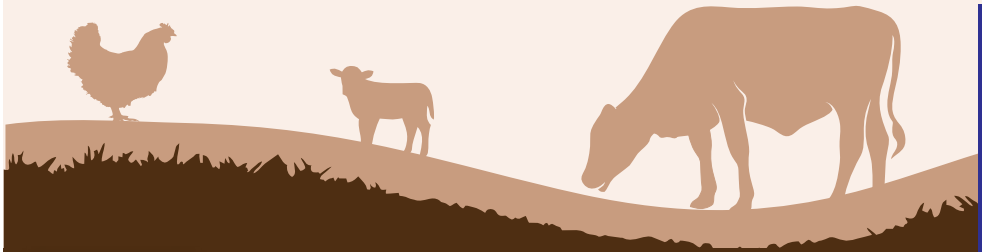

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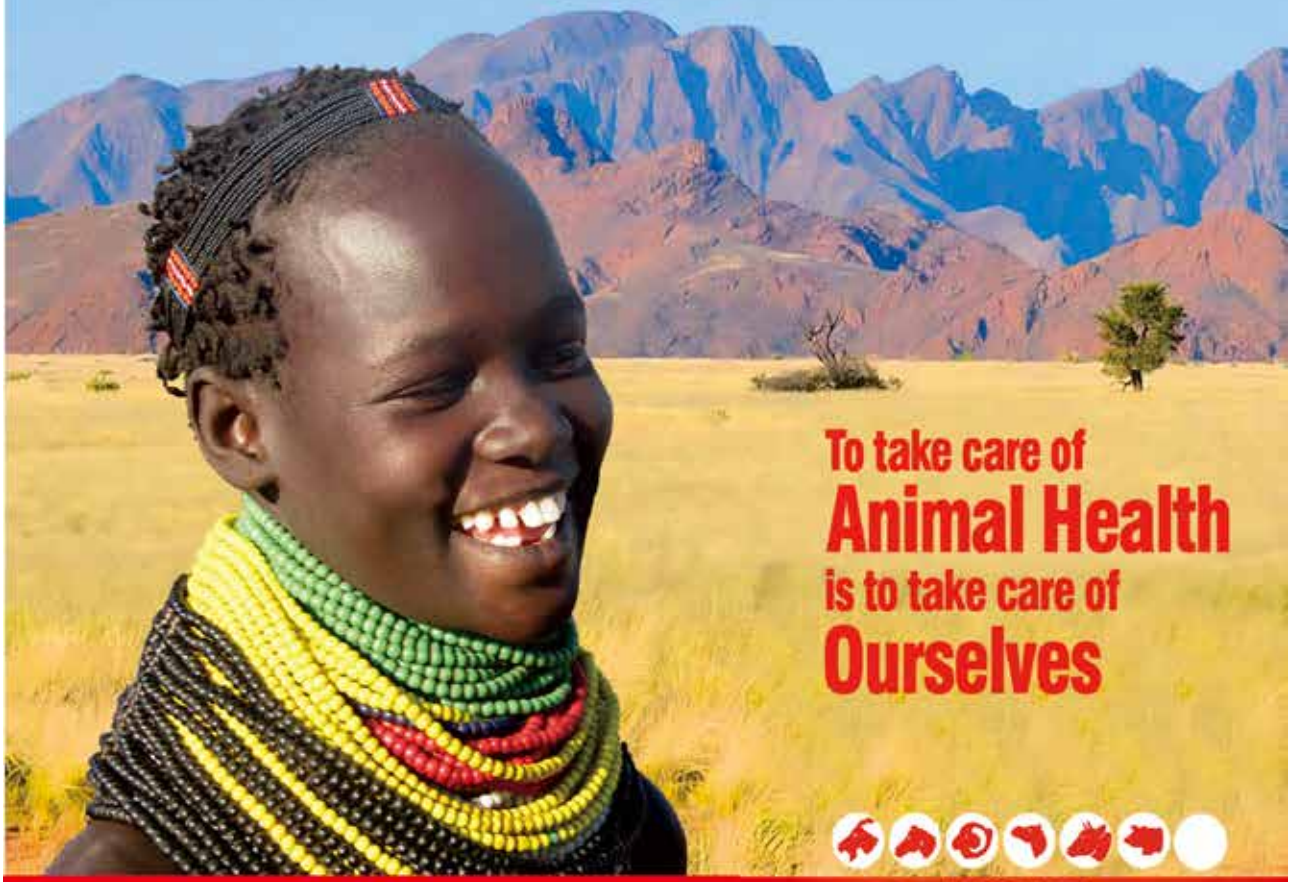

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