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Ethiopia, Animal Disease

Empowering Ethiopia’s Cattle Sector: Technical Solutions for Disease Management

Introduction

Despite Ethiopia's rich agricultural potential, various historical, environmental, political, and socio-economic factors have affected its growth through history. The people of Ethiopia face the harsh realities of poverty and food insecurity, particularly in rural areas reliant on subsistence farming and livestock. Cattle play a central role in these communities, serving as both a food source and a symbol of economic stability. However, many diseases threaten cattle health, exacerbating food insecurity. To address this challenge, I propose leveraging smart ear tags and infrared thermography camera technology in addition to the ongoing efforts of building a nationwide cattle ear tag and identification system for cattle disease monitoring, potentially revolutionizing livestock management and enhancing animal health and food security in Ethiopia.

Country & Family

A typical family size in Ethiopia can vary. However, a majority of the time it includes parents, children, and extended family members. Consisting of typically 4 to 6 members, Ethiopian families predominantly reside in rural areas. Their diet revolves around staple foods like grains and legumes, which are supplemented by dairy products and meat from livestock (Selinus, 2020). Because of this, they rely heavily on cattle farming for sustenance and draft power. A typical rural Ethiopian family earns an income primarily from subsistence farming and cattle rearing, with annual household income often falling below $500. Access to healthcare and education is limited, with many children dropping out of school to assist in farm labor. This socio-economic context makes cattle not just a source of food but a vital economic asset. This comes as no surprise, considering Ethiopia has the greatest cattle population in Africa. Agriculture, including cattle farming, serves as a major source of income for most rural Ethiopian families. The livestock sector contributes to approximately 19% of the country’s GDP and employs over 70% of the population in Ethiopia. Cattle alone represents 11% of Ethiopia’s GDP and continues to rise (Li et al, 2023). In 2010, the mixed-crop livestock system consisted of 55 million cattle. Aligning with increasing demand, however, Ethiopia's cattle population has grown to nearly 70 million in the past decade (FAO, 2019).

Ethiopia faces numerous challenges, notably poverty, food insecurity, and political instability. Addressing these issues is essential for improving living conditions, ensuring stability, and supporting economic progress in the region. Supporting Ethiopia's efforts to address underlying causes of instability can contribute to regional peace and security. Ethiopia has made significant contributions to the world in various fields, including environmental conservation, climate change, and sustainable development. By helping Ethiopia, we are helping the world.

Challenge & Impact

The first step in helping Ethiopia is understanding its challenges. Poverty and economic struggle are common in Ethiopia. As an LDC (Least Developed Country), Ethiopia suffers from severe food insecurity and poverty for many of its citizens. Limited access to education, inadequate infrastructure, political instability, and environmental degradation are all contributing factors to Ethiopia's food insecurity and poverty problems. The government of Ethiopia's most recent evaluation of food security needs projected that 15.8 million people will experience food insecurity (WFP, 2024).

Cattle are pivotal in benefiting the country's economy, agriculture, and food security. Diminishing livestock productivity, unavailability of animal-derived products, and exacerbated resources in Ethiopia all contribute to rising levels of food insecurity and economic decline. Therefore, the looming danger of cattle diseases poses a significant threat to Ethiopia's future and stability. Unfortunately, the livestock sector faces formidable challenges, particularly in animal disease management. Because of the nature of Ethiopia, the high prevalence of mycobacterial diseases like Foot and Mouth Disease (FMD) and Contagious Bovine Pleuropneumonia (CBPP) significantly impact cattle health and productivity. Despite the critical importance of such matters, Ethiopia lacks the necessary disease management systems to adequately resolve these diseases in their cattle.

Poor cattle disease management hinders economic development and perpetuates poverty cycles throughout Ethiopia. Disease outbreaks among cattle lead to substantial losses in livestock productivity, further diminishing the availability of animal-derived products. Just one detection of certain cattle diseases, such as FMD, can stop international trade for an extended period (USDA, 2023). The problems present in Ethiopia can be solved. With the help of outside assistance and support, Ethiopia can mitigate animal disease issues and stabilize their country.

Solutions & Recommendations

Vaccination campaigns against common cattle diseases aim to increase herd immunity and reduce the spread of infectious diseases (Choudhury, Mohiuddin et al, 2021). However, this isn't practical due to the number of cattle and the difficulty of applying this to all of Ethiopia. Various reasons, such as inadequate education for local cattle farmers and the lack of necessary infrastructure, limit the widespread use of vaccines. Because of this, vaccine distribution may be inconsistent, leading to gaps in coverage and making certain herds vulnerable to disease outbreaks.

Improving breeding and genetics is promising and can enhance the health and productivity of cattle. Developing breeds resistant or tolerant to specific diseases can largely reduce susceptibility and minimize the economic losses associated with these disease outbreaks. Though it is very promising, the technology required to do it is limited in many places in Ethiopia as it is still a developing country. It would also take significant time for the solution to have notable impacts on Ethiopia's urgent issues.

Ear-tags

One possibility of achieving this solution is by implementing ear tags within as many cattle as possible. Traditionally, farmers used branding, such as tattoos or markings, to keep track of their cattle. However, it has become evident that more than simply identifying livestock is needed to prevent outbreaks. Recently, influence from research projects and export requirements have shaped the evolution of livestock identification and maintenance. Ear-tagging, in particular, has grown to be more prevalent in different

areas around the world. In Ethiopia, plastic ear tags have been introduced to a limited number of herds; however, it lacks organization and standardization (New Business Ethiopia, 2017). Furthermore, the cattle traceability systems in Ethiopia are limited only to export animals and within individual farms. The first step towards addressing these issues is promoting a more widespread usage of ear tags within livestock. A harmonized national animal identification and registration system is necessary for Ethiopia to properly support the research, development, and growth of disease-prevention measures.

Smart ear-tags

By using smart ear tags, local farmers and researchers can build an evaluation profile around individual cattle that will give valuable insight into their health (Pretto, 2024). With multiple sensors and a database-driven system, the smart ear tag can track multiple aspects of a cattle's activity. This includes tracking their movement, such as how far they walk, where they walk, and the speed at which they walk. A GPS tracker built into the ear tag will provide the necessary information to evaluate these aspects of their movement. By using this information in conjunction with AI algorithms, the system can understand each cattle's normal movement patterns. This allows the AI to predict when cattle are sick based on a multitude of different factors, such as a decrease in overall distance moved or a decrease in average speed. The ear tag can also sense when the cattle is chewing on something, allowing it to evaluate eating patterns, a crucial part of understanding a cattle's functions. Many different diseases can be identified by examining a cattle's mouth activity. A cattle consuming less food on average in a day can be a sign of certain diseases, as can the grinding of their teeth. Measuring the heart rate of a cattle can be a straightforward way of evaluating its health and providing analysis on heart-related diseases prevalent within cattle.

IRT Camera

Infrared thermography (IRT) for disease surveillance and monitoring can also be an effective disease control strategy in Ethiopia to minimize damage and prevent outbreaks within cattle (McManus, Rosemary et al, 2022). By scanning cattle using IRT technology, local health authorities can monitor cattle for identifiable symptoms of certain diseases like FMD. A camera equipped with IRT technology can be placed near cattle herds, such as under a trough, and can constantly scan passing animals as they drink to detect potential symptoms of diseases. When an animal has been infected with FMD disease, their foot area rises in temperature, a symptom that can be detected through IRT screening. Another case of IRT technology use is widespread surveillance through drones. By flying overheard herds, drones can monitor large portions of land per day, surveilling thousands of cattle. This approach can provide valuable insights into disease trends, risk factors in certain areas, and transmission dynamics that can be used by veterinarians and local health authorities in the future as well. Preventive measures can be enacted to minimize spread and prevent outbreaks if promising symptoms are present within a cattle herd.

Cost Analysis

Existing ear tags and similar technology can give insights on a relative price range for this solution. Based on current market prices for ear-tags, each would cost around $0.20-$0.30. This is very practical for both small local farmers and large herd owners. The average size of a herd for local farm owners in Ethiopia ranges from 10-15 cattle. As shown in Table 1, assuming that each cattle in a herd of 15 has a basic ear-tag, it would only cost around $3 per herd. However, the adoption of smart ear-tags, equipped with sensors, would cost considerably more. mOOvement, a company specializing in cattle tracking, has developed a smart ear-tag that costs $55. Although the price of each may be more expensive, each herd would only need 1-2 cattle equipped with smart ear-tags to effectively detect disease outbreaks quickly.

Furthermore, these advanced tags offer much more additional functionalities, and are more effective and efficient than basic ear-tags. Taking this into account, the total cost per herd would be around $110. Finally, IRT cameras cost around $160 based on current market prices. The price presents a significant upfront investment, however they offer valuable capabilities for disease surveillance and monitoring.

Moreover, the nature of the cameras means only 1 is necessary per herd, and can still be used for multiple herds at a time. To address these pricing challenges, strategies such as bulk purchasing, subsidies, or other financing schemes could be explored in order to make this solution accessible to all farmers.

Table 1: Cost Analysis for Cattle Identification Options

Item	Cost per Unit	Quantity per Herd (~15 cattle)	Total Cost per Herd	Total Cost for 1000 Herds
Basic Ear-Tags for Identification	$0.20	15	$3	$3000
Smart Ear-Tags with Sensors	$55	2	$110	$110,000
Infrared Thermography Camera	$160	1	$160	$160,000

Project leadership and management

This project could be led by a coalition of organizations, such as government agencies, non-profit organizations specializing in agriculture and livestock management, and international organizations, such as the International Livestock Research Institute (ILRI). Organizations like ILRI have been advocating for livestock improvement projects in various developing countries over time, and it has a close connection with Ethiopia as well (ILRI, 2023).

Funding

There are many different funding sources, including government grants, private-sector investments, philanthropic organizations, and public-private partnerships with governments and private entities. Three examples of potential funding sources include the United States Agency for International Development (USAID), the International Fund for Agricultural Development (IFAD), and the African Development Bank (AfDB).

Roles of Stakeholders

Various parties play a vital role in ensuring the success of this project. Community members, specifically local farmers, are integral stakeholders in implementing the smart ear tag and IR camera project, as they provide feedback on usability and effectiveness. They must also be the ones to integrate this project within their herds, with the support of the Ethiopian government. The government holds a crucial role in providing the infrastructure necessary to develop regulatory frameworks while simultaneously ensuring compliance with national livestock management policies. Non-profit organizations, such as the Bill & Melinda Gates Foundation can also facilitate the training of farmers on how to utilize the technology effectively.

Policies / Sustainability

In order for this project to have lasting effects, sustainability measures must be implemented. Exploring avenues for generating revenue from the project must be considered, such as offering premium services or data analytics to farmers for a fee. Additionally, ensuring compatibility and integration within existing livestock management systems is a crucial part of the process. Government policies are needed for the project to be fully effective. For example, data privacy and security policies must be in place to protect the privacy of farmers. The involvement of local communities is crucial for the successful implementation of these technologies. By engaging farmers in the planning and execution phases, the project can ensure that the solutions are culturally appropriate and meet the actual needs of the communities. The government's role in creating supportive policies and providing necessary infrastructure cannot be overstated; their participation is key to scaling these solutions nationally.

Conclusion

Food insecurity and animal health has been a longstanding issue rooted within Ethiopia. To address this pressing challenge, innovative solutions are imperative. Leveraging smart ear tags and infrared thermography camera technology combined with an established nationwide cattle identification system can provide an outlet to alleviate this issue. By implementing these technologies, local farmers and researchers can gain valuable insights into cattle health and behavior, enabling early detection of preventable disease outbreaks. The success of these endeavors rely on the collaborative efforts of local and foreign resources. Non-profit organizations, international partners, and local communities are vital to support these efforts towards creating a more stable Ethiopia. With determination and collective action, Ethiopia can overcome its historical challenges and emerge as a leading country in agricultural innovation.

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