Agroecological Business Model Diagnostics and Upgrading Plan for Sasso Poultry Business in Murehwa District, Zimbabwe.

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Abstract

This report examines the development and upgrading of the Hamara Sasso poultry business model in Murehwa District, Zimbabwe, as part of the CGIAR Agroecology Initiative. It synthesizes the processes followed to identify potential agroecological business models, diagnose their alignment with agroecological principles, and outline financial and viability assessments. The analysis includes findings from the Value Chain Analysis (VCA), Business Model Canvas, and agroecology assessments, along with a SWOT analysis and lessons learned from implementation challenges. Key results indicate that the Sasso model achieved a B-ACT agroecology score of 61.36%, reflecting partial alignment with agroecological principles such as inclusivity, resilience, and efficiency, while highlighting areas for improvement in resource recycling, market access, and cost-effective feed strategies. The SWOT analysis identified strengths such as high consumer demand for organic poultry, robust market potential, and the hardiness of the Sasso breed, contrasted with challenges like high feed costs, limited farmer access to financial and technical resources, and logistical inefficiencies. Recommendations focus on enhancing circularity through poultry manure recycling and promoting alternative feeds like Azolla to reduce production costs. Strengthening market linkages with urban retailers and institutional buyers, along with tailored financial products and cooperative models, will improve farmer profitability. Participatory training in feed formulation, disease management, and agroecological practices will increase farmer resilience, while investments in infrastructure, decentralized logistics, and digital platforms like the Hamara App will ensure scalability. Addressing these challenges positions the model as a scalable framework for agroecological and economic advancement in rural poultry systems.

Introduction

The CGIAR's Transformational Agroecology across Food, Land, and Water Systems known as the Agroecology Initiative—is a research-driven endeavor to drive systemic changes toward resilient, sustainable, and inclusive agricultural and food systems. This initiative addresses global agriculture's critical environmental, social, and economic challenges, focusing on how agroecology can transform the interactions between food production, land use, and water management. By embedding core agroecological principles such as circularity, co-creation, inclusivity, and diversity, it seeks to advance environmentally regenerative and socially equitable agricultural practices. These efforts aim to enhance ecosystem health, improve food security, and bolster community resilience, particularly in low-income rural contexts.

Work Package 3 (WP3) plays a vital role in this initiative by bridging agroecological transitions with viable business models that create meaningful economic opportunities for smallholder farmers and rural communities. The central objective of WP3 is to ensure that these communities equitably benefit from emerging and existing agroecological business opportunities within their regions. It also seeks to strengthen producer-market linkages and foster innovative financial mechanisms to support inclusive and profitable business models grounded in agroecological principles. This is achieved through collaborative engagements with trading partners, investors, and local stakeholders to co-design models that integrate new agroecological innovations or enhance existing ones. By translating agroecological theory into actionable, scalable solutions, WP3 enables smallholder farmers and rural communities to thrive within agroecological economies. Its approach ensures that the incremental changes required for a successful transition are scientifically grounded, financially viable, and socially inclusive. In doing so, WP3 contributes to fostering resilient, sustainable agricultural systems capable of addressing modern agriculture's multifaceted challenges.

Objectives of this study.

This study synthesizes the processes followed to identify potential agroecology business models, the business model diagnostics, financial and viability analyses conducted, and business support and upgrading for a Sasso brooding enterprise in the Murehwa district.

Business model location

Murehwa is located some 75 kilometres northeast of the capital city, Harare, and at an altitude of 1400m above sea level. The district has 30 wards with a total population of 205,442 (52% being women) and an average of 4 people per household. The district covers a total area of 3,556 km^2 with an average density of 58 people per km^2. Urbanization is still very low in the district with 91.7% of the people living in the rural areas[1]. The district is categorized under Natural Region (NR) II characterized by reliable high rainfall patterns of 720 to 1000 mm per annum. The region has a tropical climate with a dry winter climate

[1] https://www.citypopulation.de/en/zimbabwe/admin/mashonaland_east/306__murehwa/

between 12 and 21°C and a maximum temperature of 42^0C. The district is known for its high crop and livestock production potential. The surface and sub-surface water resources also help the district to produce vegetables during the off-season. The soil types in the district range from deep sandy soils, and sand loamy to deep red clay soils. The average land size per household in Murehwa district is 3.43 acres (1.2 ha). The main crops include Maize, Groundnut, and sweet potato, grown by smallholder farmers under dryland production as well as with supplementary irrigation. Livestock production systems include beef, dairy, piggery, and poultry. However, due to the outbreak of theileriosis in the district, 74% and 86% of the households do not own any cattle or goats respectively.

Poultry production is common in Murehwa with farmers having their businesses of broiler production for survival. Local chicken production is a vital livelihood activity among rural households in Murehwa, with indigenous chickens kept primarily for home consumption and sale. These chickens are inexpensive to raise, as they require minimal inputs, often free-ranging and scavenging for food, making them accessible to nearly all households. They play a multifaceted role in rural livelihoods, providing protein, food security, and income, as well as acting as a form of insurance against emergencies. Women often manage poultry production, even in male-headed households, highlighting its importance as a women-led enterprise. Additionally, there is a growing preference for local chickens over broilers due to their taste and perceived health benefits, further enhancing their cultural and economic significance.

Despite their importance, productivity remains low due to challenges such as the production cycle which is long, high mortality rates, and limited knowledge of disease and breeding management. Traditionally a low-input, low-output practice, local chicken farming is evolving with the introduction of improved breeds like the Boschveld, enabling some households to transition to more intensive and commercial-scale production. These changes present significant opportunities for enhancing food security and economic growth while maintaining the cultural and nutritional benefits of indigenous chicken production. Sasso chickens are a hybrid between broilers and local chickens making it more resilient with the best qualities of each bird. A sasso resembles the taste of local chickens with improved cooking time and more resilience to the environment which makes the business model an attractive value chain for upgrading. The chicken value chain is shown in Figure 1.

Local chicken farmers in Murehwa sell their poultry through various channels, including directly to local consumers, assemblers, and supermarkets. Middlemen also play a significant role, purchasing chickens from farmers and reselling them in urban markets, including Harare and Murehwa. Some farmers additionally supply chickens to markets in nearby towns like Marondera and to local restaurants. Local chickens are highly valued for their organic nature and their status as a delicacy, often commanding higher prices in markets and restaurants. At the project sites, the birds typically sell for $5–$7 each. In addition to poultry farming, many farmers engage in livestock and crop production, creating a diversified farming system. Chicken manure is an essential resource in these systems, valued particularly for its effectiveness in vegetable and horticultural production, where it is considered superior to manure from goats or cattle.

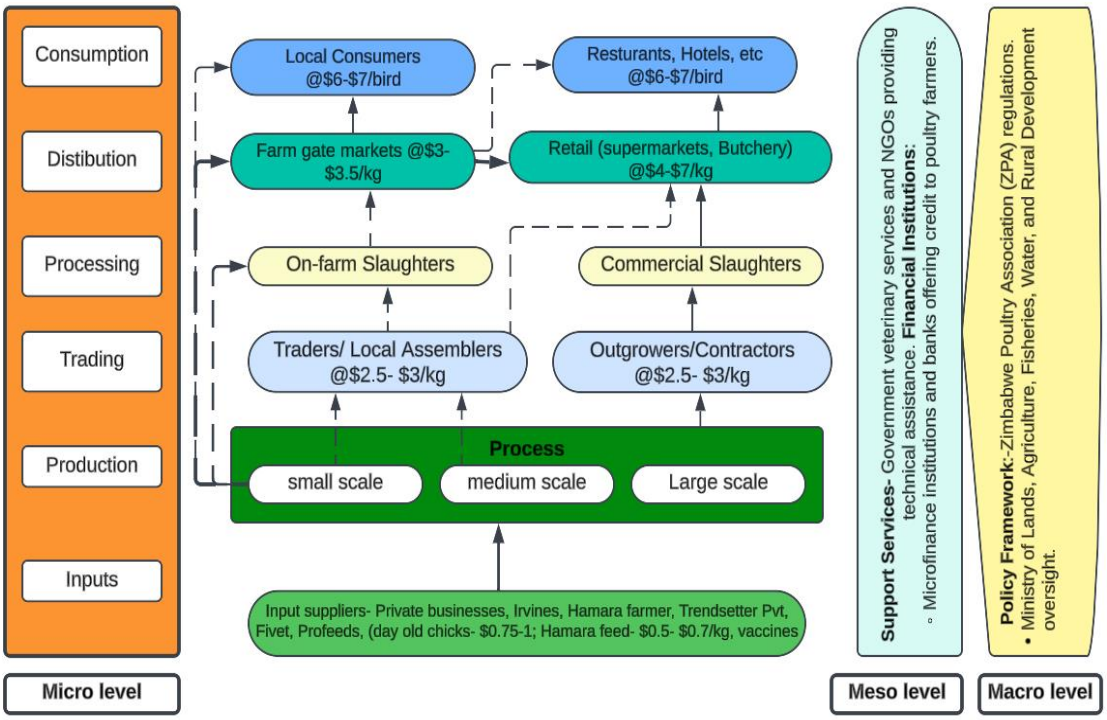

Figure 1. Poultry value chain in Murehwa, Zimbabwe.

The Murehwa poultry value chain involves several key stakeholders (Figure 1) Smallholder farmers serve as the primary producers, rearing poultry and supplying chickens to the market. Their clients include urban and rural consumers and restaurants and supermarkets that purchase poultry for resale or consumption. Local assemblers act as intermediaries, aggregating chickens from farmers and distributing them to larger markets or other clients. Input suppliers, such as Profeeds, Hyperfeed, and Fivet, provide essential resources like feed, day-old chicks, and vaccines to support production. Support services and institutions, including Agritex/ARDAS, Agricultural Marketing, the Police Department, and the Veterinary Department, play a crucial role in providing technical assistance, facilitating market access, and ensuring regulatory compliance. This network supports the efficient functioning of the poultry business model in Murehwa.

Methodology

Our approach followed a participatory and consultative process to inform the business enterprise model development and selection. All the identified business models were selected based on their interest and willingness to align or implement the new or re-designed model in line with the 13 agroecology (AE) principles. At the ward level, we conducted key informant interviews with key food system actors (FSAs) for the Rapid VC analysis, business model identification, and business canvas development. For the Rapid Agroecology Value Chain Analysis (RAVCA), semi-structured questions were framed around four modules (i) General information of the actor, (ii) value chain characterization, (iii) value chain diagnostics and (iv) agroecological assessment.

In terms of the process, the following steps were followed:

- Several value chains aligned to agroecology were assessed to identify challenges and opportunities for developing or upgrading business models
- Value chains were prioritized to identify potential business models and financial modalities to upgrade
- The business models and financial modalities were classified according to how they perform on agroecological principles (e.g., according to the Agroecology Check for Enterprises (ACE) and Agroecology Criteria Tool), social equity, and economic viability
- Business model canvases were developed for selected existing business models, including the identification of challenges and opportunities for the trading partners
- Cost-benefit analyses (CBAs) to assess the profitability of innovative business models (i.e., applying agroecological principles) versus business as usual were carried out, for short- and long-term periods.

Identification and assessment of the business models.

We used a two-step process for preliminary screening to identify and assess inspiring and promising business enterprises' alignment to agroecology. We utilized the Agroecology Check for Enterprises (ACE) tool and the "dry test" assessment of the enterprise business model. We assessed whether the existing enterprise business model, value-generating activities, or strategy/scalability are, to some extent, aligned with agroecology and the potential of the current model to incorporate some of the principles based on the developed business model canvases. The ACE tool was applied to assess business enterprises that are aligned with agroecological principles and areas with potential for improvement or activities that conflict with agroecology. The assessment is classified into three grades – "pass", "partial pass", or "no pass" per each focus area [Regenerative, Diversified, Healthy, Fair and connected, and overarching] and develops an overall assessment grade. Figure 2 below shows an overview of the Business enterprises engaged and those interested in implementing the re-designed business models in the Murehwa district. We had a preliminary assessment of an enterprise's alignment with the 13 principles using the ACE tool and found out that all three identified models were partially aligned with the agroecology principles.

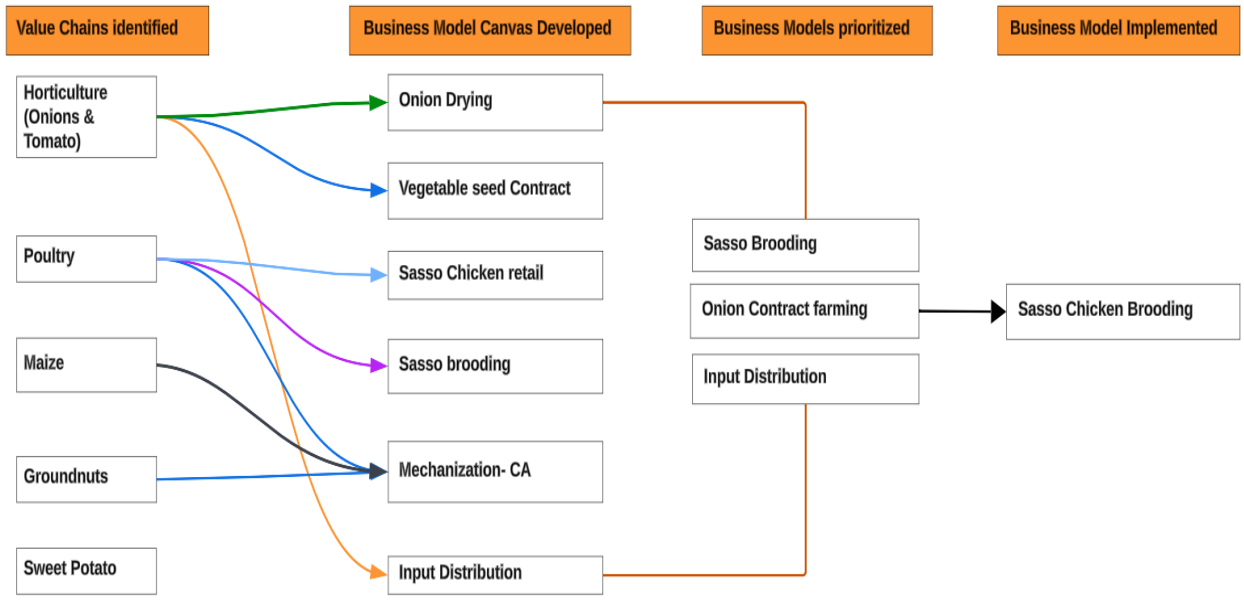

Figure 2. Identified Value Chains for Actors Mapping and Business Model Development.

In Murehwa we implemented the Hamara Sasso business model, which was selected for investment due to its high potential, considering the district's reliable climatic conditions and market proximity to Harare. Hamara Chicks emerged as a lead firm with inclusive business models for the Sasso breed of chickens. Sasso chickens were deemed suitable because they are dual-purpose, free-range, hardy, and offer good feed conversion ratios. Additionally, they have a faster growth rate for the same taste as roadrunners, Sasso takes 10 weeks to mature under supplementary feeding compared to 5-6 months for road runners. One can generate more profit with Sasso

The potential business models identified included retail, village brooding businesses, and broiler production. These models were evaluated for their capacity to increase farmers' incomes and integrate agroecological principles. Hamara's willingness to leverage development partner support and reintroduce Sasso operations in Murehwa, combined with the breed's adaptability and market demand, made it a strategic choice for promoting agroecological transitions in the poultry value chain. Previously Hamara introduced Sasso in Murehwa, but their outreach was limited but can now benefit from engaging with the ALLs and communities. From the engagement processes, the interest of the partners, and the given timelines, the Sasso brooding poultry project was implemented in Murehwa.

Business Model Diagnostics

Description of the relevant stakeholders

The proposed business model involves two primary stakeholders, Hamara Chicks and farmers in Murehwa and other players (Table 1) in the value chain.

Hamara Chicks

Hamara Chicks serves as the key supplier of chicks, feed, and other essential inputs for poultry production. The company operates with a vision to unlock Africa's productive potential by integrating small-scale farmers into agriculture-based value chains that are market-pulled and community-focused. Hamara Chicks specializes in training farmers, supplying inputs, and supporting logistics, marketing, and processing, making it a one-stop solution for poultry value chain development. The company generates revenue by selling day-old chicks, feed, vaccines, and equipment such as layer cages, and it provides intensive farmer development programs to enhance productivity. Hamara's product line includes broilers for meat production, layers for egg production, and Sasso chickens, a dual-purpose hybrid ideal for smallholder farmers. The Sasso chickens—available in three varieties, namely C431 for meat, T-Rainbow for both meat and egg production, and Sussex for eggs—are particularly suited for Murehwa farmers due to their hardiness, disease resistance, and ability to free-range for part of their feed. The T-Rainbow variety offers a promising opportunity for farmers to improve income, diversify livelihoods, and enhance food and nutrition security.

For Murehwa, the business model focuses on 2 major breeds- *Sasso Sussex* layers and the *Sasso T-Rainbow* a dual-purpose bird for meat and eggs. The T-Rainbow variety balances the traits of traditional road runners and broilers, outperforming road runners in growth rates and survivability, with mortality rates of less than 5% compared to 40% for road runners. It retains the hardiness and scavenging ability of traditional breeds, making it cost-effective and sustainable. Hamara Chicks' experience shows that rearing Sasso chickens through a dual-stage process maximizes efficiency. Stage 1 involves brooding chicks from 0 to 3 or 4 weeks, which is critical for developing a healthy digestive system and reducing mortality. Stage 2 focuses on raising these "teen birds" to full maturity (10 weeks) for meat or egg production, leveraging their adaptability for free-range systems to reduce feed costs.

Murehwa Farmers

The farmers in Murehwa play a pivotal role in this business model, divided into two categories, Stage 1 Mother Brooding Unit Farmers and Stage 2 Community Farmers. The Mother Brooding Unit farmers are selected and trained by Hamara Chicks to brood day-old chicks for the initial critical weeks. These farmers operate in well-equipped brooding houses designed to provide optimal conditions for chick growth. Their focus is on improving farm-level efficiencies, achieving economies of scale, and minimizing chick mortalities. These farmers sell 4-week-old teen birds to community farmers in Stage 2, ensuring a steady supply of healthy birds for further rearing.

Stage 2 Community Farmers buy teen birds from the Mother Brooding Units to rear them to maturity for either meat or egg production. This stage is inclusive, allowing farmers at different scales to participate. Small-scale farmers can rear a few birds for home consumption and nutritional improvement, while larger-scale farmers can rear birds for commercial purposes, supplying local and urban markets. The flexibility in housing during Stage 2 enables free-range systems that lower feed costs while maintaining productivity. This approach makes the model accessible even to low-income farmers, creating opportunities for income diversification and food security improvements.

The collaboration between Hamara Chicks and the farmers in Murehwa is a critical leverage point in this business model. By providing high-quality inputs, comprehensive training, and logistical and marketing support, Hamara ensures that farmers are equipped to succeed. The dual-stage production process, supported by strong partnerships between Mother Brooding Unit farmers and community farmers, enhances efficiency, reduces risks, and creates an inclusive, scalable model. This partnership not only improves livelihoods but also fosters sustainable agroecological practices, aligning with the broader goals of unlocking Africa's productive potential.

Table 1: Other Actors in the Business Model

Actor	Function/Role
Input Suppliers	Provide vaccines, medications, supplements, affordable feed, brooding equipment, free-range housing materials, feeders, and drinkers.
Veterinary Suppliers	Supply vaccines, medications, and disease management tools to maintain flock health.
Microfinance Institutions (MFIs)	Offer tailored loans or credit facilities for purchasing inputs, brooding infrastructure, and scaling production.
Transportation Services	Ensure efficient and safe movement of chicks, feed, and poultry products.
Local assemblers	Purchase poultry products in bulk for urban markets or export.
Local and urban consumers	Drive demand for poultry products (meat and eggs), providing a consistent market for farmers. Their purchasing preferences influence production trends, such as demand for free-range or organic poultry, impacting farming practices and marketing strategies.
Restaurants and Supermarkets	Provide direct market demand for poultry meat and eggs, especially Sasso products.
Local Government Authorities	Provide ongoing technical support and advisory services to farmers (Agritex)Facilitate permits, land allocation, and infrastructure development for poultry farming (Vet and Police)

Results of the Business Model Assessment.

The Agroecology Check for Enterprises (ACE) and the Business Agroecology Criteria Tool (B-ACT) exercises were conducted to evaluate the agroecological alignment and sustainability of the sorghum business model. This process involved assessing the business against key 13 agroecological principles classified into three operational principles – improve resource efficiency, strengthen resilience, and secure social equity/responsibility. The exercise utilized participatory approaches, engaging stakeholders including farmers, agribusiness representatives, and researchers to co-create an understanding of the model's strengths and gaps in agroecological performance. Data were gathered through structured discussions, and field observations, which provided insights into the integration of ecological practices and socio-economic benefits. This data was collected using the Biovision toolkit which was filled together with the private business enterprises.

Firstly, we carried out a preliminary assessment of how agroecological the business enterprise was using the ACE tool. This was used as a screening method against all potential business enterprises that the AEI would prioritize. The ACE result measures an enterprise's practices and operations against a set of criteria rooted in the 13 principles of agroecology. The Sasso business model assessed achieved a *'partial pass'* result indicating that the enterprise meets some, but not all, agroecological standards and practices. Apart from that, the *'partial pass'* implies room for improvement, particularly in areas like deepening ecological sustainability, enhancing social equity, or adopting nature-positive practices. The B-ACT tool was used to assess the level of agroecological practices in agricultural systems. This Agroecology score provides insight into how well a farm adheres to these principles, helping to identify areas for improvement and promote more sustainable practices. Our business model was above the 50% threshold to adhere to the HLPE's 13 principles.

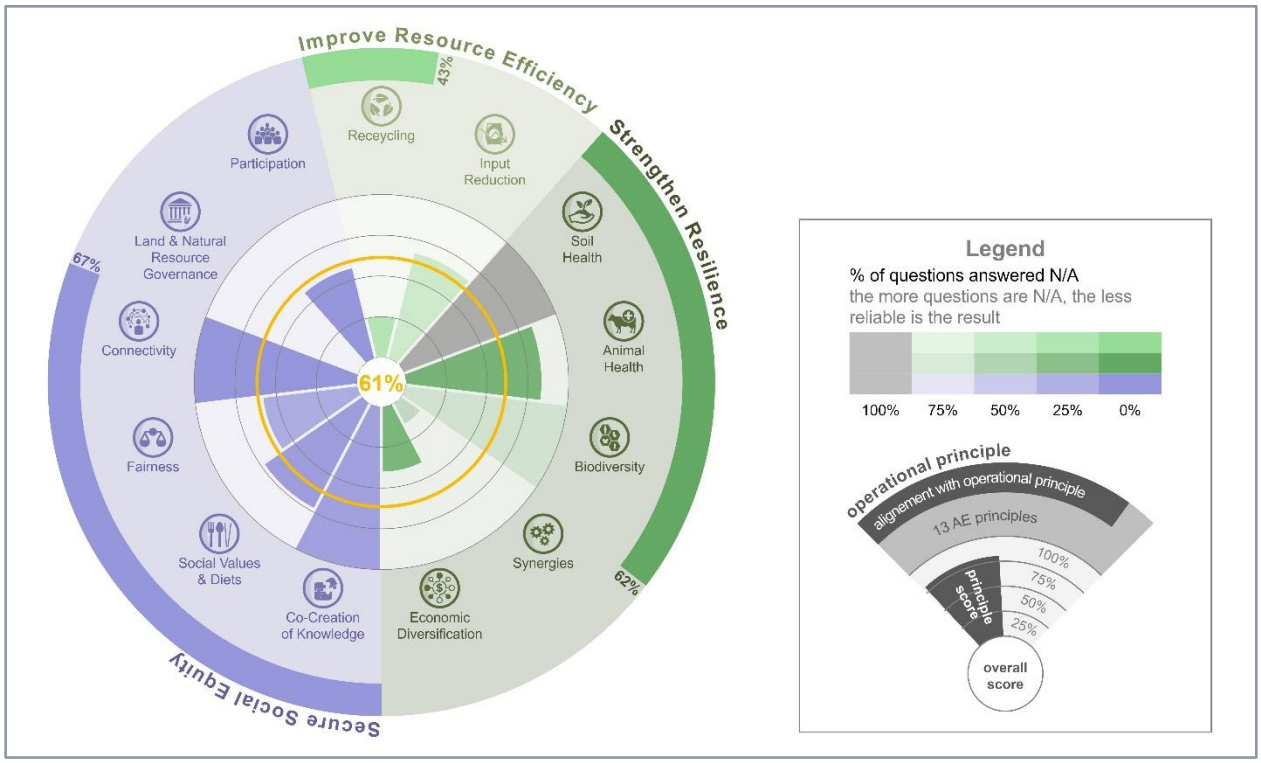

Figure 3. Summary of the B-ACT results for the Sasso business model.

The Sasso business enterprise achieved an overall score of 61%, reflecting a commendable alignment with agroecological principles across three key themes: improving resource efficiency, strengthening resilience, and securing social equity, as illustrated in Figure 2. Despite this positive alignment, the results highlight areas for improvement to enhance the enterprise's performance and impact. The theme of improving resource efficiency scored the lowest at 43%, signaling the need for significant progress, particularly in recycling practices. Among the principles assessed under this theme, input reduction was the highest contributor with 66%, emphasizing its critical role in optimizing resource use. To address this gap, integrating poultry manure recycling into the business model is highly recommended. Poultry manure could be utilized to produce Azolla, a nutritious aquatic plant that serves as an alternative chicken feed, thereby reducing dependency on external inputs and enhancing resource loops. Additionally, expanding training programs with Agritex to include modules on formulating feed mixes from locally available resources, such as crops or seeds from trees like acacias, could help farmers reduce reliance on purchased inputs, particularly after the brooding stage.

Figure 4. Azolla production in a pond awaiting harvest by communal farmers in Murehwa.

Under the theme of strengthening resilience, the enterprise scored a moderate 62%, indicating progress in building robust and adaptive systems. Biodiversity emerged as the highest contributing principle, underscoring its importance in enhancing ecosystem resilience. Furthermore, animal health received an impressive score of 83%, highlighting the active efforts in improving poultry well-being. To strengthen resilience further, promoting biodiversity through the integration of diverse feed sources, cover crops, and agroforestry systems is recommended. Additionally, leveraging localized knowledge to address climate and disease-related challenges could improve system adaptability and robustness.

The highest score of 67% was achieved on the theme of securing social equity, reflecting significant progress in creating equitable systems. However, land and natural resource governance contributed the least to this theme, suggesting limited efforts to promote fairness and equitable access to resources. In contrast, the enterprise excelled in promoting social values and diets, with a score of 72%, demonstrating its impact on community well-being. Strengthening market linkages by collaborating with urban retailers, restaurants, and institutional buyers could provide consistent demand and better prices for poultry products, ensuring fair benefits for all farmers. Facilitating access to tailored credit solutions through partnerships with microfinance institutions is another critical step to empower smallholder farmers, enabling them to purchase necessary inputs or scale their operations. Furthermore, prioritizing marginalized groups, such as youth and women, through targeted financial and technical support in collaboration with NGOs or development agencies, would enhance social equity. In the long term, the establishment of poultry meat processing and egg packaging facilities could provide significant value addition and market competitiveness.

Insights from the Business Model Canvas and SWOT analysis highlight the potential for scaling the Sasso business enterprise by addressing the identified gaps. Improved resource management, enhanced market integration, and equitable access to opportunities will not only improve the overall score but also ensure sustainable growth and profitability. While the current performance is commendable, prioritizing actions in resource efficiency, resilience, and equity is essential for achieving deeper alignment with agroecological principles and driving long-term success.

SWOT Analysis

The SWOT analysis of the Hamara business model highlights several strengths. To leverage the strengths of the poultry business, the strategy should focus on expanding production to meet high demand, building strong supplier relationships, and promoting nutritional and breed diversity to attract a wider market. Utilizing synergies between crops and poultry can improve sustainability, while low initial investment and short production cycles allow for rapid scaling. Additionally, leveraging employment creation for marginalized groups can attract funding or government support. Addressing weaknesses Immediate actions should focus on reducing feed costs by introducing alternatives like Azolla or crop residue-based feed and expanding training programs on sustainable practices. Access to capital can be improved through partnerships with microfinance institutions or government grants, while cooperative models can enhance market access and negotiating power.

Figure 5. SWOT Analysis for Hamara Business Model.

To capitalize on opportunities, the business should rebrand to cater to the growing demand for organic and free-range products, explore value-added product lines, and target export markets. Diversifying income sources through integrated farming and value chain expansion can also reduce dependency on poultry alone. In mitigating threats, strategies should include implementing strong biosecurity measures and vaccination programs to prevent disease outbreaks, building resilience to price volatility by securing long-term buyer contracts, and differentiating products to combat competition from other poultry sectors. Addressing regulatory challenges through proactive compliance and advocacy, as well as strengthening supply chain management, can further protect the business from external risks.

Figure 6. Model farmer paying his dues for chicks he got on credit from Hamara for the brooding model and a sample of the Flume pipe constructed by the farmers with training from Hamara to keep the chicks warm.

The Business model canvas for Sasso business.

Table 1. The Sasso Business Model Canvas

Hamara Sasso Chickens' Brooding model				
Key Partners	**Key Activities**	**Value Propositions**	**Customer Relationships**	**Customer Segments**
AE-I Agritex DVS Traditional Leadership Farmers (Feed Formulation)	District Engagement and Sensitization meetings Trainings outside the pilot wards Establishing communication channels Delivery of chicks and feed Payment modalities Mentorship/Monitoring and Market support.	Introduction of a hardy, dual-purpose, fast-growing, low-cost, large, and tasty poultry breed that is free range.	Good communication including WhatsApp groups and through Hamara App. Placement of agent Training of businesses and farmers	Local brooding businesses Local farmers Local and City restaurants
	Key Resources		**Channels**	
	Human capital, Delivery truck Smartphones, Motorcycle		Distribution shop in Murehwa Physical meetings & Capacity building Virtual communication Agritex and Development partners.	
Cost Structure			**Revenue Streams**	
Logistics (Truck and bike) Salaries Chicks and Feeds			Sale of stockfeed and chicks Sale of farmer-produced chickens Sale of other products (broilers, layers feeds)	

The Hamara business model for Sasso chicken promotion and production is designed to introduce a hardy, dual-purpose poultry breed that is cost-effective, fast-growing, and adaptable to free-range systems. The model leverages key partnerships with organizations like the Agroecology Initiative (AE-I), Agritex, the Department of Veterinary Services (DVS), traditional leadership, and local farmers to ensure efficient implementation. Key activities include farmer training, district-level sensitization meetings, the delivery of chicks and feed, mentorship programs, and market support. These efforts are supported by robust communication channels such as WhatsApp groups, the Hamara App, and the placement of local agents to ensure smooth operations. The model targets local brooding businesses, smallholder farmers, and both local and urban restaurants, providing them with dual income opportunities from meat and egg production.

Key resources, such as trained personnel, a delivery truck, motorcycles, and smartphones, facilitate effective communication, logistics, and support for farmers. Costs are managed through investments in transportation, salaries, and inputs like chicks and feed, while revenue is generated through the sale of stock feed, chicks, and farmer-produced chickens. The distribution shop in Murehwa serves as a central hub for input delivery and farmer engagement, while partnerships with Agritex and other development partners help expand the model's reach. Overall, this business model aligns with agroecological principles by promoting diversity, resilience, and inclusivity, creating fair employment opportunities for women and youth, and fostering local governance of resources while addressing both local and urban market demands.

Contribution of the existing business model.

The Hamara business model makes significant contributions to agroecological principles within the targeted territorial food systems by integrating diverse business models, markets, and investment modalities. It supports the principles of diversity, synergies, and efficiency by offering multiple poultry options (broilers, layers, and dual-purpose Sasso chickens) that meet diverse farmer needs, creating resilience and adaptability to market demands. The synergy between poultry and crop systems is enhanced through the use of poultry manure as organic fertilizer, which supports soil fertility and reduces chemical input dependency. Efficiency is further promoted through investment in free-range feeding systems and the use of local feed resources like Azolla and crop residues, reducing reliance on costly external inputs while optimizing resource use in the staged brooding and rearing process.

The model also prioritizes fair employment, inclusivity, resilience, and social equity, particularly for women, youth, and marginalized community members. The low-cost entry point and the decentralized brooding system make it accessible for resource-constrained farmers, providing sustainable livelihood opportunities. Poultry farming, often considered a women's enterprise, empowers women by giving them leadership roles in brooding and rearing, which aligns with local cultural norms and promotes income generation. The dual focus on meat and egg production provides farmers with two reliable income streams, ensuring financial stability and resilience to economic shocks. Youth are also engaged in the system, benefiting from training programs and income-generating opportunities, fostering intergenerational inclusion and long-term economic growth. The principles of circular and solidarity economy, responsible governance, and resource management are evident in the model's emphasis on localized resource use and recycling. Poultry manure is recycled as fertilizer or used in azolla production, creating closed-loop systems that support both poultry and crop production.
These practices reduce environmental impact and strengthen local governance of natural resources by encouraging farmers to rely on locally available inputs and make independent decisions about resource management. Investment in community-based brooding and rearing systems promotes decentralized governance and builds solidarity among farmers, encouraging collaboration and resource sharing.

Finally, the principles of market opportunities, connectivity, and co-creation of knowledge are supported through strategic investment in markets and stakeholder linkages. The Hamara model creates access to local and urban markets, enabling farmers to capitalize on the growing demand for poultry products and value-added items like frozen cuts and packaged eggs. These market linkages are strengthened by partnerships with financial institutions to provide credit tailored to smallholder farmers, enabling investment in infrastructure and scaling operations. Training programs further support the co-creation of knowledge by equipping farmers with skills in sustainable practices and innovative solutions, fostering resilience and adaptability within the food system. Overall, the Hamara business model integrates agroecological principles into business, market, and investment strategies to promote fair employment, inclusive income opportunities, and sustainable resource management in the targeted territorial food systems.

Highlights and recommendations.

To address the weaknesses and capitalize on the opportunities in the Hamara business model, a comprehensive approach is needed to enhance sustainability, inclusivity, and resilience. Feed costs, a significant barrier for farmers, can be mitigated by promoting local alternatives such as Azolla and crop residues, which reduce reliance on commercial feeds. Agritex and engagement of organizations like Fambidzanayi can be engaged for farmers to be trained to formulate cost-effective feed mixes using locally available resources like acacia seeds and maize bran. This not only lowers production costs but also aligns with agroecological principles of efficiency and resource circularity. Furthermore, partnership engagements or interventions of organizations training farmers to have ISALs could provide a local source of credit which gives room for expansion. Additionally, these group savings schemes, or farmer cooperatives can be used to pool resources and strengthen collective bargaining power.

Enhancing farmer knowledge and market access is another critical priority. Training programs should be expanded to include practical modules on disease prevention, resource-efficient free-range systems, and market-oriented production strategies. Digital tools like the Hamara App and WhatsApp groups can facilitate real-time communication, knowledge sharing, and technical support for farmers. To address market access challenges, strong linkages should be established with urban retailers, restaurants, and institutional buyers, ensuring a steady demand for meat and egg products. E-commerce platforms can be leveraged to connect farmers directly with consumers, enhancing profitability. Additionally, decentralizing logistics by setting up regional hubs or working with local businesses for last-mile delivery can improve the timeliness of chick and feed supply, particularly in remote areas.

To ensure product quality and reduce mortality rates, investments should be made in shared or community-based brooding facilities, providing farmers with access to standardized brooding spaces and technical assistance. Disease management should also be prioritized by strengthening partnerships with the Department of Veterinary Services to improve access to vaccines and training on biosecurity measures. Expanding the use of poultry manure for organic fertilizer or azolla production creates a circular economy while providing additional income opportunities for farmers.

Finally, the model should focus on value addition and tapping into premium markets. Establishing small-scale processing facilities for frozen chicken cuts or packaged eggs would allow farmers to access higher-value markets, including urban and export markets. Branding and marketing support can position free-range Sasso chickens as premium, sustainable products for health-conscious consumers. Collaborating with trade associations and development agencies can help navigate regulatory requirements for export and co-fund infrastructure development. By implementing these recommendations, the Hamara business model can address existing weaknesses, capitalize on emerging opportunities, and create a more sustainable and profitable poultry value chain for all stakeholders.

The primary challenge faced by Hamara is the cost of establishment and consolidation as well as the introduction of the business model into communities. Setting up operations and familiarizing farmers with the concept requires significant upfront investment in training, infrastructure, and promotion. This challenge can be effectively mitigated through grant funding and the establishment of sustainable partnerships with the UU program and other stakeholders within the district. These collaborations would help ease financial burdens and foster community trust in the new model.

Another major challenge is the risk of slow adoption by farmers due to the prevailing economic environment in the country. Limited disposable income and market uncertainties might deter some farmers from embracing the new breed and business model. To address this, the company plans to invest in comprehensive training, marketing, and promotional activities. By presenting the model as a lucrative business opportunity capable of generating higher incomes for farmers, the company aims to overcome hesitancy and incentivize widespread adoption.

An associated risk with low adoption is the potential for an oversupply of chickens in the district, which could result in reduced reorder rates and an imbalance in supply and demand. To counter this, the company will promote local consumption of meat and eggs, educating communities on the benefits of these products. Additionally, farmers will be trained and capacitated in marketing mature birds, enabling them to find buyers within and beyond their local areas. Hamara will also take an active role in securing end-market opportunities on behalf of farmers by partnering with restaurants and other bulk buyers to ensure consistent demand.

In summary, the challenges of establishing and consolidating the business, encouraging farmer adoption, and managing supply and demand require a multi-faceted approach. Recommendations include securing grant funding, building partnerships, investing in farmer training and marketing, promoting local consumption, and connecting farmers to stable markets. These steps will support the successful implementation of the business model and drive its long-term sustainability

Re-designing/ Upgrading Plan for the Sasso business model.

Below is the detailed upgrading plan for the Hamara Sasso brooding business model based on the document provided. The plan addresses objectives, goals, activities, indicators, current status, targets, responsible actors, estimated costs, and agroecological (AE) principles.

Figure 7. Sasso production model by a Hamara farmer who was visited for a Look and Learn tour in Harare.

Table 2. Business Upgrading plan for Sasso Brooding model.

Objective	Goal	Activity	Indicator	Current Status	Target	Responsible Actors	Supporting Actors	Timeframe	Estimated Costs	Relevant AE Principles
Increase Sasso chicken adoption	Expand Sasso brooding units in the Murehwa District	Train farmers on brooding and production systems, including housing and feeding	Number of trainings conducted, and participants trained	Limited adoption and understanding of brooding models	Train 100 farmers by 2025	Hamara	AARDS, NGOs	Sept 2024 – Dec 2025	$15,000	Co-creation of knowledge, responsible governance
Improve financial literacy and access	Enhance farmers' financial literacy for sustainable Sasso production	Conduct workshops on financial literacy and loan benefits	Number of workshops held, and farmers trained	Low farmer awareness and usage of loans	10 workshops covering 200 farmers by 2025	Hamara, MFIs	ISAL groups, ZADT	Sept 2024 – Dec 2025	$8,000	Fairness, resilience
Increase market access for mature Sasso chickens	Strengthen rural and urban market linkages	Organize Sasso tasting events and networking with the hospitality industry, cooking demos in town with celebrity chefs	Number of events held, and partnerships created	Limited access to formal markets	Organize 3 events by 2025	Hamara	Hospitality industry, Farmer groups	Sept 2024 – Dec 2025	$15,000	Connectivity, social values, and diets
Strengthen farmer networks and scale production	Establish farmer groups for bulk procurement and shared resources	Formulate farmer clusters and cooperative groups	Number of farmer groups established and operational	Fragmented individual production	Establish 10 farmer groups by 2025	Hamara, AARDS	Farmer unions	Sept 2024 – Dec 2025	$7,000	Economic diversification, solidarity

New business model configuration

Table 3. Sasso upgraded Business Model

<table>
<tr><th colspan="5">Business Model Canvas- Hamara Sasso chickens</th></tr>
<tr><th>Key Partners</th><th>Key Activities</th><th>Value Propositions</th><th>Customer Relationships</th><th>Customer Segments</th></tr>
<tr><td rowspan="3">• Private distributors (Farm & City)
• Agritex / Veterinary Service
• Trentsetter Distributors
• KVD Livestock Consultancy
• Farmers (Feed Formulation)</td><td>• District Engagement and sensitization meetings
• Trainings outside the pilot wards
• Establishing communication channels
• Delivery of chicks and feed
• Payment modalities
• Mentorship/Monitoring and Market support</td><td rowspan="3">• Introduction of a hardy, dual-purpose, fast-growing, low-cost, large, and tasty poultry breed which is free range.</td><td>• Good communication including WhatsApp groups and through Hamara App.
• Placement of agent
• Training of businesses and farmers</td><td rowspan="3">• Local brooding businesses
• Local farmers
• Local and City restaurants</td></tr>
<tr><td>Key Resources</td><td>Channels</td></tr>
<tr><td>Motorbike, Mobile phone, Delivery vehicle,</td><td>• Distribution shop in Murehwa
• Physical meetings & Trainings
• Virtual communication
• Agritex and Development partners.</td></tr>
<tr><td colspan="2">Cost Structure</td><td colspan="3">Revenue Streams</td></tr>
<tr><td colspan="2">• Logistics (Truck and bike)
• Salaries
• Chicks and Feeds</td><td colspan="3">• Sale of stockfeed and chicks
• Sale of farmer produced chickens
• Sale of other products (broilers, layers feeds)</td></tr>
</table>

Hamara has strategically upgraded its business model to enhance value delivery and operational efficiency. Previously, the company primarily targeted urban consumers seeking fresh poultry products. The upgraded model now encompasses a broader customer base, including rural communities interested in sustainable farming and businesses like restaurants and retailers requiring consistent, high-quality poultry supplies.

In terms of value propositions, Hamara has expanded beyond offering fresh, locally sourced poultry. The company now emphasizes sustainability through eco-friendly farming practices and community support by empowering local farmers via partnerships and fair-trade initiatives. The distribution channels have also been diversified. While direct sales through farmers' markets and company-owned outlets remain, Hamara has introduced an online platform, Hamara App, to facilitate group purchases. Additionally, distribution channels have been established to supply restaurants and retail chains.

Customer relationship management has evolved to include personal assistance and follow up by field officers supporting on the ground, community engagement via workshops promoting sustainable farming, and loyalty programs rewarding repeat customers and referrals. Revenue streams have been diversified. Key resources have been augmented to support these initiatives. The workforce has expanded to include skilled farmers, sales, and support staff. Physical assets now comprise farms, processing facilities, and an extensive distribution network. Intellectual property has been strengthened through brand development and proprietary farming techniques.

Operational activities have been refined to focus on efficient farming operations, supply chain management, and targeted marketing and sales efforts. Key partnerships have been established with local farmers for sourcing and co-production, suppliers for essential inputs, and community organizations for joint development initiatives. The cost structure has been realigned to accommodate these changes, accounting for operational expenses, marketing efforts, and administrative costs. Through these strategic upgrades, Hamara aims to deliver enhanced value to a broader customer base while maintaining a commitment to sustainability and community development.

Cost Benefit Analysis of the Sasso business.

The Cost-Benefit Analysis (CBA) conducted employed both economic and social methodologies to evaluate and compare the benefits and costs of the proposed business models. Quantitative assessments included Gross Margin Analysis (GMA), conducted at the farmer level, to evaluate financial benefits and costs associated with each model. This analysis helped determine ex-ante profitability for farmers participating in these business initiatives. Additionally, cashflow projections were developed to present the monthly net financial position for companies during their first year of operations under two scenarios: with Agroecological Initiative (AE-I) support and without. The projections demonstrated how AE-I grant funding could mitigate initial costs and risks, ensuring earlier profitability. Furthermore, Net Present Value (NPV) tests were applied to discount future cash flows at an 8.8% rate, factoring in inflation and risk premiums. Positive NPV results were considered indicative of viable and efficient resource allocation.

Qualitative CBA complemented these quantitative analyses by comparing "with" and "without" project scenarios using information from company records, literature reviews, and prior project experiences. These qualitative assessments considered broader environmental, social, and cultural impacts of the business models, emphasizing their alignment with agroecological principles. Key impacts such as improved social cohesion, sustainability, and alignment with agroecology goals were evaluated alongside quantitative financial metrics.

To perform the analysis, a custom CBA template was co-developed with CIMMYT and iteratively completed in collaboration with participating companies. Cashflow projections highlighted the financial differences grant funding could make, demonstrating its importance in overcoming high establishment costs and reducing risks. The analysis also identified financial viability for both farmers and companies while ensuring a broader understanding of the models' socio-environmental impacts.

The process acknowledged several limitations, including the potential for inaccuracies in determining appropriate discount rates, variability in project risks over time, and the exclusion of non-financial metrics in NPV calculations. The dynamic nature of the business environment was also recognized as a factor that could influence outcomes. Despite these limitations, the structured approach provided a holistic evaluation of the proposed business models, balancing financial viability with broader impacts on social, economic, and environmental dimensions.

Net Present Value Test

The Net Present Value (NPV) test is used to analyze the profitability and efficiency of resource allocation of business models and cashflows projections. To analyze the AE-I models a discount rate of 8.8% was used to discount the cashflows – broken down as 4.8% to account for the rate of inflation and 4% to include a risk premium. The results of the NPV tests for the Hamara model are summarized in Table 5 below. The business models have positive NPV's, thus, we accept the business model for investment as it represents an efficient shift in resource allocation.

Table 4. Net Present Value for the Sasso business model.

		2023/24	2024/25	2025/26	2026/27	2027/28
COST BENEFIT ANALYSIS:		**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Profit without grant		-7.9%	-8.2%	-5.1%	-0.6%	4.3%
Profit with $20,000 grant		-0.4%	-3.5%	-2.1%	1.3%	5.5%

The positive Net Present Values suggest that the Hamara business models are viable and represent efficient resource allocation. Positive NPV means the present value of cash inflows exceeds cash outflows, justifying the investment. The business is under pressure for the first 3 years, the investment represents a significant improvement in the company's viability. It's common for businesses to face initial pressure, often due to capital-intensive setup costs, training, or market entry challenges. Despite these initial challenges, the NPV test indicates the model's long-term potential for improvement and growth.

Farmer Gross Margin Analysis (GMA) Comparison.

Table 6 presents a financial analysis of the projected gross margin budget for Village-based Brooding businesses that rear day-old chicks for four weeks, before selling and Farmers rearing Sasso chickens to maturity. The analysis in Table 3 was done to determine (1) the most economically viable poultry enterprise and (2) the viability of the brooding business and the Sasso farmer. GMAs were compared for Sasso, broilers, and indigenous roadrunner chickens. The brooding business model for Sasso promises profitability. Profits are incremental as the business grows and reaches economies of scale. Farmers in Murehwa are expected to start at the 100-chick level, which will allow them to learn the business model establish marketing channels and scale up production gradually to maximize profitability in subsequent cycles.

Table 5.Poultry Enterprise Comparison for Murehwa District

	Sasso brooding	Broilers	Road Runner Chickens
Length of cycle (days)	28	43	180
Profit per 100 birds per cycle (USD)	44.00	68.68	74.74 *(assumed at the breeding stock of 6 chickens)*
Possible number of cycles in a year	13	8	2
Total possible income per year (USD)	572.00	549.44	149.48
Refrigeration costs	No	Yes	No
Convenience of cooking	Convenient	Convenient	Not Convenient
Growth rate	Fast	Fast	Low
Production system	Full feeding/Supplementary feeding/ Free range	Full feeding	Supplementary feeding/ Free range
Sources of Income	Meat and Eggs *(lay rate high)*	Meat	Meat and eggs *(lay rate very low)*

The Sasso brooding model stands out as the most economically viable option, combining a high cycle frequency with diversified income streams from meat and eggs, while offering a scalable business model with potential for economies of scale. Starting with 100 chickens allows farmers experiential learning, risk management, and the development of marketing channels while keeping initial risks low. With adequate training and support, farmers can expand their flock size over time, significantly enhancing profitability. Additionally, Sasso's fast growth rate, cooking convenience, and flexible production system make it highly attractive to both producers and consumers. However, success will require addressing key challenges such as equipping farmers with effective marketing strategies, capacity-building initiatives, and ensuring access to quality feed and healthcare for the chickens.

Business scaling

Table 6. Hamara desired growth projections.

Hamara : Desired Growth Projections								
				2023/24	2024/25	2025/26	2026/27	2027/28
Item	Unit	Av. Cost ($)	Potential Profi	Year 1	Year 2	Year 3	Year 4	Year 5
Farmers - no. trained (approx.) [cum]				500	750	1,125	1,688	2,531
- no. actively rearing birds [cum]				189	284	425	638	957
- no. of direct beneficiaries* [cum]				945	1,418	2,126	3,189	4,784
- no. on Hamara App [cum]				2	225	338	506	759
- no. of clubs [cum]					20	40	60	80
- no. of club journey steps [cum]**					30	60	90	120
Chicks sold - Sasso	Each	$0.80	$0.44	42,000	63,000	94,500	141,750	212,625
- broiler	Each	$0.95	$1.00	168,000	252,000	378,000	567,000	850,500
- layer (0 - 20 wks)	Each	$1.45	$2.50	8,400	12,600	18,900	28,350	42,525
- Point Of Lay (per yr)	Each	$10.50	$9.53	-	1,000	1,500	2,250	3,375
TOTAL CHICK SALES				**218,400**	**328,600**	**492,900**	**739,350**	**1,109,025**
Feed - Sasso	MT	$603.33		5.20	28.35	56.70	106.31	191.36
- broiler	MT	$650.00		59.45	113.40	226.80	425.25	765.45
- layer	MT	$574.48		-	5.67	11.34	21.26	38.27
- Point Of Lay	MT	$530.00		-	0.45	0.90	1.69	3.04
TOTAL FEED SALES	**MT**			**64.65**	**147.87**	**295.74**	**554.51**	**998.12**
Feed to Chick (F2C) ratio (ave)(kg)				0.30	0.45	0.60	0.75	0.90
Value of inputs (birds + feed)				$247,160	$412,880	$666,475	$1,070,446	$1,711,768
Farmer profit (potential)				$207,480	$320,750	$481,125	$721,688	$1,082,531
Farmer profit (potential) with discount***				$248,976	$384,900	$577,350	$866,025	$1,299,038

The Hamara model demonstrates a well-designed scaling plan, with significant growth projected in farmer participation, chick sales, and feed sales. This growth indicates a strong commitment to expanding the model's reach and impact, ensuring more farmers benefit from the program. Key to the model's sustainability is the integration of feed supply systems, farmer clubs, and digital tools such as the Hamara App. These elements provide continuous support and capacity building for farmers, creating a resilient and self-sustaining ecosystem for poultry production. The focus on profitability for farmers enhances the attractiveness of the model, ensuring it aligns with their interests and incentivizes participation. The steady increase in potential profits underscores the economic viability of the enterprise, encouraging long-term engagement.

However, achieving these ambitious projections will require addressing several challenges. The rapid growth in feed and chick sales necessitates a robust supply chain and logistics system to prevent bottlenecks. Ensuring the consistent quality and availability of inputs like feed and chicks at scale is critical to maintaining farmer confidence and productivity. Finally, while sales growth is promising, market expansion strategies are essential to prevent overproduction. Establishing strong buyer linkages and ensuring that demand keeps pace with production will be key to the model's long-term success.

Investment needs for scaling

Table 7. Sasso business model cost of growth.

Cost of Growth		2023/24	2024/25	2025/26	2026/27	2027/28
		Year 1	Year 2	Year 3	Year 4	Year 5
Total income (sales)		247,160	412,880	666,475	1,070,446	1,711,768
Expenditure						
Cost of sales + overheads	10%	222,444	371,592	599,828	963,401	1,540,591
Monthly overheads						
Personnel		8,990	10,788	12,946	15,535	18,642
Logistics		20,400	24,480	29,376	35,251	42,301
Furniture & equipment		1,400	1,680	2,016	2,419	2,903
General opearting costs		15,050	18,060	21,672	26,006	31,208
Total Expenses		268,284	426,600	665,838	1,042,613	1,635,645
Net Cashflow		(21,124)	(13,720)	638	27,833	76,123
Ending Cash Balance		(21,124)	(34,844)	(34,207)	(6,374)	69,749
Ending Cash Balance with $20,000 grant		(1,124)	(14,844)	(14,207)	13,626	89,749
COST BENEFIT ANALYSIS:						
Profit without grant		-7.9%	-8.2%	-5.1%	-0.6%	4.3%
Profit with $20,000 grant		-0.4%	-3.5%	-2.1%	1.3%	5.5%

Hamara has requested a grant of $20,000 to complete the funding required for its first year of operations in Murehwa. This funding is critical to balance the cash flow for the year, enabling the business to establish viability in its foundational stage. The grant will be used to support several key actions aimed at empowering farmers and setting the groundwork for long-term success.

A significant portion of the funding will be directed towards regular training and technical services, facilitated by an on-ground Field Officer. These activities are essential for equipping farmers with the skills and knowledge necessary to adopt and succeed within the Hamara business model. This focus on capacity building and farmer support is aligned with the broader goals of ensuring the project's sustainability and impact.

Additionally, Hamara is prioritizing the promotion of its Hamara App as a critical tool for mobilizing and guiding farmers through their development journeys. The App is designed to facilitate communication, training, and data collection, providing farmers with valuable resources and support. However, connectivity challenges in certain areas have been identified as a barrier to the App's full utilization. In response, Hamara has collaborated with Econet to address poor signal coverage in specific locations. While Econet works on installing additional base stations, Hamara has proposed an interim solution: the purchase of two StarLink stations. These portable stations will be deployed during training days, enabling farmers to download the App and receive training on its use, despite the connectivity limitations in their areas.

This planned allocation of funds demonstrates a thoughtful and strategic approach to addressing immediate operational challenges while laying the groundwork for long-term growth. By ensuring access to training, technical support, and digital tools, Hamara is establishing a strong foundation for its operations in Murehwa. The proposed actions are designed to enhance farmer engagement, increase their capacity to succeed, and ultimately drive the sustainability of the initiative.

Conclusions and recommendations

The Hamara Sasso business model in Murehwa demonstrates a strategic integration of agroecological principles to create a sustainable, inclusive, and economically viable poultry value chain. By prioritizing dual-purpose Sasso chickens, the model effectively addresses challenges in resilience, diversity, and resource efficiency. The staged brooding process, strong market linkages, and inclusive participation of women, youth, and marginalized groups highlight its alignment with agroecological goals. Key outputs include increased adoption of agroecological practices, diversified income streams for farmers, and improved food and nutrition security. However, the diagnostic and implementation processes have also revealed significant risks and challenges. These include the high initial costs for farmers, limited knowledge of feed formulation, market uncertainties, and logistical barriers in input and output distribution. Despite these challenges, the business model has shown potential for scalability and profitability, supported by strong partnerships and targeted investments.

Recommendations

To strengthen the Hamara Sasso business model, capacity building and knowledge sharing must be prioritized. Expanding training programs to include practical modules on feed formulation using locally available resources, disease management, and agroecological practices will equip farmers with essential skills to enhance productivity and resilience. Organizations like Fambidzanayi and ILRI already working in the project area can be engaged to help in this these are within their organizational mandates. Leveraging digital platforms such as the Hamara App can further facilitate farmer training, improve communication, and increase market access by providing timely and relevant information.

Market development is critical to sustaining the business model's growth. Building strong partnerships with urban markets, restaurants, and retailers will ensure a consistent demand for poultry products, stabilizing farmer incomes. Organizing promotional events, such as Sasso tasting campaigns, will not only raise consumer awareness but also enhance market penetration by showcasing the quality and value of the Sasso breed to a wider audience. A study done by Agricultural Partnership Trust recommended the need for strong marketing efforts by Hamara such as cookout competitions and celebrity chefs to raise more awareness on Sasso.

Reducing feed costs is vital to improving the economic viability of poultry farming. Encouraging the use of alternative feed sources, such as Azolla and crop residues, can significantly lower production costs while maintaining sustainability. Collaboration with research institutions to develop innovative and cost-effective feeding solutions will provide farmers with additional tools to enhance feed efficiency and reduce dependence on commercial feed inputs.

Financial inclusion strategies are essential to empower farmers, especially those with limited resources. Establishing group savings schemes or cooperatives can help farmers pool resources, manage financial risks more effectively, and access affordable credit facilities. These cooperative models can also strengthen farmers' collective bargaining power in the marketplace.

Addressing logistical challenges will improve operational efficiency and farmer connectivity. Deploying portable connectivity solutions like StarLink can overcome communication barriers in remote areas, enabling real-time coordination and access to digital tools such as the Hamara App. This connectivity will ensure timely support and information dissemination to farmers, enhancing their participation in the business model. Hamara will be running a pilot to test efficiency of this.

Promoting circular economy practices by extension and organisations can enhance resource efficiency and create additional income streams for farmers. Recycling poultry manure into organic fertilizer and supporting Azolla production for feed offers opportunities to close resource loops, improve soil health, and reduce environmental impacts. These practices align with agroecological principles and contribute to long-term sustainability.

Finally, long-term investments are crucial for scaling the business model. Partnerships with development agencies should be fostered to secure grants for infrastructure development and operational scaling. Investments in facilities such as decentralized brooding units and processing centers will enhance the model's capacity to meet market demands, ensure scalability, and create a resilient framework for sustainable poultry production.

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