

FROM SUBSISTENCE TO PROFESSIONAL DAIRY BUSINESSES

Feasibility study for climate-smart livelihoods through improved livestock systems in Oromia, Ethiopia

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Solidaridad

 **BioCarbon Fund**
Initiative for Sustainable Forest Landscapes

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GLOSSARY OF ACRONYMS

ACC	Agriculture Commercial Cluster
AI	Artificial Insemination
ATA	Agriculture Transformation Agency
BioCF	BioCarbon Fund
BMGF	Bill and Melinda Gates Foundation
BAU	Business as Usual
CDM	Clean Development Mechanism
CSD	Climate Smart Dairy
EBIT(DA)	Earning before Interest, Taxes, (Depreciation and Amortization)
ER	Emission Reduction
ERPA	Emission Reduction Payment Agreement
ETB	Ethiopian Birr
FTE	Full-time equivalent
FPCM	Fat and Protein Corrected Milk, standardized to 4.0% fat and 3.3% protein
FCR	Feed Conversion Rate, the amount of feed used to produce 1 kg of animal product
GHG	Greenhouse Gas(es), often expressed as kg CO ₂ -equivalents per kg of product
GoE	Government of Ethiopia
GTP	Growth and Transformation Plan
HF	Holstein Friesian
IRR	Internal Rate of Return
ISFL	Initiative for Sustainable Forest Landscapes
LULUC (LU)LUCF	Land Use and Land Use Change Land Use, Land Use Change and Forestry, an IPCC category where all changes in carbon stocks below and above ground are reported.
LFSDP	Livestock & Fisheries Sector Development Project
LMD	Livestock Masterplan Development (team)
MFI	Micro Finance Institutes
MRV	Measurement, Reporting and Verification
MCC	Milk Collection Centre
OFLP	Oromia Forest Landscape Programme
TD/EBITDA	Total debt/EBITDA
UHT	Ultra High Temperature
VC	Value Chain

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EXECUTIVE SUMMARY

The strategy of the Government of Ethiopia (GoE) is to become self-sufficient in milk production and to move from being a net importer of dairy products to a net exporter by 2020. The aim of this report is to contribute to this strategy by advising on a sustainable growth path that leads to economic development while realizing measurable reductions in GHG emissions. As an added benefit, a growth path like this one will protect natural forest and lead to more sustainable management of landscapes. This path presents climate-smart interventions that have not yet been introduced on a large scale in Ethiopia.

The current state of the dairy industry in Oromia, the biggest dairy producing Regional State in Ethiopia, is one in which production levels are low, fresh milk is of poor quality, and good-quality inputs and services (feed, fodder and artificial insemination) cannot be accessed easily. Meanwhile, incentives for farmers to sell to the formal market are low while market demand from consumers for high-quality dairy products is increasing. Due to low productivity per cow, the current GHG footprint of smallholder-produced milk is very high—from 15-70 kg CO₂ equivalent per kg of milk, which becomes even higher if waste and quality loss in the supply chain are included. As a result, the dairy sector contributes significantly to the GHG balance of Oromia and the country, and provides ample room for improvement.

A baseline study among 73 different dairy farms in five production zones shows the diversity within the sector in terms of different farming systems existing in different zones, referred to as “tiers” in this report. Farm systems range from rural-mixed systems in Jimma (coffee/livestock/maize) to more urban systems in Debre Zeit in which commercial dairy farmers specialize in milk production. The number of unproductive milking cows is much lower on commercially owned farms than on rural farms. The same baseline study provided important insights and data for models that are used to make simulations on GHG emissions under different scenarios.

Attempting to use the current dairy production system to make Ethiopia self-sufficient in milk would require a massive increase in area. As this land is simply not available, (climate-smart) intensification of milk production is necessary to reach the goal. Under certain conditions, milk production in Oromia can double while reducing net GHG emissions. In order to achieve this, a small part (about 20%) of the current herd needs to be replaced by six-times more productive animals, and climate-smart traction and feed production systems need to be introduced. As an alternative, more productive animals could be added to the current herd which results in modest GHG emission increases. Both scenarios show significant emission reductions compared to business as usual. Under a conservative scenario, emission reduction payments would amount to about \$90,000 per hub, if the BioCarbon

fund awards emission reduction payments to the livestock sector from 2023 onwards.

In general, improved farm management, better access to fodder in the dry period and better access to services will lead to improved production (on an annual basis), improved fertility and a lower mortality rate. To achieve this, dairy farmers must specialize and commercialize their businesses, dairy processing companies must secure access to markets and service provision to farmers must be in place. Intensifying milk production is important to achieve much lower emissions per kg of milk and less land used for grazing. These elements are at the core of a climate-smart growth strategy.

Whether farmers invest in such a growth strategy will depend on a positive business case that should lead to a higher and more stable level of income and the accumulation of productive assets. Such a business case can never work in isolation from the business cases of other value chain players. For farmers to move from one farming system to another, it is essential to follow a fully integrated value chain approach in which local dairy processors provide reliable access to markets and invest in so-called dairy hubs.

A dairy hub is a commercial enterprise that links farmers to processors. These hubs play a crucial role in ensuring that joint milking, collection and cooling can be done in close proximity to the dairy villages. Joint ownership of dairy hubs (farmers together with dairy processors) will enhance trust. The processors are in general in a better position to invest, while farmers lack access to finance but can provide labour and increasingly high-quality milk. To improve access to financing for farmers and empower them to become investors in dairy hubs, carbon credits (valued and monetized) can be used as a guarantee to incentivize banks to cover part of the initial loss on the portfolio of investments.

The business case for investing in dairy hubs is clear, and some milk processors in Oromia Regional State are already doing it. The business case for a farmer to move from a smallholder farming system (also re-

ferred to as 2/2: 2 cows each producing 2 litres milk a day) is positive but involves a lot of risks that can only be mitigated by a secured market and when reliable and affordable support is offered by service providers of feed, fodder and veterinary services. Last but not least, an organization overseeing the implementation of interventions should be in place.

Each farming system will follow a different growth path. In general, farmers need to professionalize and grow towards a larger scale while improving productivity. Climate-smart dairy practices as part of the Technical Assistance (TA) packages designed for farmers are essential in supporting farmers on this growth path. The most important practices involve the replacement of non-productive cows with productive cows, manure management, health care, young stock rearing and adoption of new dairy farming strategies such as reduced grazing in the dry period and increased availability and planning of improved fodder production.

The government recognizes the challenges and has developed new policies to increase dedicated support to the dairy industry with the aim of developing the sector more rapidly toward formalization and professionalization, creating more space for the private sector to play a role. Our proposed approach and interventions fit perfectly within the frameworks being developed by both the World Bank and the GoE, so our recommendation is to begin pilots to test the climate-smart intervention packages within the business and investment case of the value chain players involved and the climate and land use frameworks adopted by the GoE.

It will take three years for the proposed pilot schemes to bear fruit and prove the business and investment case. For a wider uptake at national level, we recommend focusing on a smaller group of farmers in Ethiopia (100,000 farmers) that have the potential to grow towards commercial farmers, responsible for supplying most of the milk to formal markets. The individual pilot initiatives are further explained in the annexes to the report, including the timelines, partners and investment needed to implement them.

1

INTRODUCTION & OBJECTIVES

The objective of the Government of Ethiopia (GoE) is to become self-sufficient in milk production, meaning that full internal market demands for dairy products will be met by the end of 2020 under the Growth and Transformation Plan II. Ethiopia plans to move from being a net importer of dairy products to a net exporter by 2020. The World Bank has granted a loan of 150 million dollars to meet this objective and implement the national dairy strategy at national level as part of the government's livestock master plan.

The World Bank BioCarbon Fund's Initiative for Sustainable Forest Landscapes (ISFL) supports jurisdiction-level landscape programmes with upfront funding to governments to enable environment and MRV, and funding to private-public partnerships for sustainable land management, as well as downstream funding to governments through 2030 in the form of results-based payments. The ISFL and its donors have a strong interest in engaging the private sector with its programmes.

The BioCarbon Fund Initiative recognizes the important role that the private sector plays in encouraging smarter land use and reducing deforestation and degradation—and that the private sector can play a pivotal role in scaling up sustainable practices in emerging markets. The initiative is being designed to enable private-sector engagement and financial investments. Its objective is to partner with private firms to help “forest-proof” the sourcing of commodities and re-

direct market forces towards more sustainable land management practices. The programmes have been selected on the basis of an assessment that major agricultural supply chain commodities are significant drivers of deforestation in jurisdictions such as the livestock and coffee sectors in the Oromia Region of Ethiopia.

In Ethiopia, the Oromia Forest Landscape Programme (OFLP) has received an 18 million dollar grant to invest in capacity reinforcement and land use management. As part of the programme, the BioCarbon Fund is supporting a feasibility scoping study for Climate-Smart Livelihoods through improved livestock systems in Oromia. The objective of this analysis is to provide subsidies for professional, market-driven and climate-smart dairy development to support small-scale farmers' diversified livelihoods in Oromia Region, backed by dairy companies and regional cooperatives. This analysis will contribute measurably to climate change mitigation and adaptation.

The most important deliverables of the study are a baseline assessment including key production parameters of selected clusters in Oromia, using the GLEAM model to obtain a better understanding of the proposed climate adaptation and mitigation practices, and business and investment plans with selected value chain stakeholders in the dairy sector. Given the ambition of the GoE, this assessment also aims to contribute to the national livestock strategy for professional



dairy development in order to develop profitable and climate-smart value chain structures in Oromia Region.

This report starts by providing a snapshot of the dairy sector in Ethiopia (Chapter 2) and introduces proposed intervention strategies and packages (Chapter 3) that will be backed by a business and investment case analysis (Chapter 4) and GHG scenario calculations as a result of expected professionalization of the dairy sector, including recommended mitigation strategies being part of the intervention strategies and packages (Chapter 5). Last but not less important, the report provides recommendations on next steps (Chapter 6). We encourage the reader to study the annexes to get a more detailed understanding of relevant topics.

2

ETHIOPIAN DAIRY SECTOR AT A GLANCE

This chapter will provide a brief description of the current state of the dairy sector in Ethiopia.

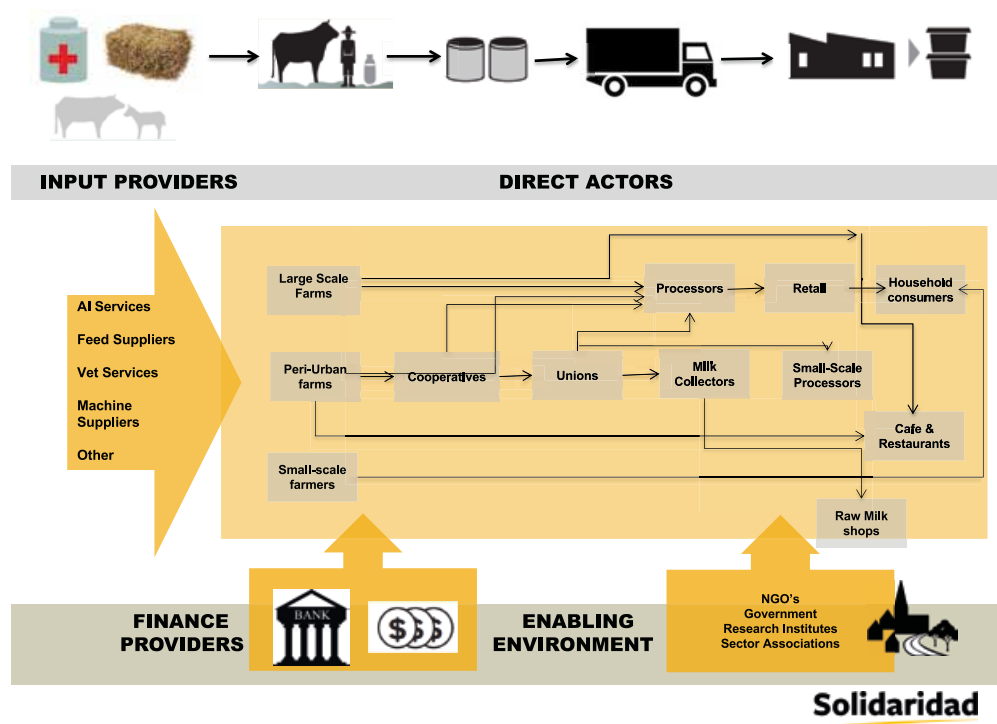
2.1 STRUCTURE OF THE SECTOR

The figure below shows the main stakeholders that are active in the dairy supply chain in Ethiopia. Having access to several input providers is an important precondition for dairy farmers to be able to ensure optimal production rates per cow. The direct actors at the core of the supply chain are the cooperatives, unions and (sometimes private) collectors who form the link between farmers and processors most of the time.

The cooperatives are usually responsible for collecting the milk via central Milk Collection Centres (MCCs). They then sell the milk to processors on behalf of all the farmers. Given the increased competition and expansion of processing facilities in Ethiopia (currently more than 35, the number is increasing each year), processors are sometimes forced to source milk at distances of up to 200 km from their facilities.

Finance providers and the GoE are important enablers of the value chain. The government, specifically the Ministry of Livestock and Fisheries, is responsible for supporting an enabling environment for all value chain

FIGURE 1: Ethiopian Dairy Value Chain



actors in the dairy sector. To encourage investment in the dairy sector, especially regarding the establishment of MCCs and other infrastructure, it is important to ensure that banks and impact investors can bridge this financial gap for processors and cooperatives.

Farming systems and main milk-shed areas

In Ethiopia there are five types of farm system involved in milk production that are being used in this scoping assessment. These systems are:

- Rural smallholder farmers (both cereal-based and perennial crop-based)
- Specialized medium-sized farmers (peri-urban farms and land-based farms)
- Commercial or urban farms, located close to cities.

Although the Ethiopian dairy cattle population is distributed across all regions in the country, the four main milk-shed regions that contribute more than 90% of total milk production are Oromia, SNNPR, Amhara and Tigray.¹ Oromia is the largest contributor, producing almost 50% of the nation's milk. The main milk-shed areas within Oromia region are: Adama-Asella, Addis Ababa, Ambo-Woliso, Hawassa, Dire Dawa and Jimma areas. Chapter 3 summarizes the characteristics of farm systems and the main findings in each of the specified milk clusters.

Production, consumption and market trends

In Ethiopia total milk production has increased gradually over the last 15 years from less than 1 billion litres to 3 billion litres in 2016. Although this rising trend is positive, there is still a lot of potential to increase milk production substantially in a short timescale, given the fact that the total herd of more than 56 million cattle includes 12 million dairy cows.² Current production rates per cow are extremely low, ranging between 1 and 2 litres per cow per day for the majority of dairy cows.

With respect to domestic and household consumption of raw milk, 32% is consumed by calves or goes to waste while 68% is used for human consumption. Looking at human consumption, half of it is consumed at home and the other half processed into local dairy

products such as butter and *ayib*.³ At the same time, market reports indicate increasing consumer demand in formal markets for quality milk and dairy products in the urban areas.⁴ This is especially the case for Addis Ababa, where consumption rates per capita are increasing annually, reaching 55 litres per capita per year. Annual imports of dairy products, especially milk powders used in infant formula milk, fluctuate between 10 and 20 million dollars.

The situation offers an opportunity for dairy farmers to meet the growing internal market demand by increasing quality milk production.

2.2 PRIVATE SECTOR INVOLVEMENT

Dairy farms

In Ethiopia almost 95% of dairy cows are kept and maintained by smallholder farmers with fewer than five head of cattle per household. The other 5% are held by bigger (peri-urban and commercial) farms with 10 or more dairy cows. This is also reflected in milk consumption: around 5% of the raw milk reaches the formal market while 95% is consumed at home or sold through informal market systems.

In total, there are an estimated 16.5 million Ethiopian farms keeping cattle, including dairy cows. Cattle are also used to provide traction power, to produce meat and manure and as insurance in dry seasons. On average 95% of smallholders produce between one and two litres of milk per cow per day, compared to 10–15 litres per day for cross-breeds kept by larger farms and more than 20 litres per day for commercial dairy farms. Besides breeding improvements, longer lactation periods and calving intervals, feed and fodder planning (including dry seasons) and lower mortality rates for dairy cows increase milk production.

Dairy processing

Dairy processors in Ethiopia are the main drivers of milk uptake from dairy farms and play an important role in the development of the sector. Their role is to collect the raw milk from different sourcing destinations through collection centres, ensure the refrigerated transport of raw milk to the milk factory, and process the milk into cheese, yoghurt and other dairy products.

1 Central Statistics Agency in Ethiopia (CSA), 2015.

2 Central Statistics Agency in Ethiopia (CSA), -Agricultural Sample Survey, Report on Livestock and Livestock Characteristics, 2016.

3 Business Opportunity Report Dairy, NABC, Wageningen Livestock Research, Centre for Development Innovation & Addis Ababa Chamber of Commerce, November 2016.

4 Central Statistics Agency in Ethiopia (CSA), 2015.

The main distribution destinations in Addis Ababa and other larger cities are supermarkets, shops, hospitals, schools, and the hotel and restaurant sector.

The number of dairy processors is growing each year in response to increasing market demand. In 2017 around 35 dairy processors are active in processing and selling dairy products, but new processors are planning to establish dairy factories in the various -shed areas. The capacity of milk processors varies greatly, from small SMEs that process 1,000 litres per day up to large processors like Elemtu, Lame Dairy, and Mama Milk that can process up to 60,000 litres of milk per day. Some processors have plans to produce Ultra High Temperature processed (UHT) milk but so far this has not yet started.

One of the main challenges for dairy processors is the insufficient supply of quality raw milk, resulting in limited capacity utilization by processing facilities. The poor quality of raw milk is another challenge for processors. This explains the current trend of processors investing in milk collection points and cooling facilities to better control supply and quality. Some processors have introduced quality-based payment systems to provide incentives to dairy farms to provide better quality milk. However, rejection rates by processors remains high, and dairy farmers can always sell their milk through informal market systems in their own villages. As a result trust among value chain players is low.

Milk collection

In Ethiopia milk is usually collected via dairy cooperatives, by private milk collectors or by processors directly from milk collection centres (MCCs). Private collectors collect the milk from producers via MCCs, sometimes using aluminium cans. Dairy cooperatives collect and buy the milk on behalf of all members.

The GoE believes cooperatives can continue to play a major role in the establishment and management of dairy hubs where milk is collected and cooled to ensure good quality milk. However, processors increasingly invest in MCCs, financed either by private grants or own capital; by doing so, processors gain control over milk quantity and quality, and build more direct relationships with dairy producers. By introducing quality-based payment systems, processors provide financial incentives for dairy farmers to ensure a more consistent supply of milk.

Inputs and services

Feed supply is a weak point for the dairy sector. Fodder and silage are scarce, leading to very high prices for hay and fodder. Some farmers in urban and semi-urban areas use concentrated feed to supplement hay or elephant grass. An important challenge for farmers arising from limited access to feed and fodder is the rapid drop in production during the dry period.

AI services are key to the Ethiopian dairy sector, but so far only a fraction of the dairy cow population in Ethiopia is made up of crossbreeds or exotic breeds. The GoE has several plans to establish a new institute responsible for inseminating over 10 million dairy cows to increase cross breeds and exotic varieties in order to boost production. Animal health is also an area of concern. Veterinary services are entirely provided by the government, and a combination of poor services and a limited pool of qualified veterinarians makes it difficult to meet farmers' needs. Drug supply problems (vaccinations) also restrict the capacity of veterinarians to keep a constant stock of drugs and medicines.

2.3 FINANCIAL SECTOR INVOLVEMENT

Ethiopia is one of the largest sub-Saharan economies, with a GDP of more than 72 billion dollars, and has a high annual GDP growth rate of between 8% and 13.6%. The growing economy is attracting foreign direct investment slightly faster than other East African nations, at 11.4% of gross fixed capital formation compared to the East African average of 10.1%. Ethiopia is strongly dependent on the agricultural sector, which has a 37% share of GDP and is one of the sectors with the highest domestic investment⁵. Nevertheless, the total amount of foreign investment is low compared to the regional average, as FDI stocks for Ethiopia are 18.9% versus a 25.3% regional average⁶.

The private banking sector has developed slowly since the liberalization of the economy in 1991. A large part of the banking sector is still under government control. The largest bank, Commercial Bank of Ethiopia, together with other public banks has a market share that fluctuates between 34% and 55% for almost all products and services⁷. The Ethiopian financial sector is closed to foreign investments and lacks capital markets. The total Ethiopian banking sector is smaller than many of

5 The landscape for impact investing in East Africa, Open Capital Research.

6 World Investment Report 2017, UNCTAD

7 Making Finance Work for Africa, Ethiopia country profile.

its counterparts in other countries in East Africa and its percentage of private credit to GDP is low at 9,3%⁸. While the Ethiopian banking sector is sound in its capital and ratios, it remains small and offers only limited services. The same is true of non-banking services like MFIs and savings clubs, which are less developed than in other countries in the region. Obtaining credit from banks is difficult, both because of a practice of not serving early-stage firms and SMEs and the high levels of collateral value to loan value required, which averages 234%. As a result, there is little or no financial support available for activities such as crop-cycle approaches, capitalizing high-potential early-stage businesses or trade financing.

These issues are reflected in Ethiopia's score on the World Bank Ease of Doing Business ranking where it ranks 159 out of 190. It scores poorly in many categories, especially getting credit where it has the lowest rating of all for ease of doing business.

In recent years, there have been some examples of feed processors, milk collectors and milk processors being financed by the Ethiopian Development Bank, Commercial Bank of Ethiopia and the Cooperative Bank of Oromia. Despite these examples, only the Cooperative Bank of Oromia lends to farmers, which creates lack of access to finance in the supply chain in addition to the financial sector's general difficulties. This is recognized by the IFC; milk processing companies need to invest in backward integration within the supply chain as a loan condition.

2.4 PUBLIC SECTOR INVOLVEMENT

Over the next five years, the government is aiming to reduce dairy imports and work on policies to stimulate the export of dairy products. The government has set an overall milk production target of 9,4 billion litres for cow, goat and camel milk.⁹ To help transform the sector and address the challenges mentioned earlier, the World Bank has granted a loan of 150 million dollars to support the development of the livestock and fisheries industry, including the dairy sector.

The newly established Ministry of Livestock and Fisheries will be responsible for ensuring the implemen-

tation of this sector programme.¹⁰ The Agricultural Transformation Agency (ATA) will advise the ministry on how to address the main bottlenecks in the sector and how the strategy and milk-shed areas for dairy development can be linked to the Agricultural Commercial Clusters (ACCs) to develop agro-processing clusters for dairy processors and service providers.¹¹ The blueprint for transforming the livestock and dairy sector is the Livestock Master Plan developed by the LMD team for the Ministry of Agriculture.¹²

One of the recommendations made to the government by input and service providers, international donors and dairy processors is to support the privatization of extension support and input provision (e.g. AI services, vet services) for dairy farmers to ensure that more farmers can access these services easily. Expanding the number of private service providers would also generate incentives for the sector to improve the quality of its services and make its prices more competitive. The GoE has already launched a PPP initiative on AI services with BMGF funding to encourage the private sector to become engaged. The government also plans to establish the National Genetics Improvement Institute in 2018, which will inseminate 10 million dairy cows.¹³ Additionally, the GoE recently approved a new breeding policy that includes a national database system to register dairy cows at national level. This will facilitate the selection of potential areas and cluster services.

The Ethiopian Meat and Dairy Industry Development Institute is a government institution that facilitates and attracts foreign investors in dairy and livestock. It encourages more vertically integrated businesses that include land for building milk factories and dedicated land for milk and fodder production. The establishment of industrial processing clusters for dairy in four regions is needed to boost milk production. Furthermore, the GoE has developed a minimum quality standard for milk processors to safeguard food safety and the quality of milk and dairy products sold on the formal markets. Although the minimum quality standard is specified by EU norms, meeting and managing the standard from farm gate to processing is still a ma-

8 FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA COUNTRY STRATEGY PAPER 2016-2020, AFDB.

9 Federal Democratic Republic of Ethiopia, GTP II, 2016

10 Ministry of Livestock Ethiopia, Livestock and Fisheries Sector Development Project (LFSDP), 2016

11 Agricultural Transformation Agency (ATA), Agricultural Commercial Clusters, 2015

12 Livestock Master Plan, MoA, ILRI, ATA & EMDIDI, 2015

13 Interview: Ministry of Livestock & Fisheries, August 2017

job challenge for milk processors when quality control checks are infrequent and limited price incentives are in place.

Last but not least, the GoE is encouraging smallholder farmers with less than five hectares, especially in high-density areas like Oromia Regional State, to specialize in dairy, crops or even fodder. In this way the GoE hopes that a natural selection will take place between

farmers who become specialized dairy producers and farmers who become specialized in fodder production.

2.5 MAIN BOTTLENECKS AND CHALLENGES

This section summarizes the main challenges and bottlenecks in the dairy supply chain in Ethiopia. Chapter 3 describes the intervention strategy linked to the various challenges.

FIGURE 2: Challenges and bottlenecks within the Ethiopian dairy sector

VALUE CHAIN SEGMENT	MAIN CHALLENGES/ BOTTLENECKS
Dairy Farming	<ul style="list-style-type: none"> • Low milk production per cow as a result of poor farm management practices, lack of entrepreneurial skills by farmers, cowsheds, and limited exotic breeds (poor genetics). • Shortage of land and fodder production resulting in limited availability of cattle feed for dairy producers and (as a result of scarcity) high fodder prices. Another issue linked to insufficient feed is the limited knowledge of manure management practices and storage of food crops. • Poor quality of raw milk as a result of limited infrastructure in the vicinity of dairy farmers to ensure a cooled chain of milk products towards the formal market. Poor milking practices and lack of hygiene are other factors contributing to poor milk quality. • Vast majority of dairy farmers are small-scale, making it difficult to reach them and create economies of scale. A related issue is that not all dairy producers with milking cows are entrepreneurs that can develop professional and commercial dairy farms. • Weak veterinary, AI, and extension support services as a result of government monopoly and underdeveloped support systems in rural areas with limited capacity. Lack of private sector engagement also results in limited quality service incentives.
Dairy Collection and Processing	<ul style="list-style-type: none"> • Lack of proper quality controls in the value chain by an independent laboratory in Ethiopia and by processors, combined with limited quality price incentives for farmers, leading to high rejection rates by milk processors. • Limited professional and business-driven dairy cooperatives and unions leading to poor collection and marketing of reliable milk supplies. This is also the result of weak governance and management structures within the cooperatives. • Lack of minimum quality standards which should be in place (and enforced) to secure the supply of high quality milk to processing companies and to motivate processors and farmers to invest in cooled storage and transport. • Limited infrastructure (roads, collection, cooling) for producers to deliver their milk to collection points and markets. • Limited capacity utilization of processors resulting from unstable and limited supplies of poor quality raw milk, leading to overcapacity of processing facilities and unprofitable facilities. • Limited dairy technology expertise at processor level results in poorly managed processing facilities and product and market development.
Enabling Environment	<ul style="list-style-type: none"> • Limited access to finance for dairy farmers (microschemes), cooperatives (harvest loans) and processors (working capital, supply chain investments) resulting in insufficient investment to encourage economic growth and sales of milk and financial sustainability in the value chain. Underdeveloped local banking sector resulting in a lack of specific and tailored loans for agribusinesses. • Limited supporting policies by the government of Ethiopia to encourage private sector engagement in AI services, veterinary services, fodder production and extension support services to improve the availability and quality of these services for producers. • Weak linkages and coordination between chain actors resulting in insufficient use of resources, duplication of efforts and uncoordinated initiatives, with few tangible results showing how they contribute to government aims.



2.6 CONCLUSION

Ethiopian dairy production has increased over the last decades, but is not reaching the quality standards necessary to meet the demands of formal markets. Over the next five years, the government is aiming to reduce dairy imports and work on policies to stimulate the export of dairy products. In the GTPII plan the government aims to increase all milk production from goats, camels and cows to 9,4 billion litres. To succeed, the dairy sector needs to professionalize, unlocking the potential of its current stock of cattle.

There is a lack of trust among value chain players. An attractive informal market offers value to farmers but not the incentives to optimize production in terms of quality and quantity. Processors do not provide guarantees for a stable and predictable offtake of milk. The private sector participation in the market for input and service provision is still limited and in a nascent

phase. As a result, risks within the value chain are high while performance is low; this is not an attractive investment case.

Access to finance is difficult and only possible in cases where there is a very clear return and the possibility of high collateral. This has been cited as a binding constraint on growth and transformation in a recent strategy paper by the African Development Bank. New ideas and transformations in the dairy sector will require external financing from international banks, impact investors or strategic investments from existing companies that have access to credit and/or capital.

3

CLIMATE-SMART GROWTH STRATEGY

When the dairy sector grows, it has to manage its GHG emissions. In designing pathways to growth, the intervention strategy has to include climate-smart elements. These elements focus on the direct and indirect GHG emissions of cattle and take projected land use changes into account.

A baseline study was needed to get a better understanding of current farming practices in order to design an intervention strategy based on an inclusive value chain approach and to calculate the impact of such a strategy on the business case (Chapter 4) and GHG emissions (Chapter 5). Annex I provides background on the methodology used to calculate GHG emissions.

3.1 BASELINE STUDY

The main purpose of the baseline analysis is to better understand current farm systems in dairy in the selected milk clusters in Oromia in terms of milk production, cattle population, feed structures and the methods that are being practiced. This supports the analysis of the outcomes and the relationship between milk production per cow and emission intensity per kg of fat and protein corrected milk (FPCM).

It will also help identify what growth scenarios can be developed for different farm systems and what the impact will be on emission intensity and total emissions when farmers increase milk production as well as the number of productive milking cows. This analysis will be done for selected farmers before being extra-

polated to larger areas and dairy zones in Oromia to understand what impact it will have on a larger scale.

To collect the data for this baseline assignment, five milk clusters have been selected in Oromia Region based on different criteria. These include, but are not limited to: the availability of infrastructure for milk collection; access to services for dairy farmers (including fodder, feed and AI services); the availability of processors for guaranteed market access; and circumstances to produce (and cool) raw milk. The milk clusters selected are: Selale/Sululta, Sheno, Debre Zeit, Arsi and Jimma. Annex II provides the main characteristics, opportunities and challenges of these milk clusters as well as the main stakeholders.

The baseline study identified three farm archetypes that comprise five different production systems. Figure 3 (see next page) lists the most important characteristic.

Analysis of the data provided important statistical findings. The most important observations are listed below. For detailed information about demographics, income and herd size, refer to Annex III:

- On 16 farms, income from edible livestock products was not the primary or secondary source of income; 15 of the 16 farms are rural farms where crops are the most important source of income;
- Replacement rates (cow deaths account for half of replacements) are relatively high compared to spe-

FIGURE 3: Farm archetypes differentiated

ARCHETYPES	PRODUCTION SYSTEM	MAIN CHARACTERISTICS	NUMBER OF COWS & BREEDS
Rural smallholders (mixed farming)	Cereal-based production system (1-2 ha, 40 farms in sample)	Production of cereal crops is most important source of income (teff, barley)	1-5 local cows (50% cross-breeds)
	Perennial crop-based production system (1-2 ha, 10 farms in sample)	Production of coffee and teff are main sources of income (only in Jimma)	5-10 local cows
Specialized medium farms	Landless peri-urban farmers (9 farms in sample)	Emerging smallholder dairy farmers located close to market/feed opportunities (crop lands)	1-5 cross-bred cows
	Land-based/peri-urban farms (1-5 ha, 7 farms in sample)	Mostly cereal-based production and grazing land available for dairy cows and feed production.	1-10 cows, mostly cross-breeds and high-grade breeds
Urban and commercial farms	Landless production systems (7 farms in sample)	Intensive dairy farming; professional and specialized farmers	10-20 cows, mostly HF (sometimes >20 cows)

cialized dairy, probably as a result of health and fertility problems;

- Local breeds still predominate on rural farms, while exotic breeds prevail on urban and peri-urban landless farms.

The baseline study provided statistical information not only for calculating the business and investment cases, but primarily to calculate GHG scenarios. As the survey did not cover all the information required to develop GHG scenarios, the following assumptions and estimations have been made:

- Animals' rations are based on data from the baseline: period of grazing, period of use of feed products and information about products bought;
- Feed LCI data are based on the study of De Vries et al. (2016), who carried out a survey of about 70 farms in Oromia in 2015;
- The amount of dung and urine deposited in pasture has been estimated by using the fraction of grazing time out of 24 hours;
- Because animal traction was classed as production, emissions from male work animals were not included in the GHG emissions for the dairy herd. Emissions from animal traction will be reflected in the GHG emissions of feed production, as the life cycle inventory for feed takes emissions from traction animals into account.

For more detailed information on assumptions made, please refer to Annex III. Important to mention is the fact that changing land use as a result of increased activities within the dairy sector has an effect on GHG emissions as well. For further reading on this topic, please refer to Annex IV.

GHG emission performance

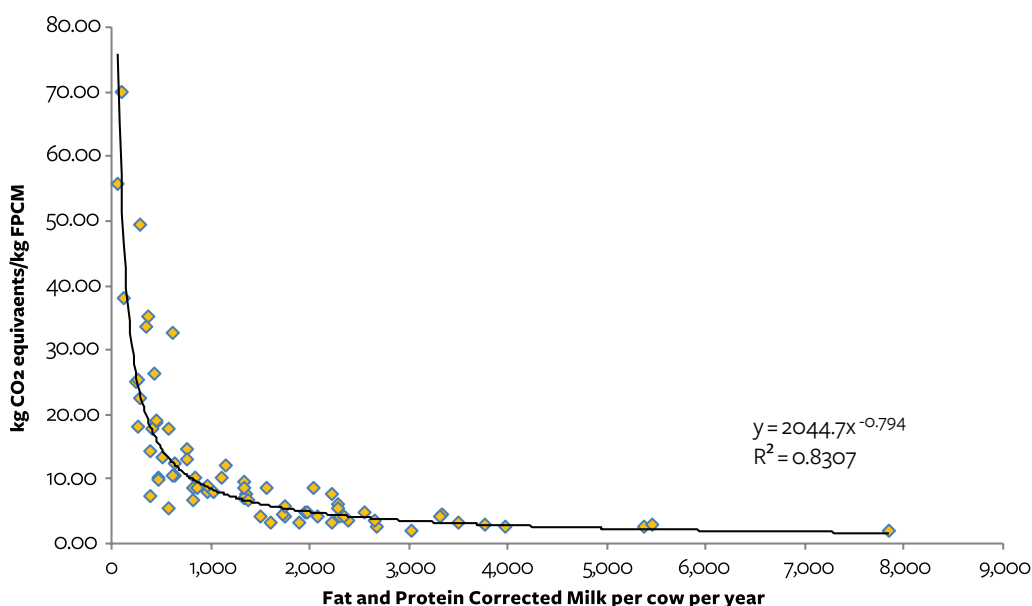
The Gold Standard provides a framework for developing a baseline relationship between the milk production rate per cow and the GHG emission intensity. GHG emissions are calculated using the GLEAM model which is recognized as the gold standard for measuring emissions (for further reading refer to Annex I).

The graph below illustrates the relationship between GHG emissions in kg CO₂ equivalent/kg of Fat and Protein Corrected Milk (FPCM) and the annual FPCM production per cow for farms in Oromia. An initial analysis produced the simple regression model shown in the graph. The regression line shows the baseline. The variation around the baseline is the result of the variation in efficiency between farms. GHG emissions per kg FPCM can be decreased not only by increasing milk production but also by improving management without changing the production level. The relationship between milk production and GHG emission intensity is very similar to that developed by Opio et al. (2017) and by Gerber et al. (2011).

There is some debate about whether all GHG emissions should be attributed only to milk and meat, as the “capital function” of cattle plays a role as well. Dry

non-pregnant cows have been separated from the others, as these are used as “capital on hooves” and provide manure and

FIGURE 4: Emission intensity in relation to FPCM, lactating animals



no longer contribute to milk production. This capital function of cattle is commonly found on rural and peri-urban land-based farms.

The GHG emissions of a reproductive bull (0.1 bulls per cow) have been incorporated in the GHG emissions. Other bulls, which are mainly kept for traction purposes, have been separated, but the GHG emissions of the traction animals count towards feed emissions and therefore to emissions from milk. In the table below, the relationship between annual milk production per cow (FPCM/cow) and GHG emission intensity (in kg CO₂ equivalent/kg FPCM) is summarized, applying the mathematical model derived from the survey data.

FIGURE 5: Milk production and GHG emission intensity

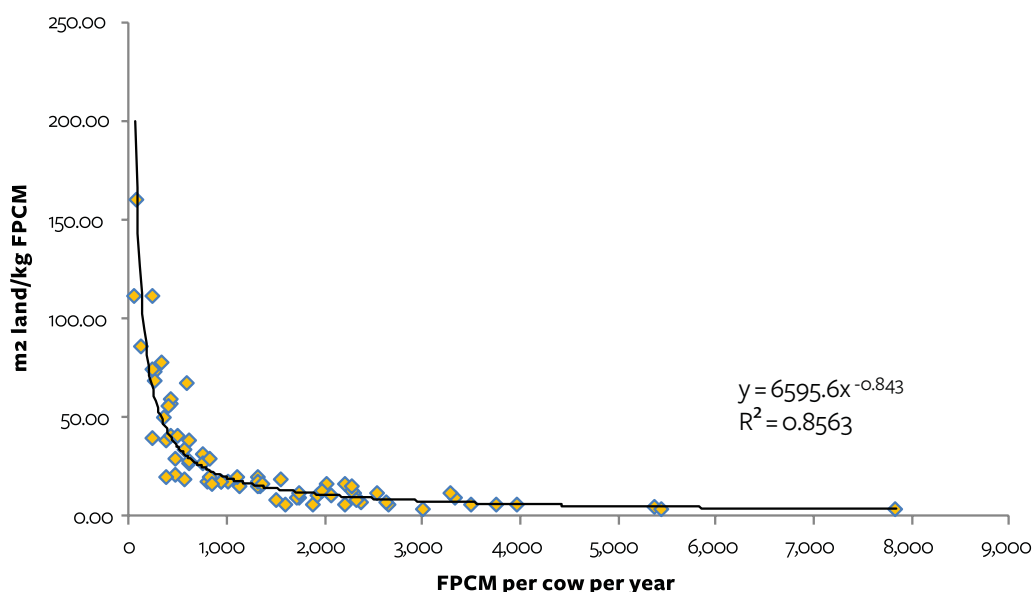
FPCM/COW	KG CO ₂ EQ/KG FPCM
100	52.80
500	14.71
1000	8.48
1500	6.15
2000	4.89
3000	3.55
4000	2.82
4500	2.57
5000	2.36

Land use

Land use changes linked to milk production have been calculated as well. This land use has been calculated by applying the location percentages used for GHG emissions. The land use reflects the same relationship as the GHG emissions. This is explained by the fact that about 95% or more of GHG emissions are related to feed production (nitrous oxide and carbon dioxide), feed intake (enteric methane from rumen fermentation) and manure storage (methane and nitrous oxide). Feed and the conversion to meat and milk are central to the livestock system.

The graph Figure 6 illustrates the relationship between land requirement in m² per kg of FPCM and the annual milk production level per cow on farms in Oromia. This excludes land use by dry non-pregnant animals and traction animals. It should be noted that land use is based on feed intake by dairy cows (including dry pregnant cows) and young stock only. When land use by traction animals is included, the gross land use is 12% to 16% higher, depending on milk production levels. The feed requirements

FIGURE 6: Land use requirement in relation to FPCM production



for traction animals are calculated using the same rules for allocation that apply to energy requirements and feed-related emissions. Feed requirements for producing crops are not incorporated in this calculation. This feed requirement can be added to the available feed for dairy cows, as it means that traction animals are competing for land.

The table below shows the relationship between milk production and land use—excluding and including land use for traction animals—applying the mathematical models derived from the survey data. The second table summarizes the importance of intensifying dairy production, which will eventually reduce the pressure on land and forests to meet market demands for dairy products.

FIGURE 7: Milk production and land use

FPCM	LAND USE EXCL. TRACTION (M ² /KG FPCM)	LAND USE INCL. TRACTION (M ² /KG FPCM)
100	135.9	157.5
500	35.0	40.0
1000	19.5	22.2
2000	10.9	12.3
3000	7.7	8.7
4000	6.1	6.8
5000	5.0	5.6

In the baseline outcomes in Oromia, milk yields were higher in rural production systems. When looking at the average GHG emission intensity, our baseline study has a wider GHG range compared to the FAO

FIGURE 8: Comparison between this study and the FAO study

PARAMETERS	FAO		THIS STUDY	
	Production range	GHG range (average)	Production range kg milk/cow	GHG range kg CO ₂ eq/kg milk (average)
Pastoral	200–350	22–80 (44.6)	n.a.	n.a.
Rural	350–550	10–35 (18.9)		
Rural perennial			60–780	5–56 (19)
Rural cereal-based			60–3,555	3–70 (13)
Small-scale commercial	900–1,250	5–16 (8.7)		
Medium-scale commercial	3,000–4,250	2–7 (3.8)		
Peri-urban land-based			540–1,780	3–33 (12)
Peri-urban landless			240–3,150	3–18 (7)
Urban smallholder			1,830–7,410	2–5 (3)

study, although average figures per group are similar. The FAO study has a relatively small range of milk production rates on rural farms, which can be explained by the remoteness of these farms. In our study, rural farms close to good-quality roads were included in the survey. Although these farms are still considered to be rural, they are starting to operate as commercial dairy farms. The broader range of milk production rates is not problematic from the point of view of the baseline development. A wide range of data helps to engender a strong relationship between milk production and GHG emission intensity.

3.2 INTERVENTION STRATEGY: INCLUSIVE VALUE CHAIN APPROACH

In this section, we describe how climate-smart dairy development can contribute to an increase in dairy production for the growing formal market with limited impact, no impact, or positive impact on land use and greenhouse gas emissions. To achieve sustainable impact for the whole dairy value chain, different interventions are required to transform the various farm systems into specialized, economically viable and professional farms. The overall approach comprises different interventions for specific farm systems. Milk processors (both local and international) play a

pivotal role in driving this development from a market-based approach. This will ensure that the required quality and volumes of milk match supply from farms and trust is created between farmers and processors.

In the first part of this section, we describe the various farm types/systems and what holistic approach is recommended to professionalize different farm systems. Linked to this approach, different intervention packages are recommended. To determine how the approach and interventions contribute to the government targets for the dairy subsector, a linkage will be made with the LFSDP Initiative (Livestock & Fisheries Sector Development Project), funded by the World Bank.

Inclusive Value Chain Approach

To enable farmers to become professional and specialized dairy farmers, the partnerships in the value chain between stakeholders and the enabling environment in Ethiopia need to change to facilitate growth in terms of secured markets for dairy processors, enabling policies, improved access to finance, inputs (feed/fodder) and other related extension services. The role of the dairy processor is pivotal in driving dairy development, which can only succeed through more secure sourcing of milk.

FIGURE 9: Value chain approach Solidaridad

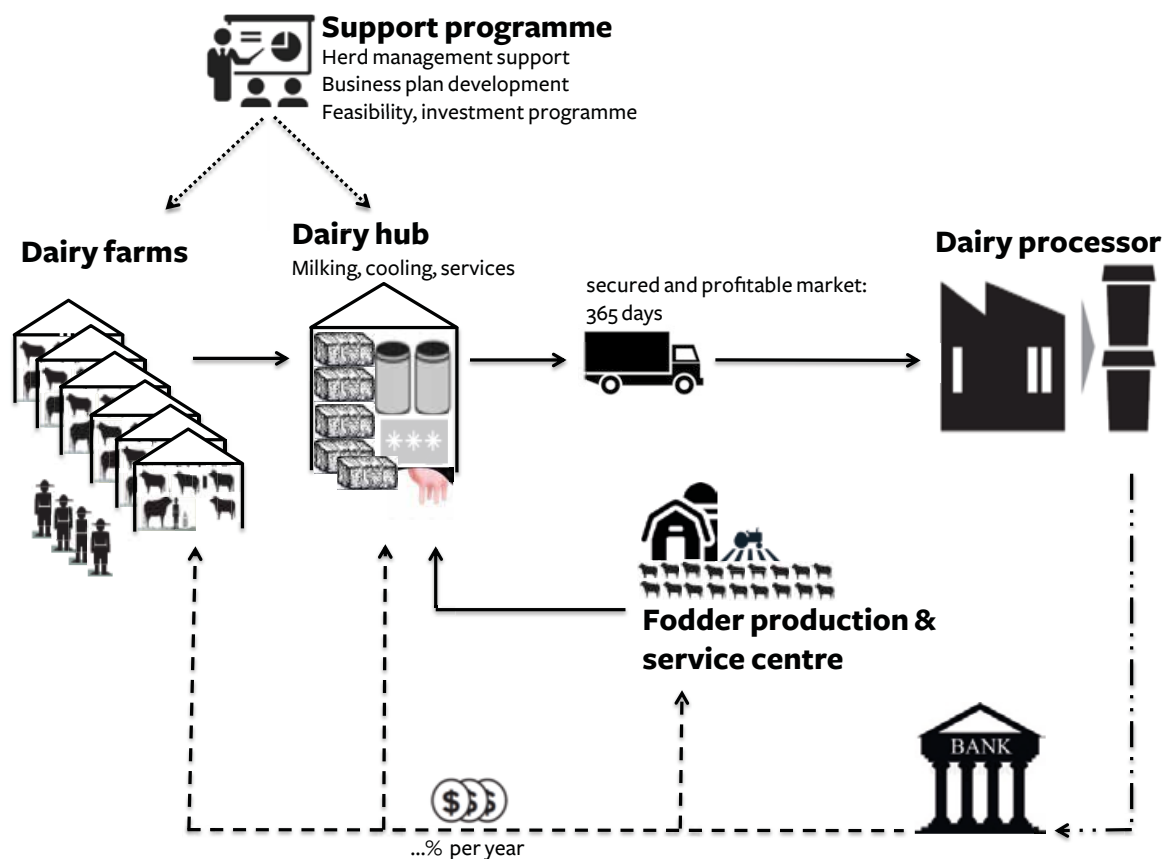


Figure 9 shows the different businesses in the value chain and their dependency on each other. The business cases are:

- **Dairy farms**, small, peri-urban and commercial
- **Dairy hubs** as service centres for farmers: milking, cooling and as marketplaces for concentrated feed, medicines, microfinance and fodder. For the dairy processor, the dairy hub guarantees volume and quality of milk by hygienic milking, quality control and quality-based payment
- **Fodder production and service centre**, necessary to make fodder and silage available year-round and especially in the dry period. Depending on the local situation, the fodder is produced on own land or on plots of farmers
- **Dairy processors**. On the condition of a stable and continuous supply of high-quality milk, the dairy processor can maximize the production capacity and is able to develop a market for different products and consumer groups.

The first step in our approach is to align business cases. It's a challenge to make the four types of businesses mentioned profitable in isolation such as when another business is missing, not functioning well or not able or willing to partner. The **dairy processor** has a crucial role to play as main pull factor, ensuring secured sourcing of milk and as a private business partner to look at backward integration. Investments in professionalization of farming and services are only achievable with secured access to market guaranteed by a dairy processor. Moreover, the dairy processor is dependent on dairy hubs and farmers to produce sufficient milk of a good quality, incentivized by quality control and quality-based payments. Alignment of

business cases can guarantee volume and quality on both sides.

Fodder is crucial to bridge the dry period and keep cattle productive and healthy. Sufficient quantities will lead to a continuous milk flow during the year, improved production, better fertility and lower mortality rates at farm level. In this strategy our advice is to develop a separate business for fodder production because much experience has shown that it is too complex to produce enough fodder by relying on individual (smallholder) farmers.

The dairy hubs provide milking, cooling and other services. These hubs are the main structures needed to support farmers with secured markets, services and inputs to improve production. To develop the dairy hubs, it will be crucial to establish private partnerships with dairy companies as investors in these hubs in order to secure the uptake of milk as well as to develop the trust of financial institutions and commitment from farmers to co-invest and deliver milk to the hub.

The dairy hub is crucial to facilitating milk collection and guaranteeing the quality of milk. In our approach, we advise including collective milking as an additional service. It will guarantee milk quality through direct cooling and hygienic milking. It aligns with common practices where farmers will graze their cows during the day and can milk them before and after grazing. Furthermore, it provides opportunities to farmers to outsource milking. The idea is based on current “community milking parlours” in other countries like India (see figure below), mostly developed to achieve higher milk quality levels.

FIGURE 10: Community milking parlour (dairy hub) in India



When secured market uptake, service structure and sufficient fodder production are in place, a risk mitigation strategy can become effective to manage risks at farm level and improve production. Important elements of such a strategy are:

- 1) Animal health services like veterinary services, vaccination and artificial insemination
- 2) Input supply for feed, medicines and semen
- 3) Heifer production with good breeds to improve the current cattle
- 4) Introduction of new technology to improve farm management and farm planning. A multi-farm solution can be used to help farmers based on performance.

Furthermore, the quality-based payment systems and milk prices, along with additional services, will influence the participation of farmers and provide economic incentives.

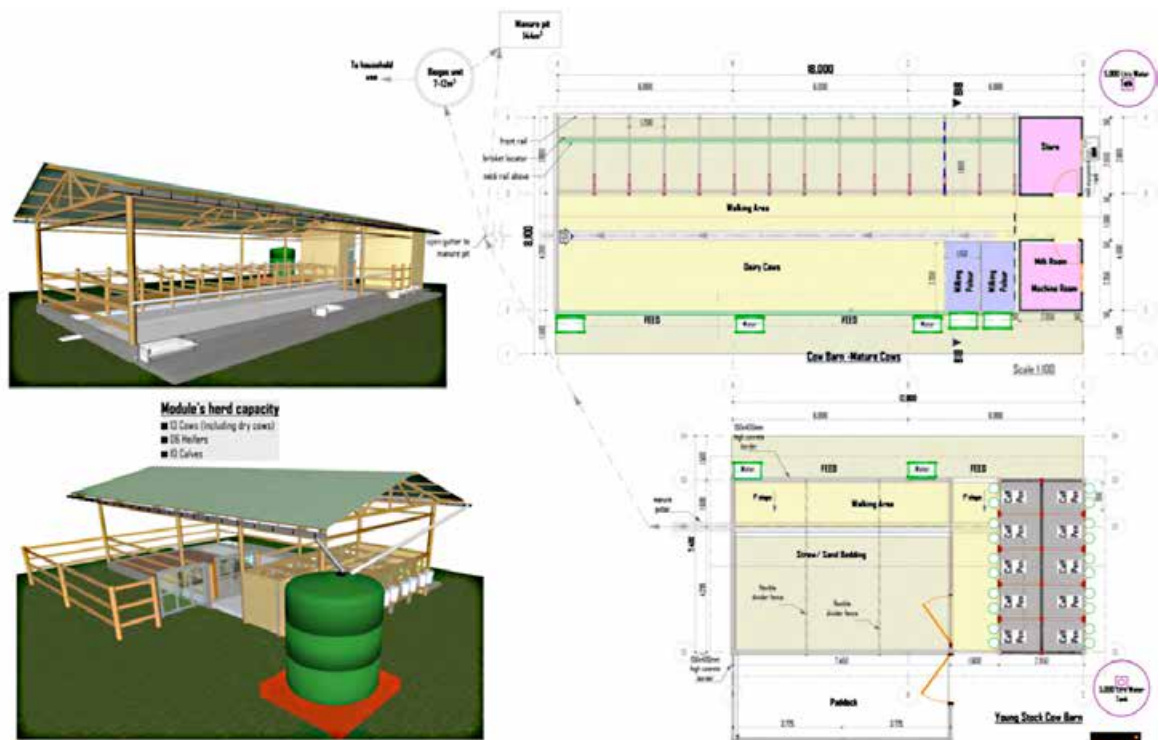
The second step in development of the dairy sector is to establish larger-scale **commercial farms**. This de-

velopment can strengthen the business case of dairy hubs by generating a greater volume of high-quality milk and allowing farmers to become more specialized. Examples are included in the survey.

An alternative model is an integrated model, the so-called **nucleus farms**, where bigger commercial farms also function as a dairy hub for neighbouring smallholder farmers. The advantage of bigger farms and smallholder farmers working together is the interest it creates for service providers to be present in new farm areas to develop support services (demand driven).

To facilitate the transformation to commercial farms, the introduction of new cowsheds systems is important, in first instance, for farms with ten to fifteen cows or more. Introducing cooling and milking machines, free-range farm systems with 24/7 availability of water and feed/fodder, including biogas production, are possible. Promising models have already been developed in other countries, see figure below.

FIGURE 11: Commercial farm systems



Intervention packages

The intervention programme in this section highlights the most crucial interventions that support the development of an inclusive dairy value chain. The programme supports the different business cases through innovation, data technology, learning and the development of business and investment plans. Furthermore, it supports the process of public–private partnerships (PPPs) by bringing different stakeholders together, including financial institutions, private companies and governments. For more details about the intervention packages, please refer to Annex IV.

Intervention package 1: Farmers support

Develop production and entrepreneurial skills among farmers, particularly in villages with a dairy hub. Preparation of early adopters and early majority in other communities for the next phase of scaling up

Intervention package 2: Commercial dairy farms

Introduce well-established commercial farms (>15 cows) with modern production and management techniques.

Intervention package 3: Dairy hubs

Introduce new professional milking and collection systems at community level with strong marketing and long-term relationships with market players.

Intervention package 4: Commercial fodder production and service centres

Promote and support professionally managed FPSCs that combine production, distribution, training and service provision in one company to assure optimal yields, product quality and quality assurance of fodder.

Intervention package 5: Finance and investment programme

Develop an investment model to finance professionalized farming, dairy hubs and fodder centres with minimum impact on forest and landscapes in partnership with all relevant stakeholders. Intervention package 5 can only become effective when the business case can be translated into an investment case. In the next chapter we analyse both the business case and the investment case.

All the intervention packages link to businesses and support farmers and entrepreneurs in developing a healthy business. The intervention strategy and the

business case are closely linked together, which is why it is important to analyse the business case. Also important to note is that business cannot thrive without support from government.

Supportive role of GoE

When looking at the role of the Government of Ethiopia (GoE) in supporting systemic changes in the livestock and dairy industry that make such interventions possible, some conclusions can be drawn. In respect of Tier-I and Tier-II milk-shed zones in Oromia, the GoE has focused strongly on attracting foreign and local investors for dairy development. They provide incentives in the form of establishing industrial parks and dedicated support from various government agencies.

At the same time, the government has acknowledged the important role the private sector can play in AI services by improving genetics and vet services. The GoE has therefore allowed several public-private partnerships (PPPs) in this domain to prove their added value, but government will still play a leading role in AI services through the approval of their new breeding policies. More commercial fodder and feed production is being encouraged through the provision of dedicated, currently unused, land for this purpose in Oromia Regional State.

Although no clear policies have been identified to facilitate sustainable landscape management activities, the Ministry of Livestock is working increasingly closely with the Ministry of Environment and development partners to ensure a more climate-smart approach.

For the interventions proposed by Solidaridad, there are no policies currently in place that might prevent the implementation of planned activities in the targeted zones.

3.3 HOW INTERVENTIONS FIT WITHIN WORLD BANK INITIATIVES

The intervention strategy and packages fit within current WB initiatives on four levels:

- Geography
- Farm systems
- Finance
- Policies and national plans



Geographical locations

OFLP (Oromia Forest Landscapes Project)

OFLP aims to contribute to sustainable landscapes and forest management in the entire Oromia Region, thereby contributing to government targets to reduce emissions and increase reforestation. Any impact of the Climate-Smart Dairy intervention (under the different scenarios) would therefore be relevant to the OFLP.

LFSDP (Livestock & Fisheries Sector Development Programme)

The project development objective (PDO) is to “increase productivity and commercialization of producers and processors in selected value chains, strengthen service delivery systems in the livestock and fisheries sectors, and respond promptly and effectively to an acknowledged crisis or emergency.” One important component is linking more productive farmers to formal markets in livestock and dairy. The 23 woredas (districts) tentatively selected for LFSDP implementation include 1.5 million cattle (7% of Oromia’s total), and 600,000 dairy animals (6% of Oromia’s total). The overlap with the Solidaridad study is seven woredas the 4 districts Sululta, Arsi, Sheno and Debre Zeit.

Farm systems (link with LFSDP Initiative - transformation pathway dairy farmers)

Level 1 smallholder subsistence farmers/rural mixed-farm systems

Farmers in this category are working in mixed-crop-livestock production systems producing primarily one of the following commodities: milk, poultry, fish, dairy meat and small ruminants’ meat. In the feasibility study, these farmers are referred to as rural farmers differentiated in cereal-based and perennial-based farm systems. When developing the business case for these farmers, reference is made to 2/2 farmers, which means farmers with an average of two milking cows that produce 2 kg of milk per day per cow.

Level 2 improved smallholder farmers/medium (peri-urban) farmers

In this category, the beneficiaries are mastering improved dairy/livestock practices and work mostly in basic organizations such as primary cooperatives for the production and/or the processing of at least one type of dairy. These farmers are characterized by an average household size of about seven members and an average herd size of five cattle (milk cows). In the feasibility study, these farmers are categorized as peri-urban farmers—landless or land-based—with 1 to 5 hectares of land. On average they have five milk cows, referring to the 5/5 business case systems.

Level 3 specialized smallholder farmers/urban or commercial farmers

In this category, the beneficiaries have some assets and are organized into formally established and legally registered commercial producers and/or coo-



peratives and have production and entrepreneurial potential. They are engaged in collective action, but are still lacking formal and well-established linkages with buyers and the market. In the feasibility study, these producers or farms are characterized as urban and commercial farmers with intensive dairy production of ten to twenty milk cows. These farms have better access to infrastructure and therefore access to markets and key services. In the business case, these farmers are referred to as 10/10 and 15/15 farmers. Depending on the particular conditions, these farmers still have potential to grow by developing formal relationships with key off-takers/processing companies.

Level 4 dairy cooperatives/SMEs

Under LFSDP, this level is categorized as cooperatives or SMEs formally engaged in market relationships through productive partnerships with buyers and processors. Dairy cooperatives have been included under the baseline assessment of the feasibility of Solidaridad, including the umbrella organizations (or unions) functioning as collective market agents and sometimes processors of the milk supplied by cooperatives.

Finance

OFLP

Carbon payments for CSD emission reduction can be financed from 2023 onwards from the ERPA grant. BioCarbon Fund can start making payments after the MRV system (Measurement, Reporting and Verifica-

tion system) has been agreed, developed and tested. Once (and only if) emission reductions are realized, emission reduction payments would be made to the GoE and would be distributed to the stakeholders who have contributed to the emission reductions according to a benefit sharing plan. Possibilities to allocate the money are to be decided in the meantime, and could include:

- Direct payments to producers/producer groups
- Dairy hub and fodder production guarantee/investments as part of a benefit sharing mechanism
- Small-scale agricultural expansion or fodder expansion combined with dairy hub development for guaranteed off-take and improved cow production (part of OFLP extension service development)
- Any other benefit sharing mechanisms that are agreed in the future.

LFSDP

A key part of the LFSDP is the development of ETH-Gap1 farmers and the development of cooperatives. This will be “supported by basic training, public extension and advisory services, inputs, basic equipment and small-scale infrastructures.” The dairy hubs fulfil this part of the development objective very well for the dairy sector. The hubs provide the basic infrastructure equipment necessary for the market to work and can provide additional services like advice, inputs and veterinary services. On this basis, the dairy hub can be the key enabler for cooperatives and

communities around it to move from ETH-Gap₁ to ETH-Gap₃ over several years' time. We have modelled this in our business cases as moving from smallholder (2/2) farmers to professional (15/15) farmers using the support of the dairy hub.

There is specific budget for this action under Sub-Component A.3 for Milk Collection Points and Milk Collection Centres that essentially provide the same services as the dairy hubs in this report. We recommend starting in the Sub-Component A.1 and A.2 stages, utilizing the dairy hub as a training centre and basic services provider (inputs, fodder) to enable long-term relations and a trust-based system.

National Livestock Plans & CSRE Climate Strategy

Based on the value chain approach described and proposed by Solidaridad, the interventions will have a positive impact on economic, social and environmental targets set by the government for dairy development and climate. The most important results are:

- **Food safety:** Through promotion and introduction of the different business cases, Solidaridad aims to ensure the highest quality milk is sold through formal distribution channels via processors. This will contribute to improved safety of milk products available for consumers.
- **Nutrition security:** Consuming nutritious, high-quality milk and dairy products is very important for farming families. Through the development of the business cases, engaged dairy farmers will be educated about the value of household consumption of dairy products.
- **Production increase:** One of the key deliverables of the Livestock Master Plan is to increase production of milk to satisfy internal demand for milk and dairy products. By means of the proposed business cases, Solidaridad aims to contribute to high milk production rates per cow and therefore more productive livestock populations in the country.
- **Poverty reduction:** Through the proposed interventions (professional farming, dairy hubs and fodder centres), Solidaridad will contribute to poverty reduction in dairy (village) communities by creating new employment/economic activities and generating incomes from dairy production and related input services. This will contribute to more sustainable and resilient farming communities

- **Reduced emissions and degradation of lands (intensity per cow and total emissions):** By integrating climate adaptation and mitigation practices in farms/villages and increasing production output per cow, Solidaridad will contribute to more productive herd structures in dairy (more productive milking cows, lower mortality rates and longer lactation periods), which will lead to reduced emissions from livestock, less overgrazing of cattle and therefore less pressure on lands. As a result, emission reductions might be realized. Emission reductions as a result of reduced deforestation and degradation rates will be covered under the MRV for forest protection and restoration. ERPA grants for reduced methane emissions from livestock, under a separate MRV, will not become available before 2023. We also understand that overall emission reduction targets need to be met in order for shareable benefits to materialize.

3.4 CONCLUSION

Data was collected from five milk-shed areas based on a sample size of 72 dairy farms from five different archetypes. Commercial dairy farmers in our study, on both urban and peri-urban farms, have a very different herd structure to that found on rural farms. They have fewer bulls and few non-pregnant dry cows, and they use less oxen for traction. The number of milking cows with a long lactation period is also much higher. This reflects a scenario in which emissions are much lower as a result of farms having more productive cows and non-productive cows being replaced or sold, which also reduces emissions. This means that urban and peri-urban farms are already commercialized or on their way to becoming specialized dairy farms.

To speed up professionalization of the sector, two measures are important to take. First is to align business models in the value chain and support business models in becoming profitable, providing the right incentives to invest in professionalizing the business. The processing companies play an important role, especially when they start securing the offtake of milk and investing (backward) in the supply chain. Second is to support the setting up of commercial farms at scale. Five intervention packages are proposed to support this transformation. These packages fit within the World Bank programming and the Ethiopian policy framework.

4

BUSINESS CASES: DRIVERS FOR CHANGE

The business case and the investment case of value chain players are drivers for the intervention strategy, but they can only become drivers when the business and investment cases are positive and feasible. As such, business cases are important for creating systemic change to increase dairy production and farmers' income while maintaining low to zero impact on greenhouse gas emissions and land use. In particular three business cases are important:

- The business case for dairy farmers (Section 4.1)
- The business case for dairy hubs (Section 4.2)
- The business case for fodder producers.

We will elaborate on the business cases for farmers and dairy hubs. Both are important for creating an efficient and effective value chain. The available data on fodder production is currently limited and not specific enough to detail the fodder business case. Because fodder is part of the cost structure of the farmers' business case, we used data from studies done in Kenya and assume this data is applicable for the farmers' business case in Ethiopia as well.

Methodology and starting point

For both business cases (for the investment case, see next chapter/section) we use financial simulation models. These Excel-based models allow us to calculate different financial scenarios (for prices, volumes, etc). The data in our models are averages based on data collected in our interviews, expert opinions and available literature. Where data was not available or

reliable, we have used estimates. To avoid complexity and to allow for different practices in the field, we have made assumptions.

The starting point in time for all the financial models is the implementation of improvements (at farmer level) or new business (dairy hub). In the next section, we first provide the business case for the farmer moving from smallholder to medium-scale farm and larger family farm. Building on this development, we dive into the dairy hub business case, which connects the farmer to the market and services.

4.1 FARMERS BUSINESS CASE

The starting point of all scenarios is the situation at farm level before the intervention takes place. Depending on the scenario we present, the starting point is either a smallholder farmer (we call this a 2/2 farming system, meaning a farmer having 2 cows each producing 2 litres a day on average), or a medium scale farmer (also referred to as a 10/10 farming system, having 10 cows, each producing on average 10 litres a day). Farmers operating at a professional level are family or cooperative farms (also referred to as 15/15 farming system, having 15 cows, each producing 15 litres a day on average).

For the farmers, we assessed two scenarios:

- 2/2 farm system evolving to a 10/10 farming system
- 10/10 farm system growing to a 15/15 farming system.

In this section, we will focus on the first scenario in detail and finish with a shorter explanation of the second scenario. The first scenario is very important as this is the transition from being a subsistence farmer to a more professional farmer who runs a business.

Underlying this business case are the improvements described in the previous chapter.

Assumptions and estimates

The most important assumptions are listed in the table below.

FIGURE 12: Assumptions explained

ASSUMPTION	EXPLANATION
Smallholder farmer switches to full milk production in year 1 instead of cottage cheese/butter	Rather than providing only subsistence, cows should become a source of income. The milk-only model becomes more profitable within year 1.
Calf-to-cow-development takes two years	Based on expert opinion
Number of bulls is reduced by 25% per year	Moving towards producing milk only will require fewer bulls for other activities.
Commercial AI is used from year 3	Ensuring high-quality AI becomes more important once the farmer has to rely on his/her cows for income. Based on the initial figure we anticipate the turnaround in year 3.
Manure is removed or used on a cost-neutral basis	Manure generally still has value for crop farmers but may require transport. It is assumed that on average these two will even each other out. This is irrespective of the use for biogas production.
Alfalfa hay will be available at price levels comparable to current natural hay prices	Currently alfalfa is more expensive than natural hay. Better nutritional fodder is required, and based on experience in Kenya, this can be developed at a price comparable to natural hay.
All calculations are without inflation	Inflation distorts the comparison between different farmer levels over time. Therefore all the models presented have been run without including inflation.

These assumptions were necessary to build the business case because data was not available. In some instances, cost estimations have been used:

- Price of cow: 40,000 Birr
- Price of calf: 500 Birr
- Cowshed construction costs: 20,000 Birr
- Meat value at slaughter: 6,500 Birr
- Labour is estimated at: 1,500 Birr per worker per month

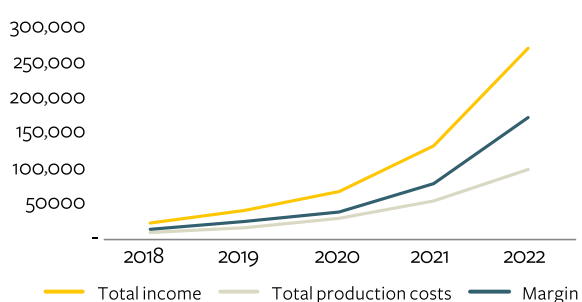
Scenario I: the business case of a smallholder farm evolving into a 10/10 farming system

A smallholder farmer already generates a profit at the outset. Most of the milk is for personal consumption, and part of it is processed at home into butter and cheese which is sold at informal markets.

Profit and Loss:

Because his cost base is negligible, the profit equals the revenue (5,000 Birr+/year) before intervention takes place. The farmer is producing slightly more than 1,000 litres a year. Typically, these farms lack adequate food supplies, are short of water and have long calving intervals. In general, small families of five or six members depend on these activities for subsistence.

FIGURE 13: Income and margin of a smallholder farmer moving to a 10/10 farming system



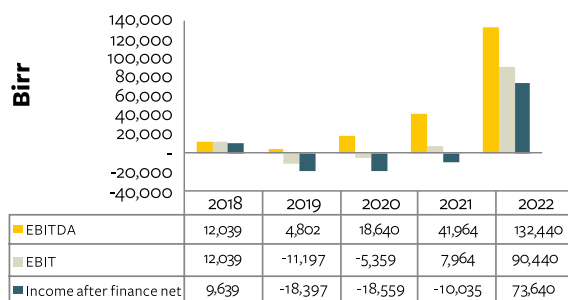
Through additional investments, income is multiplied more than 20 times within five years. Production costs consist mostly of fodder while revenues come mainly from milk and meat. Cost increases follow income, but the margin remains relatively stable at about 60% with some small fluctuations.

Income from meat will remain at a 5,000 Birr level; the increase in income is a result of increased sales of milk as the farmer will switch from butter and cheese sales to the sale of milk. This is due to the fact that sales of milk to the formal market is more profitable. If the farmer does not switch right away in year 1, the income growth curve is expected to rise more slowly.

The breakdown of costs over the years shows there are few costs in year 1 and these mostly relate to buying fodder and investing in cows. The investments in year 2 lead to high labour and depreciation costs. This is a typical professionalization point as the farmer starts hiring external labour (1 FTE). Throughout the intervention period (2019–22), fodder costs remain the biggest cost item. The percentage of total costs spent on fodder increases, with the growth of the farm remaining the primary cost driver in line with international examples. Depreciation related to livestock and cowsheds increases as the business expands, while the financing costs reach a maximum of 18,000 Birr in 2021 before decreasing slowly when cash flow is used for repayments (refer to Annex IV for more details on cost structure).

The farmer’s business case is profitable from an operational point of view, but cash flow is insufficient to finance its own growth. Earnings before Interest and Tax (EBIT) and net income turn negative during the period from 2019–21.

FIGURE 14: Profit and loss of a 2/2 farming system evolving to a mid-scale farmer



The business case for the farmer is about fodder, milk, and cow health. Low-cost nutritious fodder contributes to both the long-term health of the business (nutrition) and short-term results (price). Milk is the main revenue source, and stability of offtake and stable prices are key to a sustainable business. Cow health has a strong influence on results, as maintaining high production levels during the care cycle described in the Wheel of Livestock Well-being and achieving long lactating periods are indicators of the business’s effectiveness.

Balance sheet:

The farmer’s balance sheet comprises the following assets:

- The herd, cows, heifers, calves and bulls. In this case, investment in new cows is activated but the existing herd is not included on the balance sheet as we assume the existing herd is financed by the farmer’s own means (about 80% of total assets)
- Cowsheds, as the farmer will invest in two new cowsheds (about 15% of total assets)
- A small stock of feed and fodder, not significant (less than 5% of total assets).

Besides the capital the farmer puts in to buy cows and a stable, the most important liability is a loan (ST and LT) from a financier. The solvency rate (own capital/total assets) starts at 100% and decreases to 51% in 2021 (lowest) to recover in 2022 to 80%. As the farmer has no short-term liabilities, the current ratio (current assets/short term liabilities) is not applicable.

The business case for developing a smallholder farmer into a 10/10 farmer shows that returns are made only after four years. This is because the multiple improvements (e.g. lactation, fodder, cowshed, number of cows) needed to achieve higher production all require pre-financing (investment) and come together after four to five years, showing high growth of revenue and profit in the last two years. Despite this long development period, the farmer will still be able to maintain an income of 5,000 Birr and earn enough to repay his loans in year 5. In the next section, the investment is further explained.

Cash flow:

Professionalizing the dairy business requires investment in assets as well as additional costs. Calculating from two-cow increments, the investment in assets comprises investment in cows (2018: two cows, 2019–

22: one cow each year) and a cowshed (2020). From an economic point of view, the farmer should make all investments in 2018; however, his/her management capacity is not at a level that allows him/her to run a professional business immediately. Therefore investments are phased starting from 80,000 Birr in 2018 and fluctuating annually from 40,000-60,000

Birr. These investments have a significant impact on operating cash flow as shown in the table below. The effect of working capital is negligible: the farmer will only invest in a small stock of feed. In the model, depreciation kicks in one year after the investments are made. As a result, the operating cash flow is initially negative, before turning positive in 2021.

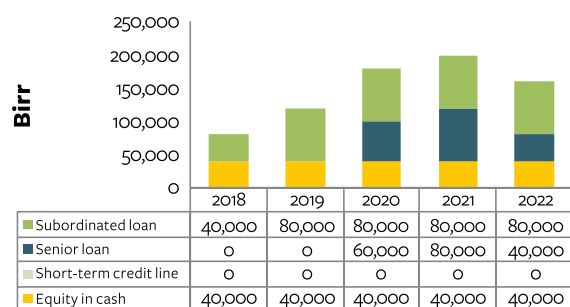
FIGURE 15: Cash flow projections of a smallholder farmer professionalizing to a 10/10 farm system

(IN BIRR)	2018	2019	2020	2021	2022
EBIT	12,039	-11,198	-5,359	7,964	90,441
Depreciations	-	16,000	24,000	34,000	42,000
Working Capital	-1,325	-1,300	-2,160	-4,512	-8,911
Investment/disposal of fixed assets	80,000	40,000	60,000	40,000	60,000
Operate cashflow	-69,286	-36,498	-45,519	-2,547	63,530

Finance:

The farmer lacks the financial means to finance investments in cows and working capital; however, the working capital issue is less of a problem because cash flow increases quite rapidly after investments in cows.

FIGURE 16: Financial package supporting a smallholder farmer professionalizing dairy production



Our advice is to finance the borrowing by:

- Equity: the farmer must invest himself to show commitment
- Subordinated loan: this is quasi-equity and can be structured as a convertible grant, or a “soft” loan that allows the farmer to pay for debt services when his cash flow is sufficient
- Senior loan: this is prioritized debt in terms of repayment and interest.

The subordinated loan is structured as a bullet loan; the loan will be refinanced after five years. The risks of refinance are moderate as the investment case is proven, but we cannot predict whether the financial sector is interested or ready to start financing the dairy sector.

The senior loan is a straightforward loan disbursed over two years, repaid in two tranches with a term of four years. In the model, both the subordinated loan and the senior loan carry a 12% interest rate on the ETB. Usually financiers offering loans require collateral. Whether the farmer will be able to provide collateral will depend on his/her personal situation.

We assume investments are partly financed by a loan so the net cash flow (operating cash flow minus finance cost) is less than operating cash flow. Finance costs increase as the farmer takes up finance gradually, matching his/her credit need each year.

The model uses a fictitious income of 5,000 Birr per year (this is the annual income at the baseline). The cash position is sufficient to meet this level of income. However, the scenario is “tight,” especially in 2019.

FIGURE 17: Calculating cash flow surplus and deficits taking a fictitious income into account

(IN BIRR)	2018	2019	2020	2021	2022
Cash position year end	8,314	4,617	7,898	7,350	14,080
Fictitious income farmer	5,000	5,000	5,000	5,000	5,000
Surplus / Deficit	3,314	-383	2,898	2,350	9,080

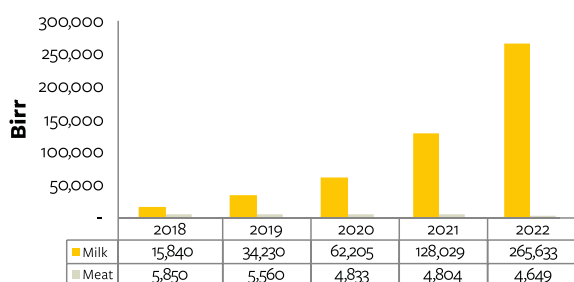
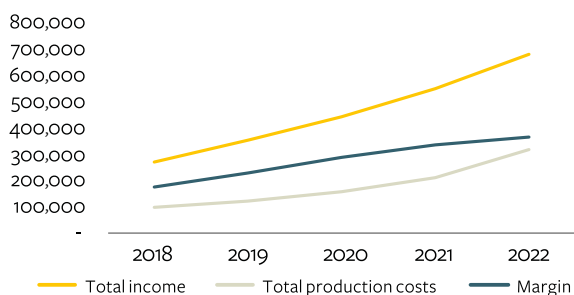
Scenario II: business case of a farmer growing from a 10/10 to a 15/15 farming system

This scenario simulates the growth path to a larger scale. The risks are lower and easier to manage as the business model of a 10/10 farm is similar to that of a 15/15 farm.

Profit and loss

The medium-scale farmer starts with a much higher income and cash flow than a smallholder farmer. We see a more gradual rise in income and costs when growing to a 15/15 farm system. The production costs consist mostly of fodder while revenues come mainly from milk sales. Costs are variable and increase as income increases; the margin remains relatively stable at about 60%, slightly decreasing during later years due to increased labour costs and less grazing land being available to accommodate increasing fodder (production) costs.

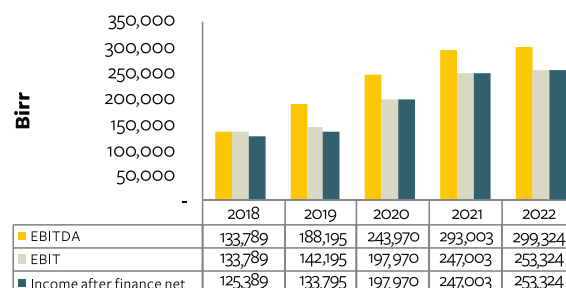
FIGURE 18: Income and revenue breakdown of a mid-scale farmer growing to a commercial farm



The revenue breakdown in the graph below shows high revenues from milk and a slight increase in income from meat sales, but this contributes little to the total revenue. Fodder costs are dominant in the cost structure, making up about 65% of total costs. The sudden increase in costs in 2021–22 is a result of the additional labour that the farmer has to hire. Please refer to Annex VI for a more detailed breakdown of costs. The profit and losses of the farm show a strong continuous growth in

income that improves once the initial investment has been paid off. The last year does not show high growth, as we anticipate an increase in labour and fodder expenses to enable future growth and optimal management in year 5.

FIGURE 19: Profit and loss of a 10/10 farming system moving to a 15/15 system



Balance sheet

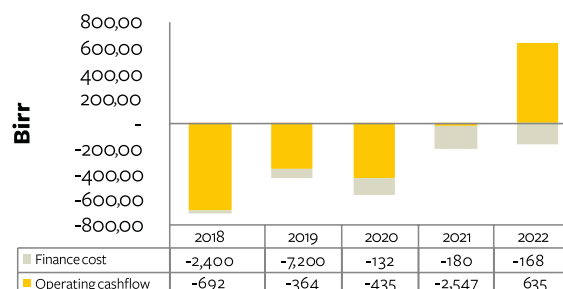
The farmer's balance sheet consists of:

- The herd: cows, heifers, calves, bulls. In this case, the investment in new cows is activated but the existing herd is not included in the balance sheet as we assume it is financed from the farmer's own resources (about 85% of total assets)
- Cowshed, as the farmer will need to invest in a larger cowshed (about 10% of total assets)
- Small stock of feed and fodder, not significant (less than 5% of total assets).

Cash flow and finance

Once a smallholder farmer has become a 10/10 farm, we expect that its operation will professionalize and the farmer will be able to attract finance. The cash flow is negative in the year of investment (year 1) and requires a one-year loan of 140,000 Birr. Full repayment is done in year 2 and the finance costs at a 12% interest rate are 16,800 Birr over 2 years. Even at a commercial rate such as 28%, full repayment is possible in year 2.

FIGURE 20: Simulation of cash flow 10/10 farm system moving towards a 15/15 system



4.2 THE BUSINESS CASE FOR DAIRY HUBS

At the core of the intervention is the establishment of a MCC that acts as a central hub (a dairy hub). This dairy hub links the processor closely to the farmers, both of whom benefit in terms of supply/sales security and quality control. Besides storing and cooling, the dairy hub provides milking services for the farmers as well. Additional business activities (not in this simulation model) are fodder and feed supply and vet services.

Investment is needed if the model is to succeed. Most farmers have a low investment capacity. Therefore finance needs to come from processors, as they are able to raise capital and need to develop their supply chain to secure a successful future for their own businesses. To link farmers and processors and secure input and output of milk, the model proposes shared ownership between farmers' cooperatives and processors. Dedicated staff (independent service providers or staff from the processing company) will operate the dairy hub.

In this model, one of the most significant business risks is farmers selling their milk on the side. This can be mitigated by agreeing contracts between farmers and processors, either directly or through the dairy hub. In return, the processor must guarantee a minimum purchasing level of milk from the dairy hub. Shared ownership also creates incentives for farmers to sell their milk to the dairy hub as they will benefit from positive results through dividends.

Assumptions and starting points

Our models simulated the performance of a small-scale dairy hub. Data in the model is based on expert opinions regarding investments and costs and assumptions about the farmers connected to the dairy hub. We interviewed one cooperative acting as a milk collection centre (no cooling) to gain an impression of pricing for the milk intake and outtake and the cost structure. This centre realized a gross margin of 3 Birr per litre of milk and a net result of 1 Birr per litre.

Assumptions, estimates and starting points:

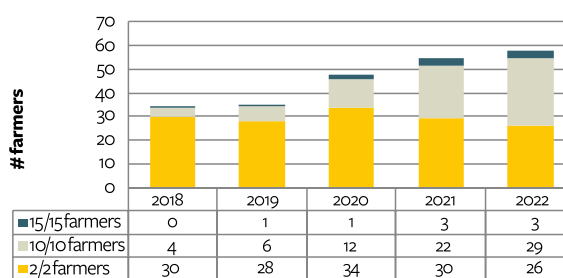
1. Intake of milk is set at 10 Birr/litre flat rate throughout the years in the financial model
2. The sales price of milk is set at 10 Birr/litre (in the fasting period), 12 Birr/litre (dry season) and 13 Birr/litre

(wet season). The latter price is the highest because most fasting days occur during the wet season and prices tend to rise steeply when fasting periods end

3. Energy price is set at 0.06-0.08 Birr/litre and based on FAO research in Bangladesh (0.004 US dollars/litre) adjusted to 60% lower kWh price in Ethiopia
4. Milk losses are set at 0.5% (FAO research)
5. Investments, chemical costs, rent and wages are based on best estimates from local experts
6. Tax rate is 30%, interest rate is 12%
7. We made our own estimates of the number of farmers connected to the hub.

Dairy hub business is local business, and the location is crucial in connecting farmers to the dairy hub. We expect that 10/10 farming systems will have the strongest incentives to adopt the concept, as they recognize the value of improved supply chain performance and have the means to co-invest in a dairy hub. Professional large-scale farmers are expected to participate as well, but they have the alternative option of supplying milk directly to the processors.

FIGURE 21: Outreach of a dairy hub in terms of farmers



When smallholders join an improvement programme and invest in and access finance for their businesses, technical assistance will be provided for free. In return, the programme requires these smallholders to deliver their milk to the dairy hub. When these smallholders become medium-scale farmers, the benefits of delivering milk to the dairy hub become evident, and incentives are in place for them to invest their own capital in the dairy hub. The uptake of farmers and connection to the dairy hub will lead to an increase in milk intake, which is the most important revenue driver in the model. The dairy hub depends on scale and must realize utilization of capacity. Annex VI provides a more detailed view on milk intake.

Profit and loss

Please refer to Annex VI, a profit and loss statement, for a complete overview. The margin in this scenario is flat during the five-year forecast period (12%).

FIGURE 22: Turnover and margin development of a dairy hub

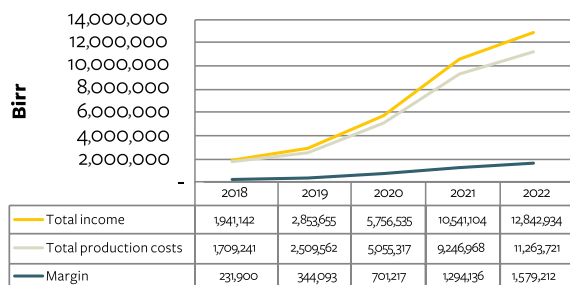


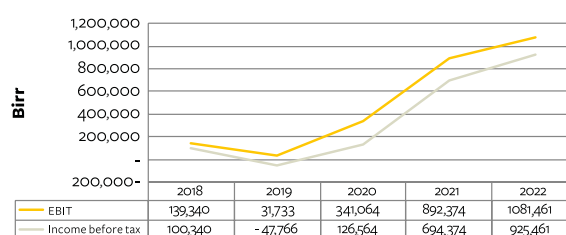
FIGURE 24: Economic ratios of a dairy hub

(IN BIRR)	2018	2019	2020	2021	2022
Margin/KG	1.39	1.40	1.42	1.43	1.43
EBITDA/KG	0.83	1.00	1.12	1.25	1.23
EBIT/KG	0.83	0.13	0.69	0.98	0.98
Income before tax/KG	0.60	-0.19	0.26	0.77	0.84

Financial results as expressed per litre of milk produced are important indicators. The margin per kg is at a reasonable level, but depreciation and finance costs put these ratios under pressure. We expect that when the dairy hub is clear of debt, the EBIT/kg ratio will reach the 1 Birr/kg point.

In this scenario there is certainly room for improvement, as we calculate the business case based on a capacity utilization of 60%-70%. On the other hand, the

FIGURE 23: EBIT and net result of a dairy hub simulation of profit and loss



The direct production costs comprise milk intake costs and additional production costs. Overheads are relatively low and comprise wages, rent and maintenance totalling 92,000 Birr in 2018, growing to 221,000 Birr in 2022. Depreciation of machines and equipment kicks in one year after investments and lasts for a period of eight years. As a result, EBIT and net profit before tax develop as follows:

gross margin is relatively high: farmers are being paid a “moderate” 10 Birr/litre.

Balance sheet

The dairy hub will invest in tanks each year to expand its storage capacity. As a result, the value of machines and equipment remains at more or less the same level. Compared to fixed assets, working capital has less impact on the balance sheet.

FIGURE 25: Balance sheet of a dairy hub

IN BIRR	2018	2019	2020	2021	2022
Machines and equipment	1,440,000	1,260,000	1,272,000	1,375,200	1,324,800
Buildings	348,000	313,200	278,400	243,600	208,800
Cash	49,640	102,602	114,676	27,097	261,378
Total receivables	79,773	117,274	236,570	433,196	527,792
Total inventory	4,601	6,763	13,641	24,978	30,432
Total Assets	1,922,013	1,799,839	1,915,287	2,104,070	2,353,202
Total equity	670,238	622,472	711,067	1,197,129	1,844,952
Long term liabilities	1,250,000	1,175,000	1,200,000	900,000	500,000
Short term liabilities	1,775	2,367	4,221	6,942	8,251
Total liabilities	1,922,013	1,799,839	1,915,287	2,104,070	2,353,202

FIGURE 26: Financial ratios of a dairy hub

(IN BIRR)	2018	2019	2020	2021	2022
Solvency (own capital/total assets)	35%	35%	37%	57%	78%
TD/Ebitda	8.6	4.5	1.8	0.8	0.4
Current ratio	3	3	2	70	99

Processors will pay the dairy hub every two weeks and the dairy hub will store its milk for a maximum period of one day. Electricity and chemical suppliers will supply on a 30-day-credit basis. In the ratios calculated below, the TD/E ratio starts at a relatively high level before dropping rapidly to an acceptable level from 2020 onwards. The other ratios are all at acceptable levels.

Cash flow

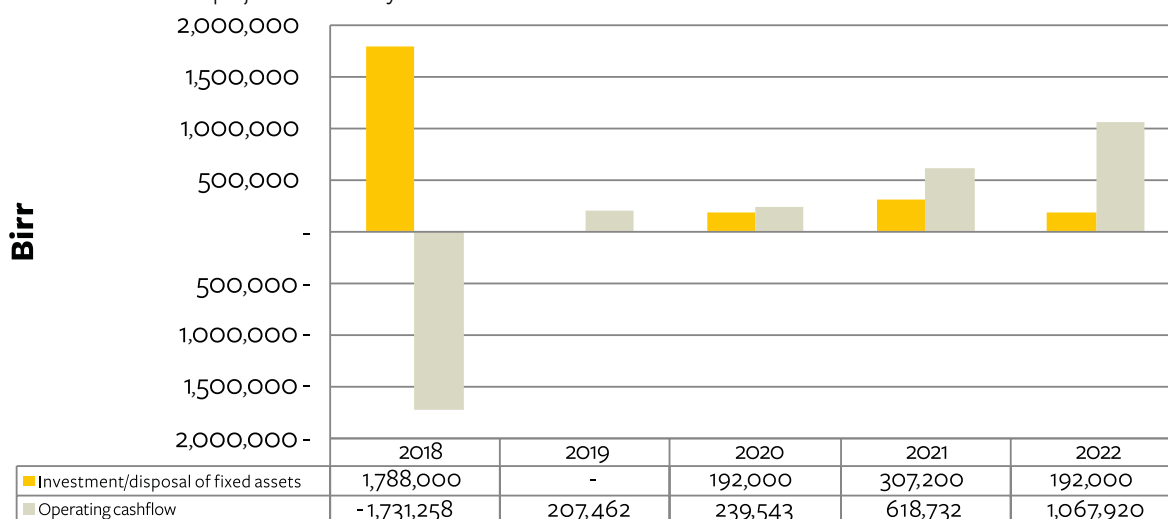
Investments in working capital are needed as we assume the dairy hub will receive payments every two weeks from the processor. Our starting point in the model is immediate cash payment to the farmer. In the farmer’s model, the farmer is able to sell his/her milk on 15 days’ credit, but we have made a conservative calculation of the working capital needed. Investments have a significant impact on cash flow. To set up the operation, the dairy hub will invest in the following assets:

FIGURE 27: Breakdown of investment in first year of a dairy hub

	2018
Milking machine	960,000
Cooling and tank(s)	192,000
Power supply	288,000
Building/construction	120,000
Cow shed	216,000
Access to road	-
Fodder storage	12,000
Test and weight equipment	-

From 2018 the dairy hub will expand its storage capacity by 1,000 litres.

FIGURE 28: Cash flow projections of a dairy hub

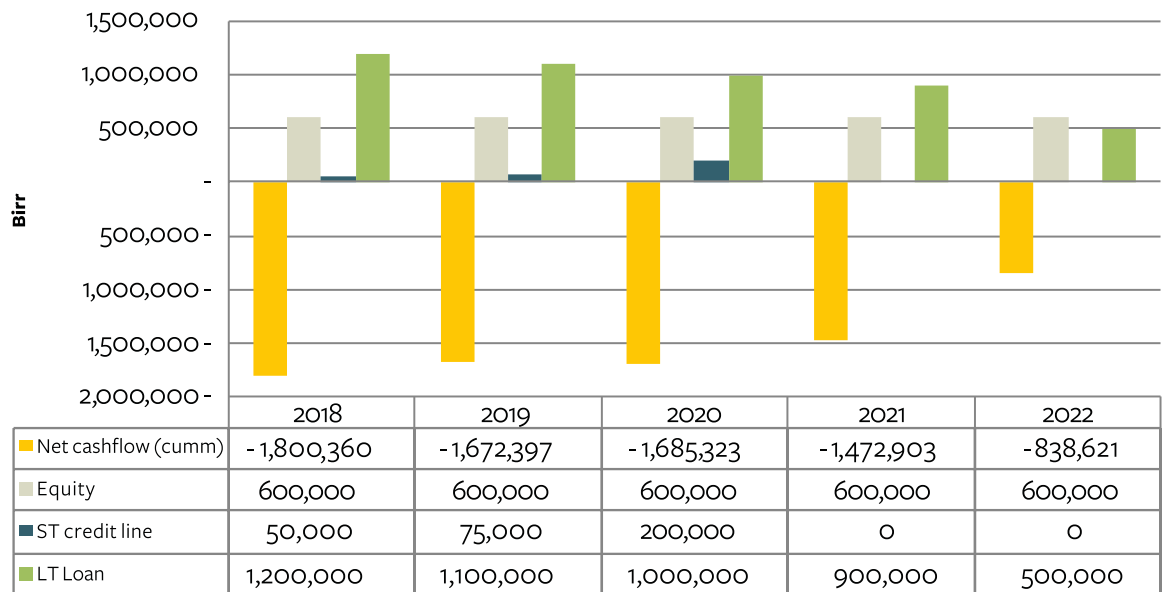


Finance

Finance needs to be in place as these investments have a significant impact on cash flow. From 2019 onwards, the dairy hub will be able to finance its investments from operating cash flow. Although finance costs and tax increase steeply from 2020 onwards, net cash flow is positive to slightly negative in 2020. When ownership is shared, the equity contribution should come from the processor and the group of far-

mers. The processor will have the capacity to invest, but for the farmers this is less clear-cut as only medium-scale and professional farmers have the resources to invest in a dairy hub. The organization providing technical assistance to the farmers could pre-finance the equity contribution and sell the shares at face value to the farmers when they have reached the medium-scale or professional level.

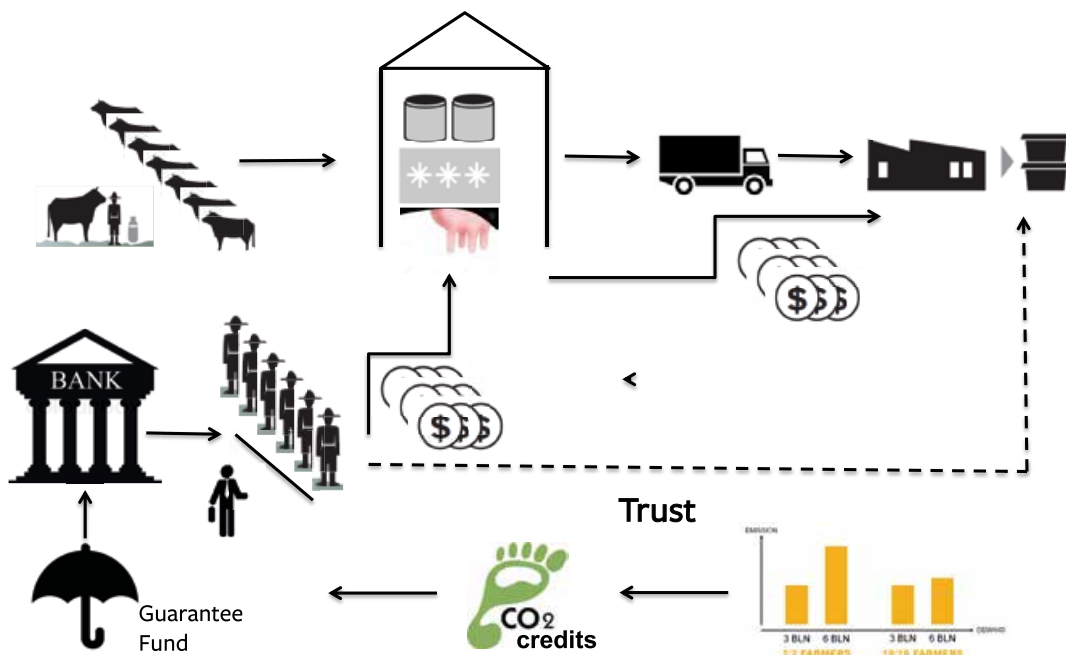
FIGURE 29: Finance package supporting the opening of the dairy hub



Once the dairy hub has raised equity and the company has been established, additional finance will have to be brought in. Financiers will probably finance 60%-70% of working capital needs with the remainder having to be structured as a long-term loan, in this case 1.2 million Birr, with a six-year term and an accelerating redemption scheme. The processor could take on the role of financier as they control the commodity stream (milk), while repayment of the loan can be secured by a cut-off on the milk price paid by the processor to the dairy hub. As an alternative, a leasing company (equipment leasing) could assume the role of financier, backed by a guarantee provided by the processor.

The IRR on operating cash flow is 7% over a period of five years, which is quite modest. Therefore, the investment in equity should be a strategic investment rather than a private equity investment, as is the case in this scenario in which farmers and the dairy hub take a strategic view of the setup of the dairy hub. The processor will have a higher return on their investment after collecting the loan, which is fair as they carry the majority of the risk. After five or six years, the processor will have recouped the majority of the investment and can allocate this money to their core business. Farmers may even wholly or partly take over the shares of the processor to release more capital for the processor. This is how we visualize the endgame, as depicted in the infographic below:

FIGURE 30: Working towards sector transformation



Monetization of carbon credits is not included in this business model (or the business model for the transitions to 10/10 and 15/15 farming system). This does not mean the CO₂ credits derived from the improvement of farmers' businesses are worthless. When certification and a purchase agreement are in place over a period of multiple years, the credits can be sold and the revenues used to fuel a guarantee fund that provides extra security to banks when lending to farmers for financing improvements. This will facilitate the endgame but will

only work on a large scale with high efficiencies; otherwise the transaction and verification costs related to CO₂ credit schemes would be too high when compared to the benefits.

4.3 RISK ASSESSMENT

The table below gives an overview of the major risks associated with the implementation of dairy activities on farmer and hub level in Ethiopia.

FIGURE 31: Business risks and mitigation strategies

RISK	EXPLANATION	MITIGATION OPTIONS
DAIRY HUB		
Selling milk on the side	The dairy hub runs the risk of not procuring milk in high-demand periods.	Establish a relationship in which offtake during dry seasons is coupled with offtake during peak seasons.
Offtake blocks during fasting periods	Processors may establish extra-high-quality demands or completely block milk procurement during the fasting period.	Improve milk quality to enable longer storage and engage in long-term relationship with processors to enable production schemes that meet demand during fasting periods.
Banks cease financing after five years	For future growth and to have an exit strategy, the dairy hub will need to be financed by banks after year 5. They may refuse to do so or lack incentive.	Engage banks in the concept at an early stage and ensure adequate reporting requirements to enable banks to make risk assessments and/or engage with processors' banks who can offer double benefits.
Processors lack capacity	Processors need both financial and milk processing capacity.	Milk processing in the short-term will not be a problem as there is currently an undercapacity. Financial capacity will have to be identified per processor, but the benefits of a secure supply chain will possibly interest investors to ensure there is enough capacity.
Dairy hub governance	The dairy hub requires good governance to deliver consistently high-quality milk, maintain impeccable financial standards and help farmers increase their herd and milk collection rates.	Hire quality personnel, implement a good management system and ownership model with appropriate checks and balances and ensure frequent training of personnel.
Producers do not adopt nor apply CSA practices	Producers play a major role in adapting to climate change and reducing emissions resulting from high output levels per cow. Producers may not adopt all practices specified in the intervention packages.	Producers will be involved in setting their own priorities in dairy production based on self-assessment. This is a farm-centred approach. Peer-to-peer learning and demonstrations will be encouraged to promote and apply new technologies and practices.
Insufficient carbon credit income for guarantee fund	The carbon facility is still uncertain and may bring in too little income to finance the guarantee fund.	Achieving high carbon savings with low transaction costs will be key to mitigating this risk and enabling the guarantee fund. Further mitigation can be achieved through proper documentation and a good business case to attract commercial financing as well.

CONTINUATION FIGURE 31: Business risks and mitigation strategies

RISK	EXPLANATION	MITIGATION OPTIONS
	Farmer	
Lack of high- quality fodder availability	High-quality fodder availability is a key precondition for achieving efficient cows and higher farmer income.	Fodder production should be part of any approach. Entrepreneurs can be encouraged to start large-scale fodder farms supported by technology to enable storage and handle high production levels during the wet season. Smallholders in mixed crop systems (Arsi, Jimma) can be included so they become specialized fodder producers.
Smallholder farmer financing	Despite the positive business case, financing smallholders remains difficult and will require support to convince banks and/or supply chain partners to extend credit to smallholder farmers so they can initiate development.	The Cooperative Bank of Oromia and MFIs in place can already partially extend credit but may need support to release financing on a longer-term basis. Backing loans with securities to drive down interest rates will be key to developing the initial business case and enabling smallholder farmers to become entrepreneurial 10/10 farmers.
Climate impact	Droughts and other climate-related events can have a big impact on smallholder farmers. In particular, the farms not able to build up reserves are at a high risk of losing everything they have.	Within the approach, there should be attention to looking at farmers as businesses that through the implementation of improvements will be able to build up reserves and either deal with climate events or have the capacity to take out insurance policies.
Milk price and offtake	Milk prices fluctuate throughout the year and can go down sharply or even lead to a lack of offtake during fasting periods.	Efficient high-quality production is necessary to enable value-added processing and overcome fasting periods. Dairy hubs need to make sure that high quality is key as this will increase consumer trust creating local processing and in the long term export markets which are able to absorb fasting period fluctuations.
Farm management & access to services	Farms their management and access to services plays a major role in achieving high quantities and high quality milk. Without enough knowledge and proper implementation or access to good services it is hard to improve cow milk output.	Ensure that the dairy hub will function not only as a simple provider of milk collection but ensure advice and linkages to services is available. The dairy hub manager that is recruited should be a trusted adviser with connections to high quality service providers in the region.

These risks are an initial selection that have arisen during development. In specific locations, there may be additional risks such as cultural acceptance of changing methods, influence of local chiefs on business practices, corruption blocking further development and the general risks of doing business in Ethiopia. This overview is not exhaustive, but it gives an idea of the most important risks associated with the business cases.



4.4 CONCLUSION

The business case of a smallholder farmer professionalizing dairy production is a positive but risky transformation and will only work when access to market is guaranteed and the transformation is supported by the dairy hub and an organization that provides (hands-on) farmer support. Professionalizing dairy production requires investments financed by the farmer personally in combination with subordinated debt (at favorable conditions) and commercial financing.

Looking at the business case for dairy farmers who own ten or more milking cows that are productive, it is clear that a significant return on investment can be achieved and dairy can become a profitable business when this growth is realized. Accessing loans for this group of farmers to invest in heifers and feed can be done via MFIs, through joint initiatives (cooperatives) or seed capital provided by special grants. TA interventions can be provided by development partners in collaboration with local government authorities.

To address the bottlenecks relating to milk quality, hygiene and safety of milk products, investment in so-called dairy hubs is an important and necessary development. This applies to production zones, whether in urban or rural areas, since a constant supply of high-quality milk can only be guaranteed through joint collection, cooling and milking at village (kebele) level. The business and investment case simulation is positive, with a positive cash flow from year 2 onward and all debts and/or investments paid off in years 6 to 7. Setting

up the dairy hub requires a big initial investment, immediately generating cash flow as long as supply and sales of milk are guaranteed through strong involvement of both farmers and processors. Because farmers and cooperatives lack the capital to make these investments themselves, the investment has to be made by private milk processors.

Co-ownership with farmers is crucial to ensuring the financial sustainability of these investments in the long run. Only medium-scale and professional farmers are able to invest in a dairy hub; processors are the most obvious investors, and smallholders can only participate when they grow to a 10/10 or 15/15 farming system. A gradual co-ownership model is also a possibility, for example by using climate investments from carbon emissions as a guarantee fund for local banks to provide loans to cooperatives.

It must be emphasized that the calculations made for the different business cases and investments are based on a set of underlying assumptions. This means the different approaches may not work in all areas. Cultural barriers and distrust between companies and farmers still exist. Farmers also still face barriers to accessing finance to reinvest in their businesses. Side selling is still happening, which could jeopardize the capacity utilization of the dairy hubs. Dairy hubs as a business model are relatively unknown in Ethiopia, and test cases need to be developed to convince banks and other financial institutions of their viability.

5

CLIMATE CHANGE: MANAGING GHG EMISSIONS

Increasing milk production raises three questions:

- Will total GHG emissions increase?
- Will total land use increase?
- Will the GHG balance of the land used for milk production change?

Therefore, as part of Solidaridad's Value Chain (VC) approach to developing more professional farms, several climate practices should be taken into account and adopted by farmers as part of the intervention packages offered and described in Chapter 3.

This chapter describes the climate practices and calculates the effect of intervention strategies on GHG emissions for different scenarios and extrapolated to national level. To monitor and verify GHG emissions, MRV systems need to be in place as described in Section 5.4. Last but not less important, the business case of reducing GHG emissions is explained at the end of this chapter.

5.1 CLIMATE ADAPTATION AND MITIGATION PRACTICES

If more animals produce more milk without changes to the current farming systems, GHG emissions and land use will obviously increase. This will be the case even if the extra milk is produced very efficiently. This means that milk production has to be increased while using proportionately fewer animals and/or land (intensification). Replacement of animals therefore has

to be considered. There are various options:

- Replacing a number of less productive cows with one highly productive animal, which produces more than the total from the less productive ones it replaced
- Replacing dry non-pregnant animals and traction animals.

For either option, feed intake has to be explored. When animals are replaced, feed production has to be improved.

Below is a summary of the most important production parameters and climate-smart practices that need to be taken into consideration when designing the intervention strategy and packages in Chapter 3. Furthermore, it's important as a guideline for monitoring. See section at the end of this chapter.

Replacing less productive dairy cows

Figure 33 gives the Feed Conversion Rate (FCR, kg feed/kg of FPCM) and the total calculated feed intake of dairy cows based on the animals' rations as provided in the survey.

The table shows that feed intake increases as milk production increases. This is caused by the higher energy requirement for milk but also the higher maintenance requirements. The more productive dairy cows are often cross-breeds or exotic breeds which have a higher live weight than local breeds. A dairy cow pro-

ducing 500 kg of FPCM has a feed intake of about 5 tons of dry matter, while a cow producing 3,000 kg of FPCM has an intake of about 7.6 tons of dry matter. To produce 3,000 kg of FPCM, about 30 tons of dry matter is required (6 low productive cows consuming each 5 tons of dry matter), compared to roughly 8 tons consumed by one cow in the alternative scenario. To a certain extent one high productive cow, this is a simplification, as highly productive animals need good-quality feed, but we should keep in mind that low milk production is partly caused by feed shortages. The quality of the feed and the availability of high-quality concentrates become more important at the higher production levels of 4,000 kg of milk production per year and more.

Replacing dry non-pregnant animals and traction animals

Commercial dairy farms such as the urban smallholders and peri-urban landless farmers in our study have a different herd structure than rural and peri-urban

FIGURE 32: Feed Conversion Rate

FPCM (KG/YEAR)	FCR	FEED INTAKE (INCL. YOUNG STOCK) (KG DRY MATTER / YEAR)
100	34.8	3,478
500	10.1	5,036
1000	5.9	5,906
1500	4.3	6,484
2000	3.5	6,927
2500	2.9	7,292
3000	2.5	7,604
3500	2.3	7,879
4000	2.0	8,124
4500	1.9	8,347
5000	1.7	8,552

land-based farms. These commercial farms have very few non-pregnant dry cows and very few bulls or oxen. The table below shows the number of lactating and dry pregnant cows, dry non-pregnant cows, and bulls and oxen in each of the five farming sub-systems:

FIGURE 33: Composition of herd for different farming systems

	PERI-URBAN LAND-BASED	PERI-URBAN LANDLESS	RURAL CEREAL-BASED	RURAL PERENNIAL-BASED	URBAN SHF
Lactating and dry, pregnant cows	3.0	4.9	2.5	1.2	9.7
Dry cows, non-pregnant	0.6	0.1	0.3	0.4	0.1
Oxen and bulls	3.3	0.5	3.3	2.0	0.3

Non-pregnant dry cows contribute to GHG emission intensity as these are part of the wider dairy herd. Bulls and oxen indirectly contribute to GHG emission intensity as their emissions are part of the feed-related emissions related to ploughing and other land work. These animals not only produce greenhouse gases, but they also use feed. Replacing these animals and increasing the milk production of the remaining animals would provide plenty of opportunity to increase milk production and decrease GHG emissions and land use. For comparison, the feed intake of a dry non-pregnant animal is about 3.5 tons of dry matter per year, while for oxen used for traction about 4.5 tons of dry matter is needed. This means that one dry non-pregnant cow consumes 40% of the feed intake of a cow with 3,000 kg of FPCM, while the feed intake of a bull is equivalent to about 60%.

Replacing dry non-pregnant animals and traction animals does not reduce beef production as these animals can still be fattened until they almost reach their adult weight. Replacing animals is not easy, as increasing milk production also affects the farm structure and the farmer's income.

Improving feed availability and quality

Dairy production can only grow when feed availability and feed quality are improved and maintained at a higher level. The calculations in the previous sections are based on the same productivity of feed as in the current situation. As soil quality and soil fertility are known to be problematic—as a result of climate change and poor nutrient management—active management of soil productivity is essential in order to reverse the declining trend in productivity caused by soil degradation.

There are various ways to improve feed availability and feed quality:

- Feed planning to ensure that sufficient feed stock is available in the dry period
- Maintaining good soil quality and soil fertility through manure management
- Maintaining good soil quality and soil fertility through improved management practices
- Grazing strategies
- Reducing competition for feed through mechanization
- Extending the growing season through mechanization
- Conserving feed by making silage
- Providing high quality co-products such as middlings, cakes, grain from breweries, etc.

Improving fodder and feed availability and quality

The improvements can be implemented by the suggested intervention in Chapter 3, the development of fodder production and service centres. More central organized fodder production can improve the availability of fodder, and additional services for planning and grazing can support an appropriate use of fodder and land. By introducing fodder production, more and more farmers can be supported to manage fodder production on their own.

Improving feed conservation by making good-quality silage is essential. This step requires the use of plastics for anaerobic coverage of feed and fodder, as well as training in making good silage and the development of infrastructure to provide good-quality plastics.

Good-quality supplements are beneficial for high-producing dairy cows in early lactation. Purchasing concentrates cooperatively and distributing them via the dairy hubs can be advantageous for quality control and price negotiations.

Improving soil quality, fertility and manure management

Productivity of land is defined by soil quality (including organic matter, water holding capacity, nutrient availability and structure), nutrient supply by manure and synthetic fertilizers, availability of water and length of the growing period. The latter has already been mentioned in the first and second bullet points. Nutrient supply via animal manure (dung and urine) is very important; even when milk production has been increased to up to 3,000 kg, 75% to 80% of the ingested nutrients (N, P, K, others) are still excreted as dung and

urine. Recycling these nutrients and the related organic matter to land is essential for maintaining soil quality and soil fertility. This requires particular attention when dairy farmers source feed from other farmers or when manure is applied to cropland. Manure management is nutrient recycling, not waste management. The use of forage legumes can play an important role in nitrogen provision, as this is a very volatile nutrient and large-scale replenishment is required. Very good experiences have been recorded in the project N2Africa (www.n2africa.org). Silvopastoral systems have been applied in Latin America with good outcomes. There are also advantages in the availability of leaves as fodder. A number of trees and shrubs are known to produce nutritive leaves (www.feedipedia.org).

Better grazing strategies

In most situations, local cattle graze on common pastures; on average, more than 80% of all animals graze on common lands. This requires good planning as there is a significant risk of overgrazing. This applies not only when large numbers of animals are added to the common pastures, but also to grazing in dry spells. Overgrazing means grass cannot recover and grassland productivity will decline rapidly. Grazing cattle farther away from the farm also involves long walking times, which reduces grazing time and ultimately leads to overgrazing elsewhere. Grazing in natural forests happens but only to a limited extent in Oromia Regional State (<2%).

Reduced competition for feed from traction animals

Although the traction animals don't need high-quality forage, they are still competing for feed. On average, there is an 11% extra land requirement.

Introduce mechanization

Mechanization of feed production is combined with mechanization of crop production. Mechanizing ploughing is known to reduce the period of land preparation and hence increases the growth period for crops by several days, thus improving crop production. Mechanization requires equipment, fossil fuels and a maintenance infrastructure. Mechanization can be done in a cooperative way or as a new business case, similar to the dairy hub. Replacing traction animals will reduce GHG emissions from feed production, as the CO₂ emissions from a tractor per kg of feed is about 5% to 10% of the GHG emissions from animal traction. In future, mechanization will also take

over human labour, which will nullify the gain to a certain extent, but emissions from feed production will decrease. However, options to avoid ploughing and introduce conservation agriculture should be considered to reduce SOM mineralization.

5.2 IMPACT GROWTH SCENARIOS ON EMISSIONS AND LUC

The growth scenarios in this section are theoretical. The most important parameters include number of animals, land use (intensity/productive capacity and hectares), feed use, milk production (kg) and total GHG emissions. In Scenario A, more high-productive cows are added to the herd, while in Scenario B some

of the animals in the baseline scenario are replaced as well.

As all growth scenarios imply an import substitution of 3 million tons of milk, the embedded emissions of this imported milk (powder) could be subtracted from the total emissions calculated for the three growth scenarios. This “emission import substitution effect” could theoretically be included in the livestock MRV system. Even if it is not allowed under the MRV to be developed, these emission reductions are real on a global level and could be taken into account in some way to demonstrate the net GHG emission reduction effect of the CSD approach.

FIGURE 34: Different scenarios and the effect on GHG emissions

SCENARIO	BASELINE	SCENARIO A	SCENARIO B
Milk total (tons)	1,000	2,000	2,000
#cows 500 kg	2,000	2,000	1,600
#cows 3,000 kg	0	333	400
# dry non-pregnant	500	500	400
# traction bulls/oxen	2,000	2,000	1,600
Feed use (tons)	20,690	23,190	19,552
land use (ha)	7101	7871	6604
GHG (ton CO ₂ equivalents)	24,843	28,393	24,134

It is possible to double milk production without increasing land use and emissions. The table above shows the emissions and land use for 1,000 tons of milk production, which account for almost 25,000 tons of GHG emissions and 7,100 hectares of land use.

When milk production increases as a result of expanding the herd with high productive animals, both emissions and land use will increase as well (Scenario A). This scenario occurs when farmers buy extra cows and take better care of these animals. This is, in fact, an unrealistic scenario because the feed for these animals is additional to the feed use of the farm. No extra land is available and so this remains unexploited. The limited area of forest is not allowed to be converted to cropland or grassland.

There are three options to meet the increased demand for feed. The first is to buy all the feed. If a large group of farmers opt for this scenario, there will be

feed shortages at regional level, meaning roughage and concentrates have to be bought from further afield, but this is likely to lead to feed shortages in those locations as well. The second option is to increase crop production using larger amounts of synthetic fertilizers and pesticides, allowing more feed to be produced locally. However, this will increase GHG emissions from crop production and consequently also raise GHG emissions. The third option is to intensify grazing in forest/non-agricultural areas and/or convert forest to pastures or fodder farms.

The only scenario that achieves an increase in milk production while reducing total emissions and land use is Scenario B, in which some of the low-productive animals, dry non-pregnant cows and bulls/oxen are replaced, and the number of high-productive animals is 400. In this scenario, 80% of the baseline herd remains the same, which implies that on 80% of farms

the situation remains unchanged¹⁵. On the other 20% of baseline farms, the farmers switch to more commercial farming practices and high-productive cows take the place of low-productive cows, dry non-pregnant cows and bulls/oxen. This is not an unrealistic scenario, as the survey has shown that farms of this type already exist.

Scenario B can take other forms in which more than 20% of the farms undergo less drastic changes, but the basic principle is that low-productive cows are replaced by an equivalent number of high-productive ones and other animals are removed from the farm. In this example, 400 low-productive cows are replaced by 400 high-productive ones and 100 dry non-pregnant cows and 400 bulls/oxen are sold.

The replacement of low-productive cows can be achieved by using high-grade bulls and improving the existing herd gradually. Buying high-grade cattle is probably expensive and the demand for large numbers will certainly increase the price. Moreover, breeding cows in the herd is preferable from the point of view of animal health. Such a shift cannot occur in assuming that these farmers will not encroach on forests because they are driven by poverty (degradation of current crops) or greed (expanding low productive cows at the expense of forests).

The absence of bulls and oxen requires two important changes. The first is a reliable AI system, the second is the introduction of mechanization. The AI system is already in place and can be scaled up. The shift to mechanization requires investments and specialized maintenance workers. This activity has to be supported by commercial fodder service providers.

5.3 EXTRAPOLATION OF GROWTH SCENARIOS AT NATIONAL LEVEL

Extrapolating milk production in three scenarios to a level of 3.54 million tons compared to the current situation of 1.77 million tons in Oromia gives an idea of the scale of the ambition in doubling production while at the same time reducing emissions and LUC at national level. The current production of 1.77 million tons is related to the proportion of cattle in Oro-

¹⁵ Assuming that these farmers will not encroach on forests because they are driven by poverty (degradation of current crops) or greed (expanding low productive cows at the expense of forests).

omia compared to the national herd and national milk production volume.

In the business as usual (BAU) scenario, the extra 1.77 million tons are produced by herds similar to the current situation. In Future 500, an increase in milk production from 350 to 500 is simulated. In Future 50/50 the extra 1.77 million tons are produced by improved dairy farms. This scenario is similar to Scenario B in the previous table. In Future 40/60, the extra 1.77 million tons plus 340,000 tons of the current quantity are produced by improved dairy farms.

Current scenario

It is clear from the baseline findings that only a limited number of dairy producers in Oromia can currently be called commercial or specialized dairy producers. They can be found in Tier-I areas on the periphery of cities and urban areas and have the potential to access feed, roads, collection points and markets.

Debre Zeit is the best example of a milk-shed area where these farms are found, but this group is small and doesn't produce enough milk to meet government targets for doubling milk production and producing UHT milk for export. Dairy producers in rural areas represent the majority of dairy farmers but still live in poverty, have limited access to services and feed and contribute to the degradation and sometimes deforestation of forests and woodlands. In Jimma and Arsi, this is certainly the case, as these farmers produce small amounts of milk per day and are involved in other crops as well.

Future Business as Usual

If we project the current situation to five years from now, assume nothing changes and business continues as usual, we see there will be severe economic, social and environmental consequences for milk-shed areas and surrounding rural communities. Not only will insufficient milk be produced that meets the quality standards of the formal market, but the majority of smallholder farmers in Arsi and Jimma and other remote areas will not be reached by support programmes or benefit from investments in nearby milk-sheds.

In terms of climate impact, GHG emissions would more than double through "horizontal expansion" of dairy production because of the emissions from land use change which will add about 374 million tons per year. This would be the result of overexploitation of

FIGURE 35: Different scenarios extrapolated

KEY PRODUCTION PARAMETERS	CURRENT	FUTURE BAU	FUTURE 500	FUTURE 3000 - 50/50	FUTURE 3000 - 40/60
Milk total	1,77 Million ton	3,54 Million ton	3,54 Million ton	3,54 Million ton	3,54 Million ton
#cows 350	5,057,143	10,114,286	0	5,057,143	4,045,714
#cows 500	0	0	7,080,000	0	0
#cows 3000	0	0	0	590,000	708,000
dry non-pregnant	1,264,286	2,528,571	1,770,000	1,264,286	1,011,429
traction bulls/oxen	5,057,143	10,114,286	7,080,000	5,057,143	4,045,714
Feed use (ton)	50,318,571	100,637,143	73,242,600	54,743,571	45,564,857
land use (ha)	17,476,474	34,952,949	25,136,124	18,839,374	15,616,659
GHG (ton)	60,215,400	120,430,800	87,944,220	66,498,900	55,712,520
land use change (ha)	0	17,476,474	7,659,650	1,362,900	-1,859,815
land use change emissions (ton CO₂eq/y)	0	373,530,510	163,712,247	29,129,716	-39,750,443

forests, water sources and woodlands by communities that are forced to find their own solutions to sustain businesses and families. Business as usual will lead to an additional 450,000 hectares (ha) being deforested annually between 2010 and 2030, according to the WB reports.

In fact, this is a hypothetical scenario as the additional land for the extra animals is simply not available at that scale. However, it illustrates the need to change livestock production in order to meet future milk demands and reduce emissions.

Future 500

This scenario shows the situation where all smallholders are able improve their production from 350 to 500 kg per cow. Compared to the future BAU scenario, fewer animals are needed, but still an increase in animal numbers in Oromia is calculated. This is also the case for non-pregnant dry cows and bulls/oxen as the herd structure is assumed not to change.

Future 3000 (50/50)

In the Future 3000 50/50 scenario, extra milk production is realized by new farms, producing 3,000 kg milk per cow per year. So, 50% of the total milk production comes from improved dairy farms. The number of non-pregnant dry cows and bulls/oxen is not reduced as all smallholders are still there and produce the initial 1.77 million tons of milk. Due to the more efficient

production of milk, the increase in land use is small and many fewer animals are needed to produce the extra 1.77 million tons compared to the Future 500 scenario. In the 50/50 scenario, there will be an increase in GHG emissions of 35 million tons due to having more animals and increasing land use.

Future 3000 (40/60)

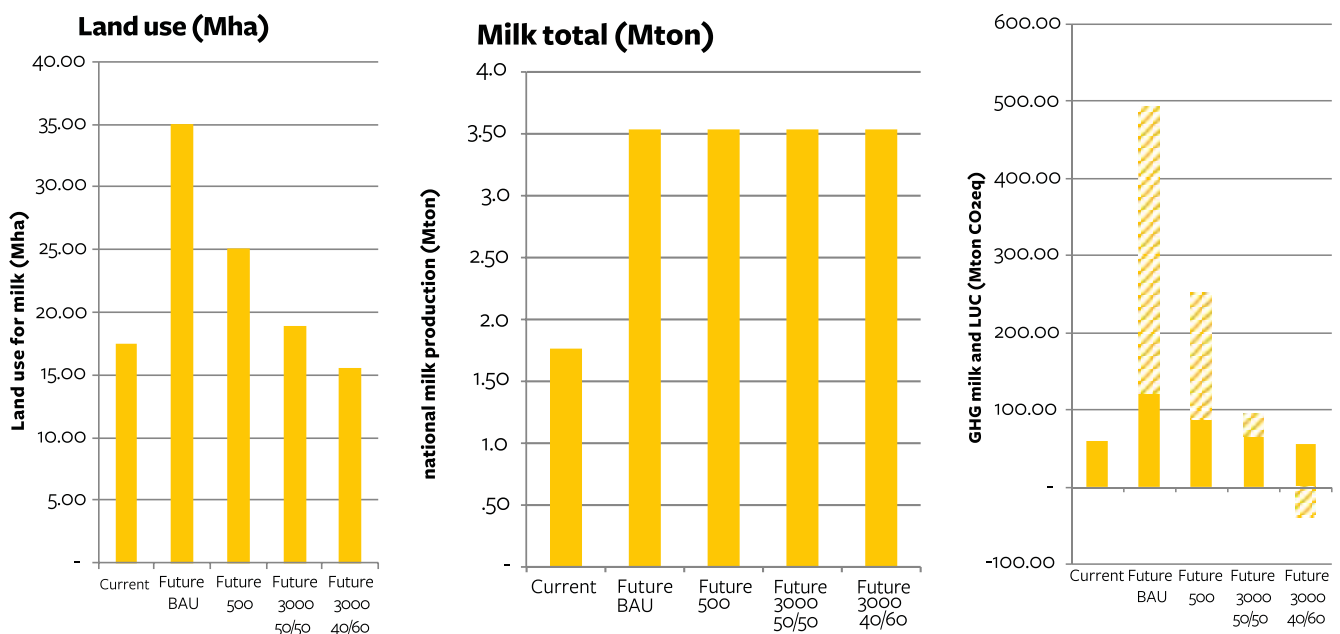
In the Future 3000 40/60 scenario, part of the existing herd is replaced. Farmers shift to commercial dairy production and adopt new management practices. In total, 60% of milk production comes from improved dairy farms (and cows), and the total number of non-pregnant dry cows and bulls/oxen is reduced. In this scenario, GHG emissions and land use are lower than in the current situation as a result of protection of forests, intensification of milk and fodder production and carefully planned herds with only productive cows.

This scenario assumes that working with 50,000-70,000 commercial farmers (with farm sizes of between 10 and 15 cows) will be sufficient to realize the growth ambitions of the dairy industry. The focus should mostly be on Tier-II farmers who can be found in Sheno, Sululta and to a certain extent in Arsi areas and who have the growth potential to become commercial farmers alongside the existing urban farm systems in Debre Zeit. However, achieving these levels requires serious commitments and investment and cannot happen in just a few years.

The majority of smallholder farmers with a few milking cows (up to 1.5-2 million farmers in total) can still benefit from this development, as considerable economic activity will take place in the respective milksheds. Rising demand for fodder and food crops will create a need for specialized crop and fodder producers that can supply the feed. Demand for other services and training will mean villages will be more developed with a spillover effect in surrounding communities. So not only will the 50,000-70,000 farmers benefit, but additional smallholders in surrounding rural areas as well.

Increased fodder production will entail a risk of deforestation that may cancel out part of the GHG emission benefits calculated for this scenario. On the other hand, embedded emissions of the imported milk that is gradually eliminated are reduced and significant future imports avoided. Although probably not within the scope of the MRV for Ethiopian livestock-related emission reductions, it does reduce the demand for imported milk powder and reduces the emissions of the exporting countries. Taking this into account, both scenarios have an absolute emission reduction (see Figure 36 below).

FIGURE 36: The total milk production (in millions of tons), land use (in millions of hectares) and the total GHG emissions (kg CO₂ equivalents) in the current situation and in four future scenarios for Oromia



The graphs above represent the current situation with 1.77 million tons of milk and the four future scenarios in which milk production in Oromia has been doubled to 3.54 million tons. The required land use in million hectares and GHG emissions of milk (solid bars) and land use change (patterned) are shown.

Land Use Change emissions have been calculated according to PAS2050 Guidelines, applying the Agri Footprint tool of Blonk Consultants. These emissions can be applied for a 20-year period according to the IPCC Guidelines regarding LULUC emissions. BAU = milk production with no change to herd structures; Future 500: since milk production on all farms from 3,500 kg per cow 50/50: 50% of milk production comes from improved farms; 40/60: 60% of milk production is from improved farms. Note the patterned bar below the zero-line in the right-hand bar in the Future 40/60 scenario.

5.4 MRV FRAMEWORK

In order to comply with standards and to measure the change in GHG emissions, a monitoring, reporting and verification framework needs to be in place. Although many factors can change, ultimately there are two decisive key performance indicators in the climate- and land-neutral growth of milk production:

- milk production per cow
- composition of the herd on a per-project basis.

Monitoring milk production

Monitoring milk production has to be done first of all by registering milk deliveries to dairy plants. Total milk production can be higher due to domestic use and home sales and does not provide information about individual milk production. The latter is an important aspect of farm management.

Therefore additional measurements are required:

- When cows are milked at the individual farmer’s dairy hub, registration and total milk production are done at that hub
- When cows are milked at home, individual milk production has to be measured regularly. In intensive dairy farming, sampling was done every two to three weeks to measure milk production, fat and protein. This has to be done by an independent controller who visits the farms on a regular basis. Total individual milk production has to be compared with plant deliveries to calculate home consumption and home sales
- All measurements have to be stored in a central database where data is controlled for quality and regular reports are made to the project management
- Procedures for calculating annual production levels are available at research institutes and similar milk registration organizations.

Monitoring animal numbers

A count of animals in the project region must be carried out twice per year in order to monitor the total number of animals in the region. This counting must be combined with milk production for dairy cows. The reduction in non-pregnant dry animals and traction animals has to be monitored as selling these animals is the second key to reducing land use and emissions. Animal numbers must be compared with the targets set at the start of the project.

Additional monitoring

Improvements in production require not only feed but also good cowsheds, water availability and animal health control. A monitoring programme has to be developed, improvement plans for cowsheds and water provision must be made and progress must be checked.

Animal health control is also required at the dairy hub.

5.5 BUSINESS CASE ANALYSIS GHG REDUCTIONS

We assume that the maximum carbon reduction of a project is set at 60,000 tons of CO₂ reduction annually. This is an arbitrary value based on the average size of CDM projects in agriculture in the period around 2010; industry projects were often much larger. With a carbon price of 3.00 dollars per ton of CO₂ reduction, the maximum revenues will be 180,000 dollars. The table below shows the required number of cows and farms in the project including LULUC and exclud-

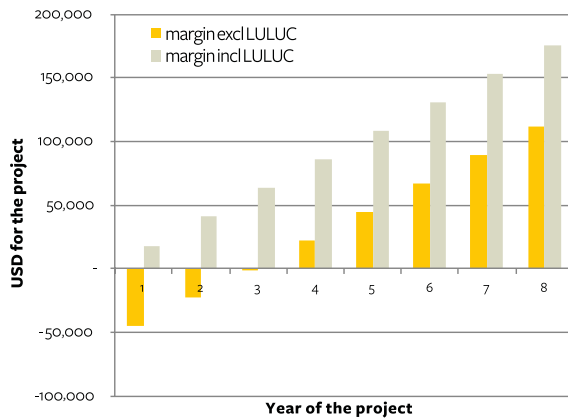
ing LULUC. This is a very important factor in carbon reduction. The amount of milk is almost 16 times higher without the benefits of afforestation compared to the situation where afforestation can be linked to the project. The costs for a proper MRV programme are estimated at 15 dollars per farm, which implies that 2%-38% of the total revenue is spent in MRV. This percentage holds when the maximum carbon reduction is realized, which is the case after a number of years.

FIGURE 37: The business case of GHG emissions

FACTOR	INCL LULUC	EXCL LULUC
Ton of milk per ton CO ₂ eq. reduction, including LUC savings	0.18	2.82
Maximum amount of carbon reduced (ton/year)	60 thousand	60 thousand
Carbon price (USD/ton)	3	3
Total carbon fund (USD annually)	10 thousand	10 thousand
Required milk production (ton/year)	10,608	169,348
Milk/cow (ton/year)	3	3
Cows (10/10 or 15/15)	3,536	56,449
Cows/farm	12.5	12.5
# farms	283	4,516
MRV expenses per farm	15	15
MRV expenses of the project	4,243	67,739
Fraction MRV of total revenues (%)	2	38
Net revenues	175,756	112,260
Revenues per ton of milk (USD)	16.57	0.66

Under the assumption that a carbon reduction will develop gradually, the MRV expenses will be a substantial part of the revenues at the beginning and can even lead to a negative margin in the first year (see figure below). When the initial cost of 150,000 dollars for setting up the MRV structure is taken into account, the carbon business case will have a (cumulative) positive margin after seven years, when no reduction from afforestation is included. When the afforestation is included in the carbon reduction, the cumulative revenues will compensate the initial expenses for setting up the MRV starting in the third year of the project. Note that the business calculations are based on a market price of 3.00 dollars per ton CO₂ which was prior to receiving BioCF information that the ERPA price is 5.00 dollars per ton of CO₂.

FIGURE 38: Effect of the MRV costs on the business case



A number of conclusions can be drawn from analysing the business case:

Even in the positive scenario where carbon reduction due to afforestation is included (and the expenses of afforestation are set at nil), the carbon fund MRV system costs money during the initial stage of the project. This means a negative balance at the start, and it will only be profitable after year 3 or 7. This is caused by the high initial transaction costs and the slow increase of the carbon reduction.

If afforestation is not included in the carbon reduction, the net result of participating in the carbon fund will be much lower or has to be compensated by extending the project to many more farmers.

The MRV costs are very high for a project; this is due to the fact that it involves a large number of family farms. MRV takes a lot of time. In projects involving industry, often one or two enterprises are involved which makes MRV much simpler and cheaper. It is necessary to think about very simple and low-cost MRV methods, using sampling statistics for agricultural projects.

Many carbon fund projects are related to situations where the total volume of production remains the same. In this case (when the project is successful), the volume of milk production has doubled and still total emissions have gone down. It is useful to consider alternatives for carbon funding, because the reductions in a situation of the same production would have been tremendous.

Although a very good result has been realized by reducing total emissions and doubling the milk produc-

tion, the largest profits from the carbon fund are caused by afforestation on unused land. With an average emissions reduction by sequestration of 21.4 tons of CO₂ equivalents over a 20-year period, it has yet to be determined whether an afforestation programme can be financed from the carbon fund.

5.6 INVESTMENT OPPORTUNITIES FOR DAIRY SECTOR EMISSION REDUCTION PAYMENTS

In addition to the business case for GHG emission reductions calculated in section 5.5, we have calculated how emission reductions in the dairy value chain can contribute to or support the amount of investment required for the transition to professional dairy businesses as described in sections 4.1 and 4.2. The Emission Reduction Payment Agreement (ERPA) that is currently¹⁶ being negotiated between the GoE and the BioCarbon Fund includes a provision that livestock sector ERs will be payable by the BioCF from 2023 onwards, under a separate MRV framework that will be developed in the 2018-2022 period.

To assess whether and how BioCF can contribute to professionalization we need to consider four points:

1. What are the baseline emissions of the dairy sector over time, and what assumptions are these based on?
2. Will professionalization of dairy farms lead to emission reductions compared to this baseline?
3. Is the price paid for emission reductions greater than the MRV costs; i.e. will there be a surplus to invest in the sector?
4. If there is a surplus, what is the most effective way to spend it in order to professionalize the sector and either benefit farmers and workers in the sector or contribute to the poverty reduction targets of the GoE, the World Bank and its investors?

1. Assumptions

These calculations are based on the following general assumptions:

1. The Emission Reductions (ER) of the dairy sector are only calculated for dairy value chain emissions, not for the associated land use and land use change (LULUC) implications of dairy professionalization, as the LULUC ERs are already accounted for by the existing MRV on forests and land use;

¹⁶ Time of writing is May 2018



2. At this stage, we will only consider emissions at farm level, based on available GHG intensity figures of the different farm models / archetypes. Later on emissions from milk collection centres and processing plants can be included. These emissions will be marginal compared to the milk production emissions;
3. The ER of the dairy sector will be included in a broader ERPA on livestock ER;
4. The assumptions made in previous sections of this report apply, including but not limited to:
 - a. current production levels and number of cows per farm¹⁷,
 - b. GHG emission intensities associated with milk (FPCM) productivity per cow¹⁸,
 - c. 58 farmers connected to a dairy hub in 2022¹⁹,
 - d. productivity of improved farms and adoption rate of intensification by farmers connected to a dairy hub²⁰, which in turn assume availability of technology, fodder and water,
 - e. MRV costs of USD 15 per farm²¹;

5. A gross²² ER price of USD 5 per ton CO₂eq will be paid by the BioCF to the GoE under a benefit sharing agreement in which the net proceeds (gross price less MRV costs) will be channelled to the dairy sector stakeholders.

2. Calculating BaU and Dairy Hub Emissions

Current GoE policy aims both to double milk production to 9.6 bn kg (PFCM) and reduce GHG emissions related to LULUC. This report argues that the introduction of dairy hubs as part of the professionalization of the sector can help to achieve both objectives, which are unlikely to be met with the current structure and level of performance. The degree to which BioCF ER payments can co-finance the transition depends on which Business as Usual (BaU) baseline scenario is used to calculate the reductions associated with the dairy hubs. Two baseline scenarios will be used.

The first scenario assumes that deforestation and expansion of land use will continue at the same rate as in recent years. The increment in smallholder farmers (2/2 farming system), heads of cattle, milk produced and GHG emissions will be based on the availability of deforested land. Doubling milk production will not be achieved in this scenario. Emissions from the dairy hub will be calculated on the basis of the total volume of milk produced by smallholder farmers. Finally, the difference between the total emissions from the in-

17 Figure 3, p17 and fig 35, page 44

18 Figure 5, p18

19 Figure 21, p32

20 ibid.

21 Figure 37, p.46: based on a rough estimation of the additional administration cost per farm of monitoring the herd size and composition, and milk quality and volume delivered to the collection centre, as these data are recorded as part of the professionalization of the dairy farms.

22 including MRV costs

creased number of smallholder farmers and a dairy hub with the same milk volume will be calculated.

In the second scenario, the production capacity of the dairy hubs (using the assumed uptake described in section 4.2) is taken as the reference point. Emissions are calculated on the basis of the total number of smallholder farmers required to produce the same amount of milk as the dairy hub. This means the expansion of traditional mixed farming is not limited to the current land conversion rate. This gives us the figures presented below.

The dairy hub and its membership – on average 58 farms in 2022 – are taken as the organizational unit for which emission reductions and potential payments are calculated. For the Business as Usual baseline, our calculations are based on a ‘reference group’ of 58 farmers with no professionalization.

The emissions per farm are calculated by multiplying productivity (kg FPCM/cow) by GHG emission intensity (kg CO₂eq/kg FPCM) and the number of cows per farm. For the dairy hub or BaU reference group, emissions from all farms are added together to give the total emissions in tons of CO₂eq per year per dairy hub. To give an idea of the total ER potential of implementing dairy hub intervention in Oromia by 2022, the emission reductions per dairy hub are then multiplied by 68 – the number of dairy hubs included in the proposed pilot scheme for the 2018-2022 period.

Scenario 1: Emissions limited by current land use change trends

In this scenario, which reflects GoE policy, no staple food or cash crop production areas are converted to

dairy production and the expansion of traditional mixed farming is limited to the current land conversion rate, meaning that no more than 38,400 ha per annum can be developed for new mixed farms with two cows each producing two litres a day (smallholder farmers). Note that in line with assumption 1 above, emissions associated with this land conversion are not included in the BaU as they are counted separately in the Forest and Land Use MRV.

This conversion limit implies that the opportunities for increasing Oromia’s milk output are severely constrained, effectively putting a cap on the increase in dairy output and the number of farms. The BaU baseline emissions of the reference group are therefore the total emissions from the existing 58 smallholder farmers plus 6 newly established farms²³. The reference group of 58 existing and 6 new farms produces a total of 51 tons of milk. With an emission intensity of 20 kg CO₂ equivalents per kg of milk, total emissions amount to 1,018 tons of CO₂ equivalents.

The dairy hub, with its combination of smallholder farmers (26 farmers), medium scale farmers (10/10 farming system: 29 farmers) and professionalized farmers (15/15 farming system: 3 farmers), has an average production level per farm of 18,850 kg of milk per year. Therefore we can say that 0.047 dairy hub would achieve the same production level as the baseline group, with emissions of 188 tons of CO₂ equivalents. This gives us a total emission reduction of 830 tons of CO₂ eq.

23 Throughout Oromia, nearly 499,135 ha of forest was lost between 2000 and 2013, or around 38,395 ha/year. Source: World Bank Oromia Forested Landscape Program (P156475) Combined Data Sheet, 2017.

FIGURE 39: Accountable Emission Reductions Scenario 1 in 2022

	# FARMS	KG FPCM / FARM	TOTAL ‘ACCOUNTABLE’ PRODUCTION / HUB (TONS FPCM)	EMISSION INTENSITY (KG CO ₂ EQ/ KG FPCM)	ACCOUNTABLE EMISSION (TONS CO ₂ EQ)
BaU/reference group	58 + 6 = 64	800	51	20.0	1,018
Dairy hub	2.7	18,850	51	3.68	188
Accountable Emission Reductions / Hub					830
Total Accountable Emission Reductions (68 Hubs)					56,440

Scenario 2: Emissions not limited by current land use change trends

In this scenario, the dairy hub's milk production in 2022 is the reference amount, which is 1,093 tons of milk. This means that 920 2/2 farms are needed to achieve the same production. With an emission intensity of 20.0 kg CO₂ equivalents, total emissions amount to 21,822 tons of CO₂ equivalents. The total emissions from the dairy hub are 4,024 tons, which implies an ER by the dairy hub of 17,798 tons of CO₂ equivalents.

FIGURE 40: Accountable Emission Reductions Scenario 2 in 2022

	# FARMS	KG FPCM / FARM	TOTAL 'ACCOUNTABLE' PRODUCTION / HUB (TONS FPCM)	EMISSION INTENSITY (KG CO ₂ EQ/ KG FPCM)	ACCOUNTABLE EMISSION (TONS CO ₂ EQ)
BaU/reference group	920	800	1,093	20	21,822
Dairy hub	58	18,850	1,093	3.68	4,024
Accountable Emission Reductions / Hub					17,798
Total Accountable Emission Reductions (68 Hubs)					1,210,264

3. Calculating Net Emission Reduction Payments

Based on the outcomes of the scenario calculations and assumption 4.e regarding MRV costs per farm, the gross and net emission reduction payments per hub in 2022 would be:

FIGURE 41: Net ER payments are based on the different scenarios for Business as Usual emissions

	EMISSION REDUCTIONS (TONS CO ₂ EQ/YR)	GROSS ER PAYMENTS / HUB	MRV COSTS/HUB (58 FARMS)	NET ER PAYMENTS / DAIRY HUB
Scenario 1	830	USD 4,151	USD 870	USD 3,281
Scenario 2	17,798	USD 88,991	USD 870	USD 88,121

4. Calculating Net Emission Reduction Payments at Oromia state level

As the potential future dairy ER payments will not be accounted at the hub but at Oromia state level, we can also calculate emission reductions based on the scenarios in figure 35. Because we do not know when the doubling of milk production is realized, we assume a conservative 10 years to reach the additional production of 1.77 M tons. Using the (optimistic) 'Future 500' scenario as a baseline, and the conservative 'Future 3000 - 50/50' scenario as the intervention outcome. This will require 983 dairy hubs and results in the following ER payments:

FIGURE 42: Emission reduction payments Oromia

	FUTURE 500	FUTURE 3000 (50/50)	EMISSION REDUCTION (value)
GHG Emissions (ton CO ₂)	87,944,220	66,498,900	21,445,320
Gross ER value	(USD 5/ton CO ₂)	USD 107,226,600	USD 109,044 per hub
MRV costs	(USD 15/farm/yr)	USD 8,850,000	USD 9,000 per hub
Nett ER value		USD 98,376,600	USD 100,044 per hub

5. Investing BioCF ER payments in Climate Smart Dairy Professionalization

Our advice is to spend the net ER payments on enhancing access to finance for the dairy hubs and farmers connected to the dairy hub. During the pilot phase, the net ER payments can be used in combination with grants and (to a lesser extent) semi-commercial finance (a mix of different finance sources also known as blended finance) to co-finance the initial investments in dairy hubs together with the investments needed at farm level.

Once the investment case of farmers and dairy hubs has been proven, the ER payments could be used to capitalize a guarantee fund that provides collateral to banks to facilitate 1) lending to dairy farmers (to invest in cattle, better feed and fodder and veterinary services) and 2) lending to dairy hubs to invest in the assets they need to set up in business. Such a mechanism would facilitate the scaling up of access to finance for multiple farmers and dairy hubs.

Based on the state-wide emission reductions, which are in line with scenario 2 at dairy hub level, ER payments in the order of \$ 90,000 per hub can be realized. This is sufficient to cover MRV, capital investment costs and benefit sharing / incentives for farmers that opt into the hub. As the ER payments will accrue to the GoE, discussions on where and how to invest the ER payments and ensure benefits are shared should commence when the concept is being piloted.

5.7 CONCLUSION

The important conclusion from the baseline assessment is that, in relative terms, the intensity of GHG emissions will be significantly reduced by transforming the dairy sector to boost milk output per cow from as much as 52 tons of CO₂/kg of milk to 2.3 tons of CO₂/kg if farmers can increase milk output from 100 kg to 5,000 kg per lactation period. In absolute terms, GHG emissions will increase as a result of the overall economic growth of the dairy and livestock industries.

However, considering the potential to reduce land use for feed production and grazing, intensifying milk and fodder production seems to be the correct approach. If cattle for traction is included, we can

conclude that farmers who increase production from 100 kg per cow/year to 5,000 kg will need only 5.6 m²/kg of milk, versus 157 m²/kg of milk for farmers with low-productive cows. This is a huge difference that can prevent further deforestation and degradation of woodlands when managed and planned properly in specific zones in Oromia with all actors involved.

Extrapolating figures to the macro level produces a situation (40/60 scenario) in which growth targets in dairy production can be reached with a smaller group of 100,000 commercial farmers in Oromia Regional State, who will double Oromia's milk production to 3 billion kg while at the same time reducing emission intensities. This is a very ambitious projection, and different approaches are needed to ensure that sustainable and inclusive growth can be realized in the dairy industry without excluding rural communities, where the risk of deforestation and degradation of forests and woodlands is greatest.

In this chapter, we have provided several recommendations that will avoid a future BAU (business as usual) scenario, as this would lead to increased migration from rural communities to urban areas, over-exploitation of forests and woodlands and uncontrolled economic growth benefiting only a few people. We recommend testing several approaches in pilots that will enable the development of dairy hubs and green villages (kebeles) in Oromia Regional State, leading to intensified land use, higher production levels, protection of forests and water sources and increased economic returns for rural societies, including job opportunities to retain future generations.

It should be noted that without dairy professionalization, it is unlikely that the dual GoE policy goals of reducing deforestation and doubling dairy output in Oromia will be met. Doubling milk output without professionalization will require cropland and forests to be converted at the current low level of productivity per cow, while restricting dairy production to current pasture land with the same or decreasing deforestation rates will add only marginal milk volumes to the current supply. So professionalization is inevitable, but BioCF participation could speed up the process considerably, as it will enhance access to finance for farmers and dairy hub entrepreneurs while mitigating the risks of front-running investors.

6

RECOMMENDATION: MARKET-DRIVEN PILOTS

The recommendation is to develop a market-driven and integrated value chain approach with milk processors that have the capacity and commitment to invest in dairy hubs and more sustainable and productive farmers. We recommend focusing on the commercialization of dairy farmers, who thereby become specialized producers. Supporting these farmers will lead to gradual improvements for their peers in surrounding villages as well as increased demand for feed, fodder and services.

For dairy farmers to become commercial farmers, the biggest growth potential is seen in the Tier-II zones, including Sheno and Sululta milk-shed areas. In these areas, dairy farmers are on their way to becoming specialized producers but need better access to technical support, fodder and feed and other related services so they can exploit this growth. With the right integrated approach, pilots can begin with local milk processors to support this particular target group in their move towards commercial production levels (so called 15/15 farms).

This does not mean that producers in Tier-I (Debre Zeit) and Tier-III zones (Jimma, Arsi) should be denied support: quite the contrary. Tier-I zones (including the industrial cluster developed around Ziway for dairy) are becoming increasingly interesting investment destinations for foreign companies. This includes the establishment of so-called nuclear farms where vertically integrated businesses are developed,

including the establishment of milk factories and dedicated land for dairy and fodder production. This can also benefit smaller farms, as they can better access markets, fodder and technical services.

Tier-III zones are crucial zones for reaching the majority of smaller dairy mixed-farm systems where communities are located closer to high-woodland areas and natural forests. In these areas, the risks associated with grazing in natural forests and collection of fuelwood are still leading to the degradation of natural forests and sometimes deforestation. Excluding these farmers would not solve these challenges. Moreover, developing the dairy industry in these zones will contribute to improved economic activity and the resilience of rural communities.

We advise starting small pilots in both Tier-II and Tier-III zones to emphasize that different approaches are needed for different farm systems, but in both cases we foresee positive outcomes in terms of climate adaptation and mitigation practices (lower GHG intensities and improved protection of forests) and economic benefits (increased milk production, incomes and services). To prove that the several business cases for 3,200 farmers in 16 villages, surrounding communities and the dairy hubs are viable, a timeline of three to five years is planned, with a requested grant investment of 4.5 million dollars for two pilot initiatives, excluding private sector investments. Once the growth potential in those areas has been established, a wider



uptake of these practices at regional level can be undertaken, starting from 2021–22. The investment needed to transform the sector in Oromia Regional State and support 100,000 farmers in doubling their milk production is estimated to be 17 billion Birr.

Based on our CO₂ calculations, this approach will lead to a reduction of emission intensities of 160 kg CO₂ per kg of milk compared to upscaling along the BAU scenario. It may reduce woodland deforestation and degradation due to the higher yields per hectare, sustainable intensification of current agricultural land, higher fuel self-sufficiency and associated higher income levels. This can prevent conversion and/or degradation of up to 9 million hectares of additional forest, based on World Bank data. It should be noted that based on our analysis, these 9 million hectares would not suffice to double milk production, and imports would still be needed. To achieve 3 billion kgs of additional milk production, some 21 million hectares would need to be converted. It is unlikely that any increase of that size is physically possible and it shows the strong requirement for the proposed efficiency and yield increases to achieve growth and self-sufficiency targets with limited increase of land use.

Pilot rationale

To prove the business case for establishing dairy hubs driven by local dairy companies in selected milk-shed areas, one or two pilots should be implemented. One of the pilot areas can be in the Tier-II zone which has the most potential to develop subsistence and (semi-) commercial farmers into specialized dairy producers.

In this pilot commercial farmers will be developed and supported, responsible for producing most of the high-quality milk for formal markets. This group of farmers is the main target group for Solidaridad and the priority area **(Tier-II: Sheno & Sululta Zones)**. Another pilot can be implemented in more rural/mixed farm systems in **Arsi or Jimma zones (Tier-III)** where the majority of smallholder farmers use mixed farm systems (dairy, livestock and commodities such as coffee and food crops). In the so-called Tier-III areas, similar dairy hub milk villages can be developed to support existing farmers in coffee production and vice versa. Both pilots are necessary to develop more professional dairy value chains while at the same time engaging producers in different production zones in practical solutions to reduce GHG emissions and avoid degradation and deforestation of natural forests and woodlands.

Tier-II pilot approach

In the Sululta and Sheno milk-sheds, there are existing peri-urban and urban dairy producers who are already specialized dairy producers or have the potential to become commercial farmers. Farmers will be intensively engaged and involved in prioritizing key (dairy) topics where knowledge gaps exist. In this approach linked to Sululta or Sheno milk production zones, the intervention strategy will focus on a number of important support packages to take them to a professional level. The first element of this approach is professionalizing dairy producers with technical support so that they become specialized dairy producers.



Farmers will be encouraged to adopt climate-smart practices and choose their own roadmaps. The investment in and establishment of dairy hubs at village level is the second component of this approach. This will allow collective milking, cooling and collection to ensure a steady uptake of high-quality fresh milk. The ownership model will be determined in collaboration with milk processors, as they will be the first to invest in the dairy hubs.

Thirdly, working with selected farms and developing them into specialized fodder producers is an important pre-condition for ensuring a constant feed supply, including during dry periods. The fourth component is to ensure that relevant services can be accessed (AI services, veterinary services, concentrated feed supply and financing to invest in heifers). Finally, an MRV framework needs to be developed that can measure carbon performance and progress arising from milk production. More details on this pilot can be found in Annex 7.

Tier-III pilot approach

Developing the local dairy sector in coffee villages in Jimma Region contributes to sustainable economic growth for at least 1,200 farmers, many of them women, and their coffee households. Milk is currently a by-product rather than the main source of income. The introduction of village milk hubs will mean milk becomes a safe product to consume and a source of local jobs. Via existing self-help groups, women will receive start-up capital in the form of microfinance to enable them to become more professional dairy producers. This will connect them to more formal mar-

kets, for example in Jimma, and give them access to better prices. Women can become specialized in this small agro-business and at the same time become suppliers of feed, biogas (from sludge) or compost for coffee farms. Household gender surveys should be conducted to assess the shifts in workload and timing associated with this proposed specialization.

This system will make an important contribution to protecting and improving natural forests around Jimma. By intensifying coffee, dairy and fodder production within and around the villages, the need to cut trees for fuel consumption will be reduced. In this inclusive approach, dairy development can still take place in Tier-III areas and a major contribution can be made to the economy, in terms of more jobs, more income from dairy, coffee and fodder production, and to the environment in the form of protected forests, sustainable landscapes and resilient communities. These interventions will begin with investments in dairy hubs.

The dairy support program, in combination with the establishment of a business school to set up micro-businesses, will ensure strong technical support. Self-help groups will be strengthened to ensure market access to milk factories. Finally, villages will be supported with green village plans in which local government authorities and farmers jointly develop plans for green investments. In order to upscale these interventions, viable business cases need to be demonstrated to ensure that impact investors or local banks can make additional investments. More details on this proposed pilot approach can be found in Annex 8.



Local and international private partners both pilots

One up to three dairy processors

Jimma/Arsi (Tier-III; Dairy Cooperatives & New Processing Company selected)

Scope and target groups both pilots

Tier-II (1,600 dairy farmers and 8 villages)

Tier-III (1,600 dairy/coffee farmers and 8 villages)

Investments needed both pilots

Tier-II Approach: 2 million dollars grant (including 300,000 dollars hardware investments)

Tier-III Approach: 2.5 million dollars grant (including 300,000 dollars hardware investments)

Timelines both pilots

A period of three to five years is needed to prove whether the business case for farms and dairy hubs is viable. At the same time, the effects of introducing new cross-breeds will take three to four years to bear fruit, which also needs to be taken into account in the pilot phase.

Outlook to macro level (upscaling strategy)

Dairy hubs and farmer improvement potentially make up an excellent strategy for increased food security and increasing income and job security in Ethiopia. It will enable Ethiopia to become self-sufficient or even export milk in good years rather than import it at high prices. Scaling up the programme to 100,000 farmers would require a one-time 17 billion Birr investment in

farmers and 5.5 billion Birr in 3,000 dairy hubs, enabling large-scale professionalization. This will deliver almost 20 billion Birr per year in profits for farmers and dairy hubs in Ethiopia. The total contribution to Ethiopia and its GDP is almost 90 billion Birr per year. Such a large-scale development will take at least seven to ten years to realize and an initial development of pilot schemes to enable education and further enhance the business cases for farmers, dairy hubs and fodder. Furthermore, the benefits of the investments materialize fully after five to six years.

ANNEX 1

**RESEARCH METHOD GHG
SCENARIOS**

GOLD Standard

The criteria for receiving carbon credits for GHG mitigation require the development of a reliable framework for proving emission reductions. The MRV framework will be described in more detail in Chapter 5, based on baseline findings and the key production parameters that have been identified. These emission reductions must cover direct emissions related to activities in the whole dairy production chain and the related emissions from land use and land use change. The latter two terms refer to the change in soil carbon stocks, both above and below ground, in situations where the horizontal expansion of grazing land leads to deforestation or forest degradation. The Gold Standard provides a framework for developing a baseline relationship between the milk production rate per cow and the GHG emission intensity. This framework, which describes sampling and data collection requirements, will be applied in the analysis of this activity.

Sample size

The sample survey measures practices at an accuracy level of 90 +/- 10%. This gives a confidence level of 90% and a margin of error of 10%. Based on a sample size calculator, the sample size is defined in the table. In total, a sample of 72 farms has been chosen.

POPULATION SIZE	SAMPLE SIZE
500	60
1000	64
10,000	67

The survey has to cover farm types that raise at least 80% of the dairy herd in the Oromia Region.

Based on experiences in other projects (Van Der Lee, De Vries et al. 2016), five farm types have been identified as relevant for incorporation in the survey.

All these farm types can be categorized as smallholder:

- Rural, mixed farming system, based on perennial crops
- Rural, mixed farming system, based on cereal crops
- Peri-urban, land based
- Peri-urban, landless
- Urban, landless

Although these farm types have been identified, no stratification has been used in analysing the relationship between milk production rates and GHG emis-

sion intensity in order to include a wide range of milk production rates and develop a statistically robust relationship. Sufficient data should be collected to support the quantification of baseline emissions. The data collection is based on a questionnaire that was developed for a similar project, ordered by the Agricultural Transformation Agency in 2015 (De Vries et al. 2016). This questionnaire has been used in other dairy development projects as well (De Vries and Andeweg, 2017, personal communication). Collected data should not be older than five years. Data collection took place in February and March 2017. Some data from the survey by De Vries et al. (2016) was included and is very recent. When existing databases are used, these should be from a recognized authority and publicly accessible. For data regarding yields of crops and fodder, statistical data was used. All other data for calculating emissions, publicly available emissions generators and calculation methods has been applied.

GLEAM (Global Livestock Environmental Assessment Model)

The GHG emissions are calculated using the GLEAM model as described by Opio et al. (2013) which is recognized as the gold standard for measuring emissions. The GLEAM model has been made available as an Excel model, allowing calculations to be made for individual dairy farms. A detailed model description is provided by De Vries et al. (2016). The most important aspects are described in detail below.

The Herd Module

The herd module breaks down the animal numbers into six cohorts: adult female, replacement female, adult male, replacement male, surplus female and surplus male. When GLEAM is applied on a regional basis, the numbers are defined by so-called rate parameters: calving interval/fertility rate, death rates of animal cohorts, replacement rate, age at first calving and growth rates. These are taken from literature and surveys and applied to the total number of cattle in the statistics. This method is clearly described by Opio et al. (2013). For the calculations for individual farms, the rate parameters are not used. Instead, the real numbers of sold and deceased animals, calves born, etc. are used. Applying this approach leads to a larger variation among farms, especially on smallholder farms where selling one in three cows is a large proportion and significantly affects farm output, compared to a situation in which one cow is sold on a farm with 100 head of cattle. Given the fact that dry non-pregnant



cows are also present on farms, mostly functioning as “capital on hooves,” two further categories have been identified: adult female (AF) lactating and AF non-lactating. Pregnant dry cows are counted as lactating animals, as their non-lactating phase is a period between two lactations.

Manure Module and Life Cycle Inventory for Feed

This module is applied as described by Opio et al. (2013), with the addition of the share of discharge of animal manure to the management options. This module describes the GHG emissions relating to the production and processing of feeds. These can be primary crops but also by-products such as crop residues or by-products from industrial processing, like cakes. All used feed materials have to be described in the Life Cycle Inventory. The LCI activity and yield data has been collected on the basis of the LEAP Guidelines for feed and the PEFCR for feed. Compared to the cal-

culations of Opio et al. (2013), animal traction has been incorporated more explicitly in the LCI using a calculation of GHG emissions by traction animals and their productivity in ploughed hectares per year. These calculations have been documented by De Vries et al. (2016). Land use change will be calculated separately when extra land is required.

Animal Nutrition and Allocation Modules

The herd output module calculates the intake of feed and the related emissions of methane and nitrous oxide on the farm. This module is exactly the same as described by Opio et al. (2013). This module describes the distribution of emissions for meat and milk. Calculations have been performed for all individual farms, earning 72 data points for calculating the baseline relationship between milk production rate and GHG emission intensity.

ANNEX 2

BASELINE MILK CLUSTERS

MAIN CHARACTERISTICS, OPPORTUNITIES AND CHALLENGES OF MILK CLUSTERS, OROMIA

	SELALE/SULULTA	SHENO	DEBRE ZEIT	ARSI	JIMMA
Population 2017	169,257	98,513	161,354	112,586	195,228
Nearest city	Addis Ababa (35 km)	Debre Berhan (50 km), Addis Ababa (75 km)	Addis Ababa (45 km), Mojo (20 km)	Adama (65 km)	Jimma City
Major dairy farming system	cereal-based	cereal-based	specialized dairy farm systems (both medium-sized and commercial)	cereal-based	perennial crop-based+
Main dairy industry participants	- Selale Union (collection) - Elemtu Milk (processing) - ALPPIS (inputs)	- Sheno Coop (collection)- Etete Milk (processing) - Biruk (collector)	- Ada Coop (collection) - Alema Koudijs (feed processing)	- Derese Dairy (production, collection and processing) - Ethio Feeds (feed processing)	- Jimma Cooperative (collection) - Dairy farm (production and retail)
Main challenges	- High feed cost - Low milk prices - Lack of improved forage - Poor manure management - Knowledge gap	- High feed cost - Low milk prices - Lack of improved forage - Poor manure management - Knowledge gap	- High temperatures for cows - Ongoing feed shortage - Shortage of land for expansion - Feed/fodder production	- No processors in the area - Limited services provided - Knowledge gap for farmers - Union inactive, limited collection points	- Shortage of heifers - Poor service delivery systems - Knowledge gap for farmers - High feed cost
Main Opportunities	- Suitable agro-ecological climate - More experienced farmers - Better access to feed and services	- Suitable agro-ecological climate - More experienced farmers - Better access to feed and services	- Good milk prices - Location to main markets - Good access to feed processors and services	- Access to markets - Availability of feed via crop production systems/land - Active dairy cooperatives	- High milk prices caused by high demand and low supply - Proper manure application - Suitable agro-climate for dairy

Main stakeholders of milk clusters, Oromia

Based on the overview provided above, the main stakeholders and their roles in the value chain are further explained in the table below.

CLUSTER	KEY VALUE CHAIN ACTOR	ROLE IN THE VALUE CHAIN	POSSIBLE WAYS OF INVOLVEMENT IN THE VALUE CHAIN
Sululta	Elemtu Dairy Selale Union ALPPIS	Milk processing Milk collection and processing Input supply (vet, drugs, AI)	1. Providing embedded service to farmers, managing community milking parlour, chilling center and dairy hub 2. Organizing farmers for community milking parlour 3. Participate in input supply
Sheno	Sheno town dairy cooperative Etete Milk Biruk Sewunet	Farm input supply and milk collection Milk collection and processing Milk collection and transport	1. Organizing farmers for community milking parlour 2. Providing embedded service to farmers, managing community milking parlour, chilling center and dairy hub 3. Organizing farmers for community milking parlour and dairy hub
Bishoftu	Ad'a Dairy Coop Alema Koudijs Feed National Veterinary Institute	Milk collection, feed processing, milk processing Feed processing Veterinary vaccine and drug manufacture	1. Organizing farmers for community milking parlour, input supplying hub 2. Provision of quality concentrate feed for dairy hubs 3. Provision of veterinary drugs and vaccines for dairy hubs
Asela	Mastewal Dairy Ethio Feeds	Milk production, collection and processing Feed processing	1. Organization of surrounding farmers for community milking parlour, provision of AI and vet services, milk collection and processing 2. Provision of quality concentrate feed for dairy hubs
Jimma	Jimma town dairy cooperative Wendimamach-och dairy farm	Collecting and marketing milk, feed supply Milk production and retail	1. Organization of surrounding farmers for community milking parlour, provision of AI and vet services, milk collection and processing 2. Organization of surrounding farmers for community milking parlour

ANNEX 3

MAIN STATISTICAL FINDINGS

FARM CHARACTERISTICS

DISTRICT	PERI-URBAN LAND-BASED	PERI-URBAN LANDLESS	RURAL CEREAL-BASED	RURAL PERENNIAL-BASED	URBAN SHF	GRAND TOTAL
NUMBER	7	9	40	10	7	73
Household size	4.0	3.0	4.2	4.0	6.4	4.2
#children	1.7	2.0	2.7	2.9	2.3	2.5
MILKING FREQUENCY						
Three times a day			1			1
Twice a day	7	9	39	19	7	72
MILK COOLING						
Blank			1			1
No	6	8	36	10	4	64
Yes	1	1	3		3	8

PRIMARY INCOME FARMS

PRIMARY INCOME	PERI-URBAN LAND-BASED	PERI-URBAN LANDLESS	RURAL CEREAL-BASED	RURAL PERENNIAL-BASED	URBAN SHF	TOTAL
Cash crops			6.0	10.0		16.0
Edible livestock products	1.0	7.0	10.0		5.0	23.0
Non-cash crops	6.0	1.0	21.0			28.0
Off-farm labour			1.0			1.0
Others		1.0	2.0		2.0	5.0
TOTAL	7.0	9.0	40.0	10.0	7.0	73.0

SECONDARY INCOME

SECONDARY INCOME	PERI-URBAN LAND-BASED	PERI-URBAN LANDLESS	RURAL CEREAL-BASED	RURAL PERENNIAL-BASED	URBAN SHF	TOTAL
No		3.0	1.0		2.0	6.0
Cash crops	1.0	1.0	3.0			5.0
Edible livestock products	5.0	2.0	23.0	2.0	2.0	34.0
Manure		1.0				1.0
Non-cash crops			8.0	7.0		15.0
Others	1.0	2.0	5.0	1.0	3.0	12.0
o	7.0	9.0	40.0	10.0	7.0	73.0

On 16 farms, income from edible livestock products was not the primary or secondary source of income. Fifteen of these farms are rural farms where cash and non-cash crops are the most important income sources. Cattle is kept for traction and domestic consumption of raw milk.

Herd Size

The table below provides an overview of animal numbers and herd characteristics for the five different farm systems in the survey, in the five substrata.

ANIMAL NUMBER	PERI-URBAN LAND-BASED	PERI-URBAN LANDLESS	RURAL CEREAL-BASED	RURAL PERENNIAL-BASED	URBAN SHF	AVERAGE
LACTATING COWS	2.7	3.9	1.8	0.8	7.0	2.5
Dry cows, pregnant	0.3	1.0	0.7	0.4	2.7	0.9
Dry cows, non-pregnant	0.6	0.1	0.3	0.4	0.1	0.3
Heifers, pregnant	0.6	0.7	0.3	0.2	1.3	0.5
Heifers, non-pregnant	1.6	2.7	1.1	0.7	0.4	1.2
Oxen	3.0	0.2	2.9	1.7	0.0	2.1
Bulls	0.3	0.3	0.4	0.3	0.3	0.4
Young males	0.4	0.3	0.5	0.9	0.1	0.5
Calves	0.6	1.2	1.4	0.5	1.4	1.2
Total animals	10.0	10.4	9.4	5.9	13.4	9.5
HERD CHARACTERISTICS						
Bull to cow ratio (-)	1.10	0.11	1.35	1.67	0.03	0.76
Replacement rate (-)	0.28	0.38	0.25	0.13	0.28	0.27
Death rate adult (-)	0.12	0.11	0.15	0.00	0.13	0.13
Death rate calves (-)	0.25	0.47	0.33	-	0.43	0.40
Age of first calving (month)	45	25	37	38	27	34
Calving interval (month)	12.0	14.3	18.1	17.3	14.8	16.5
Milk production (kg/year)	1,096	1,745	1,249	411	3,616	1,407

Peri-urban landless and urban SHF have the highest number of cows, the lowest number of dry non-pregnant cows and the lowest bull-to-cow ratio. The latter implies that they have few or no traction animals. Replacement rates for dairy cows are relatively high compared to specialized dairy, probably as a result of health and fertility problems. Cow deaths account for half of all replacement.

There are two ways to calculate the death rate for calves, both of which produce high numbers. The stated death rate is relatively low, but the real figures are assumed to be higher. A recorded death level of 40% to 45% of the actual figure is realistic. Age at first calving is at a good level on landless farms, but the figures are assumed to be over-optimistic. The average calving interval is 1 year and 4.5 months, but in some instances we believe this figure to be too optimistic. The 12-month interval given for peri-urban land-based farms is not realistic: for this system a period of 15 months is assumed.

All farms have dry non-pregnant cows which are assumed to act as capital on hooves that can be sold to raise cash. Milk production is relatively high, but a number of the surveyed farms are known to have access to traffic infrastructure and hence relatively good access to concentrates and informal milk markets. In general, landless farms are already specialized in dairy or in the process of becoming so, while the others are still mixed farms.

The table below provides the average number of animals per breed and the calculated average female adult weight in the five substrata.

ANIMAL NUMBER PER BREED	PERI-URBAN LAND-BASED	PERI-URBAN LANDLESS	RURAL CEREAL-BASED	RURAL PERENNIAL-BASED	URBAN SHF	AVERAGE
Local	3.6	2.0	5.2	5.0	0.0	4.1
Exotic	4.9	8.3	1.2	0.0	13.0	3.4
Cross-bred	1.6	0.1	3.0	0.9	0.4	1.9
Average weight kg	449	503	385	331	547	425

Three categories of breed have been distinguished: local breeds; cross-breeds with between 25% and 75% of exotic breeds; and exotic or high-grade breeds with more than 75% of exotic (mainly Holstein Friesian) origins. The exotic type predominates on urban and peri-urban landless farms, indicating a high level of specialization in dairy production. Local breeds still predominate on rural farms which have a relatively small fraction of cross-breeds and exotic breeds. This trend is stronger on cereal-based farms than on perennial-based farms. Peri-urban land-based farms fall between the two.

The table below provides the number of cows active in lactation (currently lactating and dry pregnant) and the average minimum and maximum lactation period per substrata.

MILK PRODUCTION (KG/DAY)	PERI-URBAN LAND-BASED	PERI-URBAN LANDLESS	RURAL CEREAL-BASED	RURAL PERENNIAL-BASED	URBAN SHF	AVERAGE
Lactating cows	2.7	3.9	1.8	0.8	7.0	2.5
Dry pregnant cows	0.3	1.0	0.7	0.4	2.7	0.9
Lactation period max (months)	13.2	14.7	11.4	8.4	13.3	11.8
Lactation period min (months)	10.0	8.9	7.0	6.1	8.8	7.6

As the GLEAM model is not used on a regional basis, a number of rate parameters have been omitted from the calculations, such as calving intervals and death rates. However, it serves to illustrate the averages per category. The age at first calving allows the growth rates of animals to be calculated. The table below provides the average age at first calving and the calving interval per substrata of the survey.

FARM SYSTEMS	AGE AT FIRST CALVING (MONTHS)	CALVING INTERVAL (MONTHS)
Peri-urban land-based	45	12.0 (considered too optimistic)
Peri-urban landless	25 (considered too optimistic)	14.3
Rural cereal-based	37	18.1
Rural perennial-based	38	17.3
Urban SHF	27	14.8
GRAND TOTAL	34	16.5

Rations

Animal rations are based on the survey. No quantitative information was provided about the use of feed. The rations are estimated on the basis of:

- Information per feed material about period of use, expressed as months per year
- The period of grazed grass “application” was used to estimate grazing time
- Information about products bought
- Information about rations from a similar survey for the five farm types in De Vries et al. (2016)
- Information from Gerber et al. (2010) and Opio et al. (2013) about the rations of dairy cows
- Milk production per cow—higher milk production requires higher fractions of energy and protein density by product and compound feed.



Feed LCI data

To calculate GHG emissions per kg of feed, activity and yield data per crop is required. The survey did not collect data about crop yields and collected limited information about fertilizer application rates. From the background information, it is known that the amount of mechanized work done (i.e. done with a tractor) is close to nil. GHG emissions for the use of animal traction for ploughing, seedbed preparation and—partly—harvesting is based on the study of De Vries et al. (2016). Also all other activity and yield data has been taken from De Vries et al. (2016), who carried out a survey of about 70 farms in Oromia Region in 2015.

Manure management data

The survey collected information about manure management. Farmers were asked whether they had separate or mixed collections of dung and urine and how it was stored. In addition, information was collected about the use of dung for fuel (dung cakes). The manure management systems have to be described in a way that fits the calculation framework provided by the IPCC (2006). Based on the collected information, the manure management system has been defined by estimating the grazing time and using the fraction of grazing time out of the total time to identify the amount of dung and urine deposited in pasture. The remaining manure was allocated first to drying/dung cakes on the basis of the response given, from “nearly all” (75%) to “almost nothing” (10%). Any remaining manure was allocated to liquid and solid storage. When both answers were “yes,” the total was evenly shared between pit/silo and pile/

heap; where only one answer was “yes,” the whole amount was added to the liquid or solid storage, as applicable; and where both were “no,” the manure was discharged.

Allocation data

Because animal traction was classed as production, emissions from male work animals were not included in the GHG emissions for the dairy herd. Emissions from animal traction will be reflected in the GHG emissions of feed production, as the Life Cycle Inventory for feed takes emissions from traction animals into account. To be completely accurate, a small fraction of a male animal should be included in the calculation since a bull is needed for reproduction. Gerber et al. (2010) and Opio et al. (2013) apply bull-to-cow ratios of 1 to 10 for natural service (which is common on smallholder farms) and 1 to 100 for artificial insemination. As farmers become more market-oriented, they are more likely to employ the latter method, but for this study it has been ignored. The allocation for meat and milk is based on the protein production of each product. It is known that the preferred and prescribed allocation method is based on biophysical principles (Thoma et al. 2011) and used by the Product Environmental Footprint Category Rule for dairy. A standard formula has been developed using the ratio between the production of Live Weight (LW) and milk (the Beef-to-Milk Ratio, BMR). The BMR values of Ethiopian farms is often far outside the BMR range that has been explored by Thoma et al. (2011). Applying this formula to Ethiopia will occasionally produce negative emission figures. We have therefore used the fallback option of protein allocation.

ANNEX 4

LAND USE CHANGE AND GHG EMISSIONS

The Ethiopian dairy sector impacts climate change through the emission of GHG by cattle and land changes that occur when expansion of herd sizes leads to increased area for grazing and/or fodder production. This annex explains in short how changing land use as a result of dairy sector activity affects GHG emissions.

Based on a study commissioned by the World Bank, an analysis was conducted of the main drivers of deforestation in Oromia Regional State.¹⁶ The natural environment of the main remaining forested landscapes in Oromia can be divided into moist forest, dry forest, high woodlands and low woodlands. This typology of land cover allows for spatially disaggregating drivers and agents. The following main drivers and respective agents can be identified: small-scale subsistence agriculture and commercial coffee production affecting moist forests; small-scale agriculture, wood fuel extraction and livestock expansion in dry forests; commercial agriculture affecting high woodlands; and livestock expansion and unsustainable fuelwood extraction mainly affecting low woodlands. As regards the dairy sector in Oromia Regional State, two main drivers can be identified. One is the expansion of commercial and smallholder farmers in dairy, which leads to the degradation of woodlands due to increased searches for fodder and feed in these areas. Another driver is the expansion of grazing land for cattle by smallholder farmers at the expense of forests. The latter is mainly related to the pastoralist areas in South Oromia (Borena). When the outcomes of the study are linked more closely to the selected milk clusters, different trends can be identified. First of all, in Jimma, coffee farmers contribute to the degradation of high woodlands by collecting firewood in the forests and through free grazing of livestock and fodder production. Particularly in the dry seasons, the natural forests are widely used as grazing areas to supplement the annual feed requirement for the livestock enterprise, supplementing the feed from crop residues and foraging from small grazing land reserves. This is also a challenge in Arsi, where the carrying capacity of natural grazing lands is not sufficient considering the stocking rates. The same is true for North Shewa (Sululta Area). The GoE in Oromia has designated available land close to the main commercial dairy clusters that is currently not used for cultivation

to become areas for fodder and feed production. Another solution to the deforestation of natural forests and degradation of woodlands proposed by GoE is to encourage smallholders in dairy areas that produce local crops to actively become fodder producers.

The Climate-Resilient Green Economy (CRGE) strategy indicates that, if current trends continue, nine million ha will be deforested between 2010 and 2030. Over the same period, annual fuelwood consumption is expected to rise by 65%, leading to the degradation of more than 22 million tons of wood biomass. Ethiopia is known for its severe land degradation, with 45% of the total land mass having been affected by soil erosion of arable land (Lakew et al. 2000). This degradation has severe implications, including soil loss and agricultural productivity losses, both locally and nationally (Zelege & Hurni 2001). Between 1990 and 2005, Ethiopia lost over 2 million ha of forest with an average annual loss of 140,000 ha and an annual deforestation rate of 0.93%. Between 2000 and 2005, the rate of deforestation increased by 10.4% to 1.03% per year. This resulted in a total loss of around 2.114 million ha, or 14% of forest cover, in the 15 years between 1990 and 2005 (FAO, 2010). With an estimated deforestation rate of 150,000-200,000 ha per year, Ethiopia will be completely deforested in less than 20 years unless drastic measures are taken to reverse the trend (Teketay et al. 2003).

Several important solutions and strategic options have been proposed in the national REDD+ study to ensure that the scenarios described above do not become reality. Helping small-scale producers intensify production through climate-smart practices must be a priority to reduce emission levels. Sustainable fuelwood and charcoal use through energy-efficient systems is also encouraged. Protecting forests, woodlands and natural areas through ownership land tenure systems is also mentioned, including the promotion of sustainable and commercial timber plantations to avoid further deforestation and ensure that current forests can be rehabilitated. Enhancing local institutional capacity to better protect and manage the forests is also a must.

16 OFLP Project: Analysis of causes of deforestation and forest degradation in the Oromia Regional State and strategy options to address those, September 2014.

ANNEX 5

INTERVENTION PACKAGES

Farmer support

Objective: Develop production and entrepreneurial skills of farmers, particularly in villages with a dairy hub. Preparation of early adopters and early majority in other communities for the next phase of scaling up.

- a. Farm management training based on the developed agenda using established dairy hubs and/or commercial farms as demonstration and training units;
- b. Training in hygienic milking in places where farmers have no access to village milking systems;
- c. Training in calf rearing, fertility management and heifer production;
- d. Training in business development and finance;
- e. Training in management and planning (for fodder in dry periods).

Farm management app

A herd management app can be developed in partnership with current providers of this technology. The existing app needs adaptation for the local situation. The app includes farm data like milk production, herd management, medicine registration, treatment protocols, herd status, health and farm comparison. A multi-farm tool makes it easy to monitor different farms. The information enables adapted and daily support where necessary. The farm data can also be used by service providers, dairy processors and banks. Further, the data can be used to monitor progress of development and—after calculations—emissions of greenhouse gases.

Training

Training and support will focus on (re)introducing farmers to basic practices for successful dairy farming, use of herd management app (see above) and a “farm planning format” that gives insight into longer-term profitability. Training material is already available—one example is Cow Signals from Roodbont publishers—and can be translated and used.

Credit facility

Together with dairy processors and/or dairy hubs, a credit facility can be introduced based on farm development and loan repayment through deductions from milk payments.

Commercial dairy farms

Objective: Introduce well-established commercial farms (>15 cows) with modern infrastructure and practices, including heat stress management and preferably mechanized milking.

- a. Selection of individual farmers with the willingness and capacity to grow farm size. Support for these farmers with developing a business case and investment plan;
- b. Establishment of modern farm infrastructure and practices, including heat stress management and cow comfort, potentially combined with a biogas digester.

The above-mentioned support to farmers can be provided to smallholder, peri-urban and commercial dairy farmers. In addition, commercial dairy farming can be further developed by the introduction of new farm systems (currently available in other countries) with optimal conditions for cows, milk quality and biogas production.

Pilot dairy farms

A pilot can contribute to the successful development of a locally adapted and accepted farm system. The pilot can test technology and scale, and management can show what scale is required to make the farm economically viable. Infrastructure components of professional dairy farms are a) cowsheds/equipment for cows (water, feeding space, cow comfort measures), b) (optional) cooling (500-2,000 litres) and milking machines, c) grid connection and/or generator where necessary, d) manure store with a biodigester.

Feasibility study “middle class” dairy farms

During the pilot phase, the programme can start with a) the mapping of farmers and their characteristics and b) development of a financial simulation model to assess the investment opportunity for investors and/or value chain partners. The feasibility study should also include a market-based approach (cowsheds, technology, data management including a financial part with description of return on investment, free available cash flow and financial instruments like equity, loans and grants).



Dairy hubs

Objective: Introduce new professional milking and collection systems at community level with strong marketing and long-term relationships with market players.

The hub will also function as a marketplace for services.

- a. Establishment of dairy hubs with small bulk-milk coolers and collection equipment in collaboration with dairy companies as co-investors, as well as quality control and marketing;
- b. Management training of hub managers/financial training for cooperatives;
- c. Training of milkers and collectors;
- d. Implementation of a seasonal quality-based payment system. Sometimes cooperatives will manage the hub, while in other cases a service provider or dairy company provides the hub as a community service.

An important challenge is to convert current Milk Collection Centres with often weak management, a low return on investment and lack of partnership with dairy processors into more business-oriented service providers (milking, cooling, input supply) in close partnerships (including financial) with farmers and processors. Another challenge is to develop new dairy hubs with groups of farmers, entrepreneurs and/or dairy processors. Two activities can be undertaken:

Pilot dairy hubs

In order to gain experience, current Milk Collection Centres can be upgraded to dairy hubs that collect and cool milk and analyse milk quality as well as offer various services to farmers like concentrated feed, medicines and fodder. An option is milking of cows as a service. The pilot can test technology and the marketplace for such services. The experiences can show what scale and kind of partnership are required to make the dairy hub economically viable. Infrastructure components of the hubs are a) cooling facilities (2,000-5,000 litres) with test equipment and milk cans, b) facilities and marketplace for input supply and services (concentrated feed, veterinary services, semen), c) grid connection and/or generator on site.

Feasibility study upscaling and professionalization dairy hubs

The programme can start during the pilot phase with the mapping of potential groups/cooperatives to develop dairy hubs and required investments. Based on current infrastructure for cooling, collection and milk testing, the feasibility can describe business case development including a financial part with return on investment, free available cash flow and financial instruments like equity, loans and grants.

Feasibility commercial fodder production and service centres

Objective: A professionally managed FPSC that combines production, distribution, training and service provision in one company to assure optimal yields, product quality and quality assurance of forages.

The following services can be offered by the company:

- a. Production and harvesting of high energy and high protein crops (on leased land)
- b. Storage and conservation of own and/or purchased crops in silos at a central location
- c. Supply of ready-to-use fodder in bulk or baled/packed (e.g. maize silage, grass silage, Lucerne, hay) to dairy farms
- d. Sourcing, purchasing and storage of quality-assured feed ingredients
- e. Preparation, packaging and distribution of (total) mixed rations
- f. Agricultural machinery contracting services to farmers for soil improvement, seedbed preparation, crop protection, harvesting, storage and transport.

By using analyses of best practices in Tanzania, Uganda, Kenya plus existing studies, a feasibility study for commercial fodder production and service centres will be carried out with a) mapping of potential areas and discussion with potential entrepreneurs for fodder production, b) development of business approaches with analysis of potential fodder types, approach for silage making, storage and distribution, c) analysis of potential partners for land, machinery, storage and distribution, d) description of the financial part: return on investment, free available cash flow and financial instruments like equity, loans and grants and further description of a repayment system related to milk payments and supply chain structure.

Finance and investment programme

Objective: Develop an investment model for financing the professionalization of farming, dairy hubs and fodder centres with minimum impact on forests and landscapes in partnership with all relevant stakeholders.

- a. Development of a business model for dairy hubs with long-term relationships with dairy companies
- b. Development of an upscaling model for dairy hubs with a franchise package to develop hubs for the next group of farmers

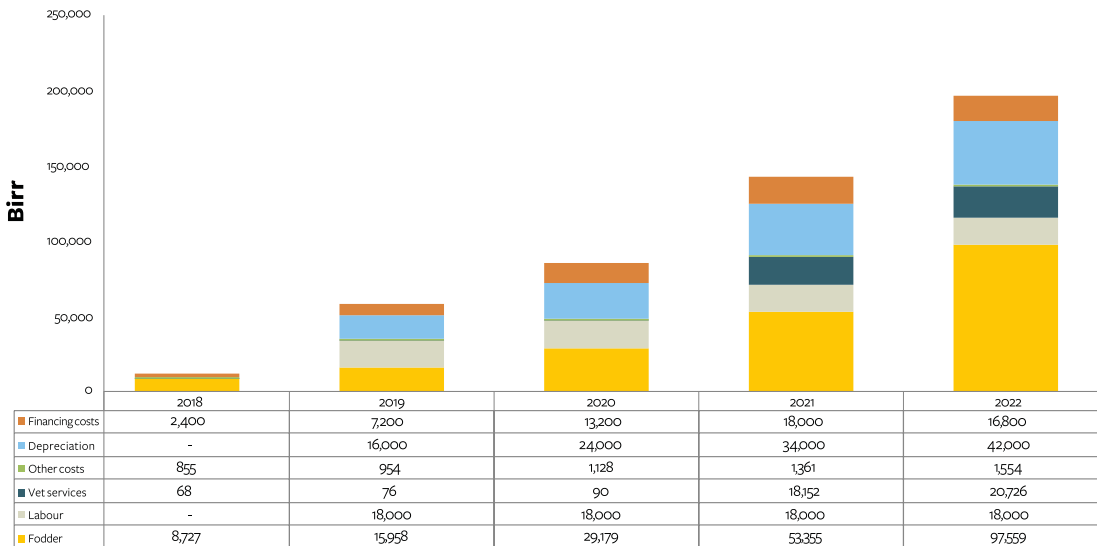
- c. Building of relationships with banks, credit cooperatives and foundations, and development of proof of concept for financing from impact investors, including descriptions of conditions for climate and deforestation
- d. Development of access to credit for smallholder farmers and investment packages linked to technical assistance (TA) support, enabling SHF farmers to grow to 10/10 farmers. Attract entrepreneurs and reduce risks by enabling farmers to invest their own equity.

To facilitate the further development of business cases, it is relevant to create well-functioning financial conditions. To meet this goal, a finance and investment programme can be developed. Activities to develop a finance and investment plan are a) investigation of potential investors including impact investors, banks and funders (grants) for different types of business cases, b) discussion with dairy processors about their role in facilitating development of a payment system, (quantity, quality), financial instruments and facilitation of the financial structure (repayment system), c) development of the investment plan: support to potential financiers in development of a risk-and-opportunity analysis, d) development of technical assistance programme to support the investment programme.

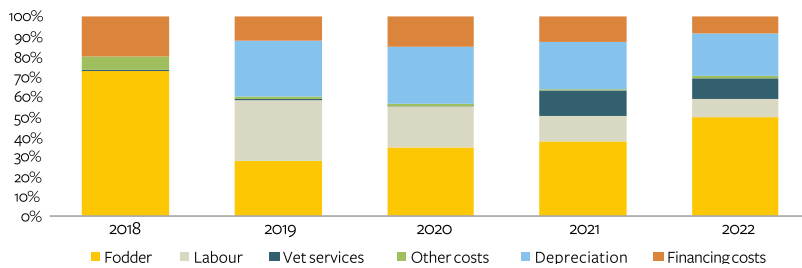
ANNEX 6

**FINANCIAL DETAILS
BUSINESS CASES**

Scenario I cost structure



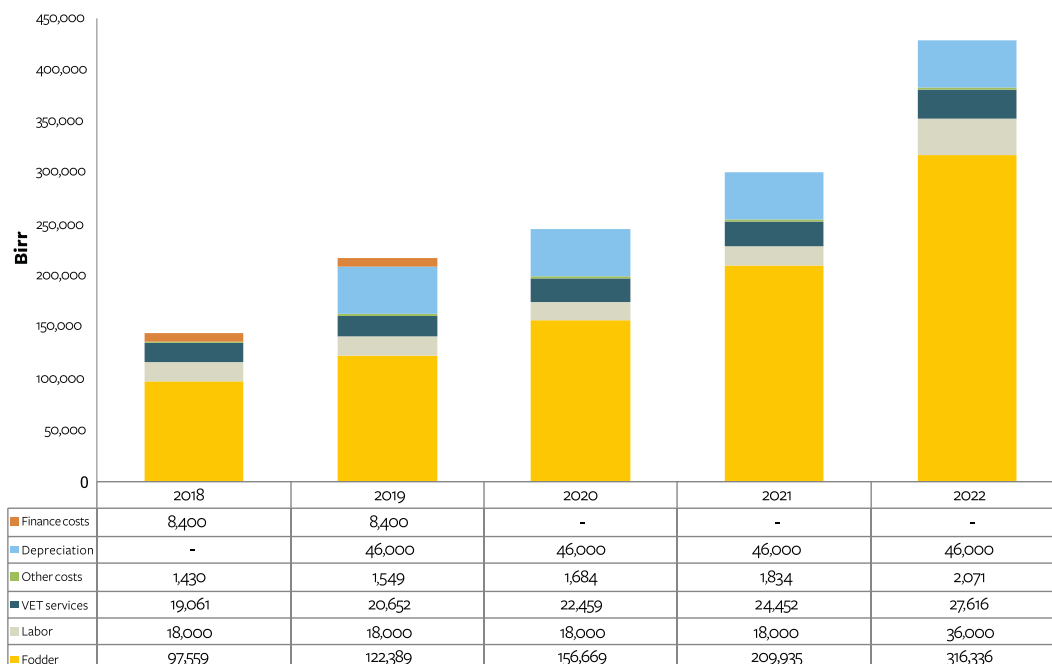
Cost in % of total costs



Scenario II cost structure

The medium-scale farmer's costs are almost 150,000 Birr in the first year, of which almost 100,000 Birr are for the purchase of fodder. Vet services and labour make up the bulk of the other costs. In year 2 there is a big increase in costs because the investments from year 1 have depreciated. Because a large proportion of the investments and

costs can be financed through the farm's own cash flow, we see relatively limited financing costs for growth to a 15/15 farm, and these only occur in years 1 and 2. All the other costs increase steadily over the years, but labour costs show a big increase in year 5 due to the need to hire additional personnel, moving from 1 FTE to 2 FTE at the 1,500 Birr per month rate.



Dairy hub milk intake:

	2018	2019	2020	2021	2022
Milk intake (liters/year)	167,925	246,842	497,907	911,693	1,110,780
Milk outtake (liters/year)	167,085	245,608	495,417	907,134	1,105,226
Average intake per day (liters/day)	460	676	1,364	2,498	3,043
Maximum intake per day (liters)	485	705	1,411	2,566	3,128
Minimum intake per day (liters)	435	647	1,317	2,429	2,958
Storage and cooling capacity (liters)	1,000	1,000	2,000	4,000	5,000
Capacity used (on average)	46%	68%	68%	62%	61%

P&L Dairy hub

	2018	2019	2020	2021	2022
INCOME					
Wet season	565.369	822.175	1.644.817	2.991.678	3.646.341
Dry season	788.533	1.173.011	2.387.352	4.402.734	5.362.026
Fasting	587.240	858.469	1.724.366	3.146.692	3.834.568
Total income	1.941.142	2.853.656	5.756.535	10.541.104	12.842.934
PRODUCTION COSTS					
Milk intake	1.679.250	2.468.421	4.979.070	9.116.928	11.107.800
Collecting	-	-	-	-	-
Fodder	-	-	-	-	-
Power and fuel consumption	10.076	17.279	39.833	72.935	88.862
Chemicals	11.520	11.520	11.520	11.520	11.520
Milk losses	8.396	12.342	24.895	45.585	55.539
Total production costs	1.709.242	2.509.562	5.055.318	9.246.968	11.263.721
MARGIN	231.900	344.094	701.217	1.294.136	1.579.213
Salaries	54.000	58.860	86.346	94.584	103.628
Rent	2.800	2.940	3.087	3.241	3.403
Other costs	56.800	61.800	89.433	97.826	107.032
Maintenance					
Machineries and buildings	35.760	35.760	55.920	65.136	113.520
Total Maintenance	35.760	35.760	55.920	65.136	113.520
EBITDA	139.340	246.534	555.864	1.131.175	1.358.661
Depreciation	-	214.800	214.800	238.800	277.200
EBIT	139.340	31.734	341.064	892.375	1.081.461
Finance costs	39.000	79.500	214.500	198.000	156.000
INCOME AFTER FINANCE NET	100.340	47.766-	126.564	694.375	925.461
Appropriations (optional)	-	-	-	-	-
INCOME BEFORE TAX	100.340	47.766-	126.564	694.375	925.461
Income tax	30.102	-	37.969	208.312	277.638
INCOME NETT	70.238	47.766-	88.595	486.062	647.823

ANNEX 7

**PILOT APPROACH TIER-II
ZONE (SULULTA)**

Main objective

To integrate professional, market-driven and climate-smart dairy development into small-scale farmers' diversified livelihoods in Oromia Region, supported by dairy companies and regional cooperatives, that contributes measurably to climate change mitigation and adaptation.

Duration

Five years (Pilot Phase I – this concept note) – 7-10 years (including upscaling)

Country and region

Ethiopia, Oromia Region

Administrative production zones

Sululta/Selale milk-sheds (Tier-II zones)

Sectors

Livestock (dairy)

Target groups (5-year horizon)

Sululta Zone: 1,600 small-scale dairy farmers (new) – 20% women

TARGET GROUPS AND IMPACT	2018	2019	2020	2021	2022
Villages	1	2	4	6	8
Farmer groups	4	8	16	24	32
Total number of farms	200	400	800	1,200	1,600
of which SHF	175	338	657	928	1,161
10/10	23	58	132	246	396
15/15	1	4	11	26	43
Number of dairy hubs	6	12	21	29	34
Total milk production (litres)	1,035,234	2,519,006	5,727,299	10,654,954	16,764,979
Investment farms (ETB)	17,309,942	23,811,382	49,728,919	58,406,830	67,014,425
Investment dairy hubs (ETB)	11,100,000	11,100,000	16,650,000	14,800,000	9,250,000
Total revenue (ETB)	22,561,641	60,246,820	156,994,738	303,951,258	525,086,654
Total profit (ETB)	5,377,094	7,543,797	16,477,847	49,438,747	97,493,452
GHG emissions BAU (ex. LULUC, ton CO ₂ eq/year)	25,718	62,580	142,283	264,701	416,492
Expected GHG emissions (ex. LULUC ton CO ₂ eq/year)	12,492	30,397	69,112	128,575	202,306
GHG emissions BAU (incl. LULUC ton CO ₂ eq/year)	25,718	62,580	142,283	264,701	416,492
Expected GHG emissions (incl. LULUC ton CO ₂ eq/year)**	-71,552	-174,105	-395,850	-736,432	-1,158,735

Indirect (7-10 year horizon)

More than 10,000 dairy farmers in domestic supply chains supported by local milk factories.

RATIONALE

Dairy has business potential for subsistence and coffee farmers in a growing domestic market in Ethiopia: milk consumption will increase from 4 to 5.5 billion litres between 2016 and 2020. However, current raw milk is not suitable or is of limited suitability for processing because of low quality: high bacteria counts and contaminants due to poor hygiene, insufficient or no cooling and more or

less no quality control. Small-scale producers with small numbers of cattle are disconnected from the formal markets. Professionalization is possible but needs farms with more than 25 cows. A strategy with support from the main Ethiopian dairy company, Elemtu Dairy in Sululta Zone, would involve them sourcing from professional community farms. Professionalization of milking, cooling, fodder production and bioenergy production will be organized on a village farm scale and provides an opportunity to improve marketing and incomes together with the dairy companies. More income per cow, less or zero grazing and concentrated fodder production will reduce GHG emis-

sions and prevent increased land use and deforestation. Setting up a dairy academy and incubator will allow knowledge transfer and scale up (>30,000 farm households by 2026) of the initiative to the rest of Oromia and beyond. The interventions will be linked to a broader multi-stakeholder debate on climate, development and land use in Oromia and lessons shared via the Dairy Exporters and Processors Association to encourage a wider uptake of best practices.

Implementing agency

Solidaridad Ethiopia

Local partners

Ministry of Livestock & Fisheries

Oromia Regional and Zonal Livestock Agencies

Ethiopian Dairy and Meat Industry Development Institute

Local private sector partners

One up to three dairy processors

Affiliated partners

Wageningen University Livestock Research Centre (CSA)

Ethiopian Society of Animal Production

National or international dairy companies

PROJECT OBJECTIVES

1. Foster sustainable and inclusive economic growth of the dairy sector through the development of market-driven, professional and profitable value chains in Sululta Zone, contributing to increased milk productivity and quality and climate resilience
2. Improve climate resilience and land governance (policies) of small-scale dairy and livestock production systems by introducing climate-smart practices and woodland management in Sululta Zone to avoid further land degradation and to increase productivity
3. Demonstrate emission reductions and carbon sequestration of targeted production zones in Oromia Region by implementing a coherent monitoring framework with REDD+/BioCarbon Fund-approved measurement tools to allow climate finance to be allocated to programme interventions in Sululta.

STRATEGIC PROGRAMME INTERVENTIONS

I. Pilot dairy hubs

Objective: Introduction of new dairy hubs at community level in different areas, with more specialists within the community, enabling improved uptake of high-quality milk to the processing factories.

- a. Selection of communities in which to start in partnership with milk processing companies
- b. Forming of producer groups at community level where no functioning cooperatives exist
- c. Establishment of dairy hubs including small bulk-milk coolers in collaboration with (and in the future as co-investor) dairy companies including quality control and marketing. Milkers and collectors will be trained and quality-based payment systems will be implemented
- d. Development of new SMEs linked to dairy hubs within and supporting communities: livestock services, artificial insemination and input supply (feed, medicines).

II. Commercial Fodder Production and Service Centre (FPSC)

Knowledge and capital for optimum on-farm forage production is often lacking, while availability of fodder is crucial to develop profitable farms and to increase dairy production substantially.

Objective: A professionally managed FPSC that combines production, distribution, training and service provision in one company to assure optimal yields, product quality and quality assurance of forages.

The following services can be offered by the company:

- a. Production and harvesting of high energy and high protein crops (on leased land)
- b. Storage and conservation of own and/or purchased crops in silos at a central location
- c. Supply of ready-to-use fodder in bulk or baled/packed (i.e. maize silage, grass silage, Lucerne, hay) to dairy farms
- d. Sourcing, purchasing, storage of quality-assured feed ingredients
- e. Preparation, packaging and distribution of (total) mixed rations
- f. Agricultural machinery contracting services to farmers for soil improvement, seedbed preparation, crop protection, harvesting, storage and transport.

III. Dairy Farmers Academy

Objective: Preparation of early adopters and early majorities in other communities for next phase of scaling up

- a. Training, visits and development of business plans for community dairy farming, development of SMEs, biogas production
- b. Forming of producer groups at community level where no functioning cooperatives exist.

IV. Multi-stakeholder approach in different zones

Objective: Support local communities to develop new dairy businesses and a sustainable landscape approach, for pilot and new potential zones

- a. Development of a sustainable landscape approach partnering with communities and different stakeholders, taking into account rural economy, climate and landscape
- b. Solidaridad Ethiopia could play a convening role in a wider multi-stakeholder debate on climate and landscapes in Oromia, but this would be a separate assignment for which a separate proposal would have to be developed in collaboration with other key stakeholders such as the Government of Ethiopia/Oromia and the World Bank.

V. Establishment monitoring framework

Objective: Capture climate-smart performance of interventions of Solidaridad in Oromia – Sululta/Selale Zones for integration of WB/GCF MRV frameworks

- a. Introduce and develop the GLEAM model and related MRV framework to measure carbon performance, carbon sequestration and climate resilience of farmers (farm systems)
- b. Introduce Rural Horizons as a self-assessment tool to capture data and measure performance of farms and milk production throughout the pilot phase.

MAIN IMPACT AREAS

1. More economically viable livelihoods of 1,636 dairy farms through increased production (productivity) of dairy and improved product quality and market uptake
2. More sustainable and climate-resilient farm communities and production zones through promotion of climate-smart agricultural production systems and land governance (policies), resulting in

reduced land degradation, better carbon performance and resilient farm systems (reduction in land use and overgrazing, higher and more secure incomes, access to markets and finance).

Estimated grant request: 2 million dollars

Co-funding: We expect substantial matching funding by the private sector in hardware and technology during the pilot phase (50% of dairy hubs), and coverage of all productive and supply chain investments by farmers, milk buyers, and processors. After the pilot, assuming the business and investment case is positive, the private sector will fully finance the investments needed.

Budget division

900,000 dollars

(Technical Assistance and Capacity Building)

300,000 dollars

(50% investment in Hardware and Equipment)

800,000 dollars

(Project Management, Coordination, M&E, Learning and Communication)

ANNEX 8

**PILOT APPROACH TIER-III
ZONE (JIMMA)**

Main Objective

To integrate professional, market-driven and climate-smart dairy development in small-scale farmers' diversified livelihoods in Oromia Region, supported by dairy companies and regional cooperatives, that contributes measurably to climate change mitigation and adaptation.

Sub-objectives

- In coffee villages, 1,600 women farmers will get offtake of quality milk twice a day 365 days per year for a better price. This will lead to increased incomes
- More rural employment for women and young entrepreneurs
- Fewer emissions and reduced degradation of forests, as a result of replanting of coffee trees and improved protection of natural forests around coffee villages.

Duration

Five years (Pilot Phase I – this concept note) – 7-10 years (including upscaling)

Country and region

Ethiopia, Oromia Region

Administrative production zones

Jimma Zone (Tier-III zones)

Sectors

Livestock (dairy), coffee and forestry

Target groups (5-year horizon)

Jimma Zone: 1,600 small-scale coffee and dairy farmers (new); 100% women

TARGET GROUPS AND IMPACT	2018	2019	2020	2021	2022
Villages	1	2	4	6	8
Farmer groups	4	8	16	24	32
Total number of farms	200	400	800	1,200	1,600
of which SHF	175	338	657	928	1,161
10/10	23	58	132	246	396
15/15	1	4	11	26	43
Number of dairy hubs	6	12	21	29	34
Total milk production (litres)	1,035,234	2,519,006	5,727,299	10,654,954	16,764,979
Investment farms (ETB)	17,309,942	23,811,382	49,728,919	58,406,830	67,014,425
Investment dairy hubs (ETB)	11,100,000	11,100,000	16,650,000	14,800,000	9,250,000
Total revenue (ETB)	22,561,641	60,246,820	156,994,738	303,951,258	525,086,654
Total profit (ETB)	5,377,094	7,543,797	16,477,847	49,438,747	97,493,452
GHG emissions BAU (ex, LULUC, ton CO ₂ eq/year)	25,718	62,580	142,283	264,701	416,492
Expected GHG emissions (ex, LULUC ton CO ₂ eq/year)	12,492	30,397	69,112	128,575	202,306
GHG emissions BAU (incl, LULUC ton CO ₂ eq/year)	25,718	62,580	142,283	264,701	416,492
Expected GHG emissions (incl, LULUC ton CO ₂ eq/year)**	-71,552	-174,105	-395,850	-736,432	-1,158,735

Indirect (7-10 year horizon)

More than 10,000 dairy farmers in domestic supply chains supported by local milk factories

Rationale

Development of the local dairy sector in the coffee villages could contribute to sustainable economic

growth that would benefit at least 1,600 coffee households (female farmers) around Jimma in West Oromia. Collective dairy hubs for milking, cooling and collection will generate employment for women and youth and sufficient safe milk for the local villages and sales of milk to the formal markets in Jimma. Through professional production of milk in villages, milking

cows receive additional fodder and feed (hay), with the result that there is less need to take the cows into the natural forests for grazing, thereby restoring and protecting the natural forests. In short, the production of coffee and milk in the same villages has multiple benefits. By-products from the shade trees on the coffee farms can be used as cow feed. In both sectors more jobs are generated as a result of more economic activity. The sludge from milking cows can be used for compost for the coffee farms or biogas. Replanting coffee trees on the coffee farms and agreements about the natural forests (zero or regulated grazing in forests, less or improved regulation of firewood collection) for improved landscapes, reduced degradation of forests and improved carbon performance,

Implementing agency

Solidaridad Ethiopia

Local partners

Ministry of Livestock & Fisheries

Oromia Regional and Zonal Livestock and Forestry Agencies

Local private sector partners

One up to three local dairy companies

Affiliated partners

Wageningen University Livestock Research Centre (CSA)

Agricultural Transformation Agency (in supporting the development of Jimma as coffee/livestock cluster)

OLMP World Bank Project in Oromia

STRATEGIC PROGRAMME INTERVENTIONS

I. Pilot dairy hubs and development of business plans

Objective: Set up eight new dairy hubs at community level in different areas, with more specialists within the community, enabling improved uptake of high-quality milk to the processing factories.

- Selection of communities with which to start
- Strengthening of producer self-help groups at community level where no functioning cooperatives exist to become dairy groups for improved market uptake via dairy cooperatives and the factory
- Establishment of dairy hubs including small-bulk milk coolers in collaboration with (and in the fu-

ture as co-investor) dairy companies, including quality control and marketing

- Milkers and collectors will be selected from the villages and trained
- Quality-based payment systems will be implemented to provide better prices for better quality milk at the dairy hubs.

II. Dairy Farmers Academy and one Business School

Objective: Prepare women dairy farmers to become more professional dairy producers for the villages and formal markets; provide knowledge development and education about entrepreneurship and finance management for SME growth (heifers, feed supply and other services).

- Development of a Farmers Academy for dairy farmers through self-help groups
- Farmers will receive practical solutions for priorities to improve livestock husbandry and dairy production by introducing Rural Horizons
- A Business School will be developed for women, men and young entrepreneurs to start small microbusinesses in services demanded by the dairy and coffee farmers (nurseries, seedlings, fodder production, heifers).

III. Development Green Villages

Objective: Support local communities to develop 10 village plans where coffee/dairy producers, SMEs and local government authorities in Jimma (Oromia Livestock/Forestry) make agreements to promote green investments.

- Development of a sustainable landscape approach with partnership of communities and different stakeholders, confirmed in Green Villages plans
- Solidaridad Ethiopia could play a convening role in a wider multi-stakeholder debate on climate and landscapes in Jimma in Oromia Region to support the development of these green development plans.

IV. Establish monitoring framework

Objective: Capture climate-smart performance of interventions of Solidaridad in Oromia – Sululta/Selale Zones for integration of WB/GCF MRV frameworks.

- Introduce and develop the GLEAM model and related MRV framework to measure carbon performance, carbon sequestration and climate resilience of farmers (farm systems)
- Introduce Rural Horizons as self-assessment tool

to capture data and measure performance of farms and milk production throughout the pilot phase.

MAIN IMPACT AREAS

1. More economically viable livelihoods for 1,600 women producers in coffee villages through increased production (productivity) of dairy and coffee and improved product quality and market uptake
2. More sustainable and climate-resilient farm communities and production zones through promotion of climate-smart agricultural production systems and land governance and policies, resulting in reduced land degradation, restoration of forests, better carbon performance and resilient farm systems (reduction in land use/over-grazing, higher and more secure incomes, access to markets and financing).

Estimated grant request: 2.5 million dollars

Co-funding: We expect substantial matching funding by the private sector in hardware and technology during the pilot phase (50% of dairy hubs), and coverage of all productive and supply chain investments by farmers, milk buyers and processors. After the pilot, assuming the business and investment case is positive, the private sector will fully finance the investments needed.

Budget division

1,250,000 dollars

(Technical Assistance and Capacity Building)

300,000 dollars

(50% investment in Hardware and Equipment)

950,000 dollars

(Project Management, Coordination, M&E, Learning and Communication)

MORE INFORMATION

For more information about Solidaridad, please visit our website and follow us on Twitter, LinkedIn, or Facebook.

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