EDGET Project Final Evaluation

March 2018

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Abbreviations

AgID	Agro Input Dealer
AI	Artificial insemination
B2B	Business to Business
BOFED	Bureau of Finance and Economic Development (at regional level)
CI	Confidence interval
DA	Development Agent
DFEG	Dairy Farmer Extension Group
DID	Difference in Difference
DPU	Dairy Processing Unit
EDGET	Enhancing Dairy Sector Growth in Ethiopia
EM	Effective microorganism
FGD	Focus Group Discussion
FTC	Farmer Training Centre
GDP	Gross Domestic Product
HEW	Health Extension Worker
HH	Household
IYCF	Indicators for assessing infant and young child feeding practices
KDDC	Kebele Dairy Development Committee
kg	kilogram
KII	Key Informant Interview
M&E	Monitoring and Evaluation
MCC	Milk collection Centre
MFI	Micro-Finance Institution
MIYCN	Maternal, infant and young children nutrition
MOLF	Ministry of Livestock and Fisheries
MTS	Milk Transportation System
NSA	Nutrition Sensitive Agriculture
SARI	South Agricultural Research Institute
SBCC	Social and Behavior Change Communication
SNV-DEP	Dairy Extension Promoter (woreda level)
SNV-ZDCM	Zonal Dairy Community Mobilizer

SO	Strategic objective
TIP	Trial of Improved Practices
TOR	Terms of Reference
TOT	Training of Trainers
W-MDDS	Minimum Dietary Diversity for Women
WCA	Woreda Cooperative Promotion Agencies
WLO	Woreda Livestock and Fisheries Resource Development Offices

Executive Summary

Background

Background to the EDGET project

Agriculture contributes 35.8% to economic GDP in Ethiopia, within which, the dairy sector contributes 12-16%. The Ethiopian government's goal is to double domestic milk production between 2015-2020 to reduce the dependency on dairy imports. In 2015/6, 11.33 million milking cows in Ethiopia produced a total of 3.06 billion litres of milk. SNV'S Enhancing Dairy Sector Growth in Ethiopia (EDGET, 2013-17) project promotes inclusive development of the dairy sector. Working in close collaboration with the newly formed Ministry of Livestock and Fisheries (MOLF), the work has been financed by the Embassy of the Kingdom of the Netherlands. In Oromiya, Amhara and SNNPR, the project aimed at doubling incomes for 65,000 smallholder dairy farmers in 10 zones, 51 woredas and 353 kebeles by the end of 2017. EDGET project interventions included extension services, input systems, dairy market development and institutional strengthening "to improve household income and the nutritional status of children through increased dairy production and enhanced dairy processing & marketing".

Specific objectives of the project include:

1. To enhance sustainable dairy production, productivity, input supply and services;
2. To increase processing and marketing of dairy products;
3. To contribute to development of institutions and to dairy sector-wide initiatives;
4. To develop a knowledge base on dairy related issues and;
5. To improve nutritional status of children through dairy consumption.

The project also includes two cross-cutting objectives: a) To promote women and youth entrepreneurship and b) to promote climate smart practices.

Background to the Evaluation

The EDGET project board commissioned ALINe to undertake a final and independent evaluation between Dec 2017 and March 2018 to assess the performance and approach of EDGET. The evaluation captured the project outputs, outcomes and impacts and assessed strategies and approaches to strengthen the dairy value chain in Ethiopia. The evaluation reflects the relevance, effectiveness, and sustainability of interventions and their outcomes within the dairy value chain, their associated actors and the extent to which benefits resulted from the project (e.g. extension, agro input dealers, forage system, etc.). Insights from the evaluation provide recommendations for future inclusive dairy development interventions on a larger scale.

ALINe adopted a mixed methods evaluation comprising:

- A quantitative component consisting of an endline household survey covering 12 intervention and 5 comparison woredas, equivalent to 432 and 218 households respectively. In addition to

the comparison of intervention and comparison groups at the endline, this was to be compared to a baseline dataset to be provided by SNV, using the same comparison woredas.

- Qualitative case studies of key actors in the dairy value chain in 5 project woredas: Dangla (Amhara), Machakel (Amhara), Lemu Bilbilo (Oromia), Wuchale (Oromia) and Aleta Wondo (SNNPR). Woredas were selected based on their performance in terms of extension services, cooperatives with DPUs and Agro-Input Dealers (assessed by the EDGET team) to enable learning across different contexts. The qualitative work used a combination of KIIs and FGDs.
- Secondary data analysis, including records for Agro-Input Dealers, Dairy Processing Units and Woreda Livestock Offices, project documents (including strategy documents, progress reports, studies and project M&E data) and wider literature on the dairy sector were also reviewed.
- Analysis of the relevance, effectiveness and sustainability of the project components and synthesis of evidence and learning was expected to help inform any future refinements.

Key limitations of the evaluation include:

- The quantitative and qualitative field work components of the evaluation were carried out under time constraints during December 2017, due to the unavailability of project staff beyond this period. This reduced the time available for testing and refinement of tools leading to some shortcomings.
- The endline questionnaire differed from the baseline in a number of questions, limiting the comparability of the data sets.
- Baseline data was found to be very unsatisfactory. It had very significant credibility and usability issues with significant errors forcing the evaluation team to interrogate it, reorganise it, clean it, recalculate it and address missing values. Comparisons with baseline should therefore be interpreted with some caution.
- Due to the tight timeframe, some qualitative tools were only finalised after data collection started. As a result, data collection in Yirga Chefe, Enemay and Kuyu utilised penultimate versions of the tools.

Strategic Objectives

SO1 To enhance sustainable dairy production, productivity, input supply and services;

Strategic Objective 1 focuses on increasing milk production through strengthened input systems and extension, leading to the adoption of improved dairy management practices. The strategic objective was subdivided into three main components: (1) the extension system; (2) the forage production system; and (3) the agro-input dealer network. This section presents findings related to each component, followed by the overall change observed in the adoption of practices.

Extension system

EDGET's support on strengthening the extension system comprises a) strengthening the capacity of government extension providers at the woreda (Woreda Livestock Offices) and kebele (Development Agent) levels, b) establishing and strengthening Dairy Farmer Extension Groups (DFEGs) as a farmer-to-farmer extension model and c) developing and distributing extension materials and other key inputs (calf feed, MTS and forage seed).

Developing capacity of extension providers (WLO, DA)

By the end of 2017, the EDGET project had provided training to 1,476 public extension providers/officers at various levels, but with a particular focus on WLOs and DAs. Overall, the capacity development of public extension providers was found to be highly valuable and relevant. Recipients of the training, including DAs and WLOs, frequently reported gains in knowledge related to the overall dairy development approach and on specific technical topics. The WLOs appreciated the advantages of the project extension approach.

EDGET's approach to building the capacity of the government extension system has strong potential to be sustainable. DAs are a long-term, paid, skilled workforce that can play a critical role in strengthening dairy development beyond the life of the project. The knowledge acquired by DAs and their access to training materials, increases their ability to provide ongoing extension advice. However, some risks to sustainability persist, including; (1) high DA turnover, excessive workloads and low levels of motivation; (2) Some DAs have not fully embraced their dairy development roles; (3) in a number of cases, WLOs and DAs depend significantly on SNV DEPs to be effective (i.e. DEPs play a direct role in training or following up with DFEG leaders and members, particularly where the capacity of DAs is weak).

Establishing and strengthening DFEGs

DFEGs provide a viable mechanism for DAs to reach a larger number of farmers with improved knowledge. 68% of intervention farmers reported being a member of a DFEG. However, their relevance depends on the demand for new information by members, and the capacity and motivation of leaders to play their envisioned roles. Overall, the DFEG model appears to have worked well. The evaluators consider the approach of drawing on farmers (not existing model farmers), as DFEG lead farmers to be positive, allowing more farmers to play a role and overcoming entrenched power relations associated with the existing model farmers. While there are clearly examples of DFEGs functioning well, the overall sustainability faces some significant risks: (1) DFEG leaders depend on project support for motivation; (2) WLOs and DAs face budgetary constraints in providing continued support to DFEGs; (3) there are limited incentives for DFEG leaders to play their role (little formal recognition of their role amongst members and no observed financial returns).

Training Activities and inputs

The project appears to have led to improved coverage in the provision of dairy extension/advisory services. 68% intervention farmers participated in at least one dairy-related training or exposure visit activity, vs. 11% of comparison farmers (female and male headed households). 47% of intervention farmers received advice and follow-up support compared to 6% of comparison (both female/male

headed households) and 78% intervention farmers cited SNV/DEP as the key source for advice and public service providers in 21% of the cases.

In terms of inputs, the EDGET project provided households with forage seed, calf feed and MTS. 64.4% of intervention farmers reported receiving MTS, compared to 0.6% comparison farmers. 33% of intervention farmers reported receiving forage seed (13.9% comparison group) and 32% reported receiving calf feed (8% comparison group). Similar input provision activities are certainly carried out in at least some comparison woredas, but at a lower coverage.

EDGET's training materials were perceived to be useful and relevant especially illustrated and translated versions which increase their relevance to respondents - i.e. Amharic/Amhara and Afan Oromo/Oromia.

Feed and forage solutions

The EDGET project supplied dairy farmers with forage seeds and supported them to produce different types of forage, in addition, to adopt improved feeding techniques, and use supplementary concentrate or other products to improve their feed e.g. urea or effective micro-organism (EM) treatment. The EDGET project also promoted various models of decentralised forage seed production through FTCs and farmer groups. SNV reports that farmers are able to save money previously used for buying hay and additional feed supplements; and generate new income by selling forage seeds/splits to farmers.

Due to EDGET, there is growing and relatively widespread recognition that feeding appropriate types of forage increases the quantity and quality of milk produced. There are successful cases of forage seed development through FTCs and farmers themselves. In the case of FTCs, institutional, financial and manpower constraints limit the approach to scale - and raises the risk that demand outstrips supply. Where farmers are multiplying, exchanging and selling seed, either individually or through seed multiplication groups, this is contributing to the availability of forage seed. However, for these farmers access to quality seed is essential for them to replenish fresh forage seed stocks over multiple years. Thus, while significant progress has been made and the model of farmer/group based multiplication appears to be a successful model of addressing green forage supply a larger scale solution will be required to create a sustainable supply of forage seed.

Agro-Input Marketing and Supply Systems

EDGET supported the establishment and development of 50 Agro Input Dealers through trainings, guidelines, Business to Business (B2B) networking (AgIDs, national and regional dairy input suppliers), and microfinance institutions (MFIs). The AgIDs provide avenues for getting quality inputs – particularly various types of concentrate and improved feed – to farmers. Furthermore, by routing the supply of key project inputs (e.g. calf feed) and equipment (e.g. the MTS) through the AgIDs, EDGET has helped AgIDs to establish sustainable networks and distribution channels for the benefit of farmers.

- **Milk Transportation System (MTS)**: The MTS (locally referred to as 'Mazzican') is a high-quality food grade plastic container with lid, filter and measurement gauge - to improve the hygienic collection and transportation of milk for farmers. By 2017, a total of 95,000 MTS were

distributed (95% of the new target). Farmers say MTS quality comes with a higher price (e.g. compared to simple buckets which costs and weighs less).

- **Calf feed supplement strategy**: EDGET sought to promote the practice of feeding calves with specialised calf-feed to improve growth of the calf and reduce the time to fertility. EDGET project extension staff, DAs and AgIDs were trained on assessing conditions of calves, ear tag applications, and other topics to identify eligible calves for supplementary feed. Households received vouchers for feed supplements which reinforced the establishment of relationships between dairy farmers and the project-supported AgIDs in the woreda. By 2017, EDGET had supported the distribution of 14,176 quintals of calf feed to 14,683 households (30% of original target). The measurement of calf growth by DAs and DEPs illustrated the benefits of supplementary calf feed to farmers, changing their perceptions of the value of proper calf feeding and management practices. EDGET also found that the age at which female calves were ready for their 1st AI service had reduced from 24-36 months to 14-18 months (EDGET Annual Report 2016).

AgIDs rate highly the support from EDGET, particularly the B2B linkages providing access to better deals and further business development. Overall, the AgIDs fill gaps in the market by providing better quality feed (than the traders) at a more affordable price (than high end feed businesses) and are incrementally adding more product lines (e.g. forage seed, milk collections). AgIDs are a promising distribution channel for dairy related inputs with their businesses growing (volume of goods, expanding customer base and profitability). They expect growing demand for their inputs in the future. Quality, price, variety and availability of inputs provided do indicate some areas of weakness in the AgIDs' ability to meet the demand for sufficient quantity, quality and diversity of feed.

Household adoption of inputs and practices

The endline study gathered data on a total of 34 practices related to improved forage and animal feed, milking and milk transportation, animal health, calf management, housing and manure management, climate smart practices. Adoption rates were found to be significantly higher for 16 of these practices in the intervention group than in the comparison group, with respondents most likely to report having adopted these practices within the project period.

Key results include:

- At endline, 47.2% intervention group farmers are involved in forage production compared to 40.0% of comparison group farmers. Notably, however, intervention farmers are considerably more likely to be growing more than one variety (32.4%) than comparison farmers (20.0%) at the endline and compared to intervention farmers at the baseline (6.5%) and, when asked about perceived changes in forage production, more intervention farmers reported an increase in the last 4 years (52.6%) vs. comparison (36.8%).
- In terms of forage seed production, 19% intervention farmers are engaged in seed production, compared to 3.2% comparison. 9% intervention farmers reported practicing farmer to farmer seed exchange, while no comparison farmers did.

- 27.9% intervention farmers reported using supplementary calf feed, compared to 9.3% in the comparison group. Farmers using calf feed reported very positive benefits (67.9% across both groups). 78% intervention farmers reported planning a continuation of using supplementary calf feed, compared to 66.7% in the comparison group.
- Comparison farmers reported no income from the sale of forage seed, improved forage or natural grass/pasture. Only 11 intervention group households did. The average income earned from selling forage seed (n=1), improved forage (n=5) or natural grass/pasture (n=5) for these 11 households, is 2951.5 Birr.
- Intervention households were more likely than comparison households to report that they prepare their own improved feed (26% vs 12%) and to vary feeding depending on lactation (35% vs 20%)
- 67% of intervention households reported using the MTS for milking and 47% reported using it for transportation of milk
- The adoption of hygienic milking practices improved over the project period for intervention and comparison groups. At the endline, intervention households were more likely to report cleaning hands before (63% vs 42%) and after (55% vs 46%) milking and to report cleaning the milking area (77% vs 63%). Intervention group farmers were also found to perform hygienic milking practices to a greater extent after every milking than comparison group farmers.
- Animal health practices showed very similar adoption rates for both intervention and comparison households although intervention households were more likely to report using antibiotics than comparison group households.
- In terms of calf management, intervention households were significantly more likely to report having adopted improved practices than comparison households. For example, 53% of households in the intervention group allowed the calf to suckle the mother, compared to 34% in the comparison group. Intervention households were also much more likely to apply ear tags and conduct regular heart girth measurements (33% vs 4%).
- Intervention household were more likely to provide adequate ventilation and lighting for cows (53% vs 39%) and adequate storage of manure for crop application (34% vs 25%).
- The study did not detect statistically significant differences in the adoption of climate smart practices, such as the use of biogas, enriching livestock feed with agricultural by-products or using manure to fertilise the field.

Milk production

By endline, intervention and comparison woredas were found to have an average milk production of 953 and 1068 litres respectively. Overall, milk production increased between baseline and endline for both groups. While the increase was larger for the comparison group, the difference in the increase was not found to be statistically significant. Moreover, issues with the baseline data, limit the validity of this comparison. Perceptual data on changes in milk production over the last years, revealed that 38% of comparison farmers and 47% of intervention farmers reported an increase in milk production. The main reasons for increases were birth of calves (88% vs. 92%) and purchase of animals (12.2 vs.

4.4%). Keeping in mind the limitations of the data, evidence from the evaluation does suggest that the project has contributed to increased milk production.

SO 2 Processing and marketing of dairy Products

Strategic objective 2 focuses on increasing the processing and marketing of dairy products both at the household level and within the dairy value chain. It aims to enable households to earn higher incomes either by selling their milk to a more remunerative market or producing processed/value-added dairy products that can be sold at a premium.

Household milk processing and sale

Milk processing

Baseline and endline surveys gathered data on household level milk processing, focusing in particular on butter, cottage cheese, soured milk and the quantities produced and sold of each. No statistically significant difference was found in the proportion of households involved in processing milk in intervention and comparison villages (82% and 86% respectively). However, overall, the proportion of intervention group households producing all three products increased between the baseline and endline though substantially only for butter and cottage cheese. In terms of perceived changes, 51% of the intervention group farmers reported an increase in processing of milk products, compared to 39% of the comparison group. The comparison group were 10% more likely to report that production had stayed the same.

Sale of raw milk and milk products

According to the endline survey, more intervention households (32.4%) reported having sold milk than comparison households (21.5%). Individuals (>40%), followed by cooperatives (>21%) and traders (>20%) were the main buyers to whom raw milk was sold by both intervention and comparison groups. Comparison households were marginally more likely to sell to a private company than intervention households (15% vs. 5%). A much smaller difference was found between the two groups for the proportion selling to cooperatives. However, of those selling to cooperatives in intervention groups, the majority (around 60%) reported selling their milk to the DPU cooperatives supported by EDGET.

No significant differences were found in terms of the volume of raw milk sold by the intervention and comparison groups (1524.4 litres vs. 1505.3 litres on average) and the average prices obtained during both the fasting and non-fasting seasons were also found to have little variation, generally being in the range of 10.9 to 11.4 Birr per litre. Butter was the most frequently sold product (comparison n=89, intervention n=154), followed by cottage cheese (comparison n=24, intervention n=30). Who these products were sold to, did not vary significantly between comparison and intervention groups. Overall, butter was sold at a price of 130 Birr per kg, cottage cheese at 46 Birr per kg and soured milk at 13 Birr per kg.

Income from the sale of milk and dairy derived products

The total gross income earned from dairy related activities, has an average of 10,120 Birr/household/year earned in comparison woredas and 9,553 Birr per/household/year earned in intervention woredas at endline. This difference is not statistically significant.

Costs of production

Overall, the costs of production increased for almost half of the respondents in both comparison and intervention groups. 41.6% of households in the comparison group reported an increase as compared to 50.0% in the intervention group. Where people reported increased costs, significant differences were not found in the reasons for the change given. The main reasons for increases were more cows (40% vs. 36%) and buying better quality feeds (55% versus 57.3%).

Net income from dairy

Average household net income from dairy at the endline was found to be in the region of 6,220 Birr/year to 6,500 Birr/year across intervention and comparison groups (no statistically significant difference). However, a significant difference was found in the net income between baseline and endline for both groups. The average costs incurred in the comparison group increased considerably from 1,191 Birr per household to 3,595 Birr per household, but had not changed so much for the intervention group (2,394 to 3,325 Birr) over time.

Average household net income in the intervention group increased from 792 to 6,221 Birr per household, equivalent to a total increase of 7.8 times. For the comparison group, net income was found to have increased from 254 to 6,525 Birr, equivalent to a total increase of 25.7 times. While problems with the baseline data limit the accuracy of the results, the figures do not lead us to question the notion that there have been significant increases in income from dairy related activities. It is, however, more challenging to attribute this very clearly to the EDGET project.

Cooperatives with Dairy Processing Units

EDGET's approach to developing output markets for milk and milk products focuses on the establishment of Dairy Processing Units (DPUs) - at the woreda (mainly) and kebele (in some cases) levels. Dairy Processing Units are facilities that are attached to a cooperative and managed by a dedicated management committee. Dairy farmers in the woreda can become members of the cooperative, whether they are members of a DFEG or not. EDGET provides training to the management committees (on management, bookkeeping, hygienic milk production, milk quality testing, marketing, etc.) and equipment for milk collection, storage, testing and processing. EDGET also provides trainings to the woreda cooperative agency and the woreda livestock office to orient them on the DPU's and get their support in key technical, legal and operational matters.

Where the catchment of the DPUs are large, EDGET has promoted the establishment of decentralised Milk Collection Centres (MCCs) to facilitate the aggregation of milk from individual dairy farmers to the cooperative. Cooperatives with DPUs sell either raw milk or processed milk products to private sector or institutional buyers, including other milk cooperatives/milk unions and larger scale milk processors. EDGET project and the Woreda Cooperative Agencies play a role in facilitating linkages between the

DPUs and these other agencies. Farmers are typically paid for the milk they provide on a monthly or two-weekly basis and in some cases also receive annual or bi-annual dividends.

Overall, the number of established MCCs and DPUs was 86 (96% of revised target) with small-scale technology support for 70 of them (76% of revised target). 44 DPUs (83% of revised target) received business linkages support. By the project end, a total of 3,198 dairy households (20% of target) were linked with the formal milk market through the DPUs and MCCs. EDGET conducted market studies in Woredas in which DPUs and MCCs were to be supported with capacity development, storage and processing technology and market linkage support. A number of delays were faced in the establishment of DPUs, including the slow process of membership mobilization, registration as a cooperative, and fulfilling the necessary prerequisite for a dairy processing unit (e.g. securing the building, equipment, etc.). A total of 22 DPUs had received processing equipment and relevant training by 2016. Six DPUs received support on business linkages. In 2017, 34 Milk Collection Centres (MCCs) and further 21 DPUs were established.

The evaluation found that DPUs address – or have the potential to address – key gaps in existing output markets for milk and milk products for quality standard buyers who can purchase from smallholder dairy farmers. Overall SNV's support in establishing and developing DPUs has been effective, but market development is not linear and contextual factors are a challenge. Delays in the provision of equipment limited the extent to which the dairy cooperatives supported with DPUs have been able to function as intended during the project period. Indeed, DPUs are not all functioning well. Some were even found to have stopped collection at the time of the evaluation. DPUs face difficulty in establishing market linkages limiting their ability to purchase and sell-on the milk produced by farmers and; management issues that undermine their functionality and operations. Despite these DPUs have increased interest in dairy farming and facilitated recognition of the importance of milk quality. Their contribution to increased incomes for dairy farmers is still unclear and the sustainability uncertain.

SO 3 Development of Dairy Institutions and Dairy Sector Wide Initiatives

Strategic Objective 3 engages with selected dairy value chain actors at the regional and national levels as well as with woreda livestock offices. Preliminary discussions with relevant institutions (e.g. SARC and zonal agricultural bureaus in SNNPR and Amhara) were held in 2014 to explore opportunities and needs for capacity strengthening. A needs assessment conducted in 2014 led to the prioritisation of (1) institutional support to woreda livestock offices; and (2) engagement with regional/national forage seed producers and multipliers.

Institutional support to woreda livestock offices (WLO)

EDGET's institutional support to WLOs focus on addressing key constraints to the provision of Artificial Insemination services. EDGET provided motorcycles, large and small liquid nitrogen flasks for storage at the woreda livestock office and for transportation by motorbike as well as other AI related equipment Technical trainings and capacity development were also provided to AI technicians to enhance their ability to provide services. Animal health services, also a key responsibility of the woreda livestock office were not identified as a priority area for support by the woreda livestock office.

More than 55 government offices benefitted from AI equipment, even though delivery of procured goods and services by contracted suppliers was sometimes late. A total of 183 AI technicians were trained. Six regional and federal level dairy sector institutions were supported (100% of revised target). Challenges were experienced in engaging more institutions due to budget constraints and limited engagement by some regional partners.

The support provided by EDGET to the WLO addressed clear needs of the WLO in the provision of AI services. Equipment provided included the provision of nitrogen flasks and motorcycles, critical for AI technicians to maintain the quality of semen, increase their response time and expand their coverage area. The support to AI technicians increased their coverage and showed a perceived improvement in the delivery of AI services. The success of the AI support has been further bolstered where there was an overlap with AGP (e.g. Aleta Wondo), which supported the recruitment of additional AI technicians. Overall, the capacity training and equipment support played a constructive role in enabling the ongoing provision of AI services in the woreda. The technical trainings and equipment provided are likely to make a sustainable difference (good quality, etc.). However, the motivation of AI technicians appears to be variable, budget constraints on the WLO side for logistics/transportation/fuel and the irregular and insufficient supply of quality semen and liquid nitrogen remain challenges.

Finally, a number of actors thought animal health (i.e. access to vets/medicines) was important, despite this being beyond the scope the project.

Engagement with regional/national forage seed suppliers

In 2016, engagement with government regional forage seed multiplication centres began to address the shortage of forage seed and planting materials. Selected institutions had to develop project proposals for the future support by EDGET project. Only SARI's (south agricultural research institute) proposal on forage seed multiplication led to 130 quintals of forage seed multiplied.

The supply of improved/quality forage seed constitutes a major constraint in the dairy value chain. As such, working with credible and reliable-supply institutions to develop seed/planting materials is highly relevant. While the work with SARI has been positive, it is clear that the quantity of forage seed produced falls short of the requirements. As such the overall effectiveness of this component reveals some significant gaps. The mechanism of requesting proposals from institutions seeking to collaborate with EDGET proved challenging due to limited capacity within the sector. Alternative approaches may be required to address this gap. Finally, it is unclear if farmers' demand or forage seed is well understood. In light of this, a clear assessment of the quantity of seed required and a clear plan to meet the demand should be undertaken.

SO 4 Development of a knowledge base on dairy related issues

EDGET developed and disseminated extension related and good practice materials in dairy production, processing, marketing and development and developed its Learning and Knowledge Management Strategy in 2014. EDGET is an active member of the Livestock Broader Platform and Livestock Task Force. The project organised a variety of knowledge related activities at various levels (woreda, zone), facilitated discussion amongst livestock experts and extension personnel, conducted review sessions at

the central and regional levels and published various practice briefs and extension training materials. Regional managers attended various technical working groups and multi-stakeholder meetings contributing to cross-organisational learning, collaboration and knowledge sharing. Overall these activities are seen to constitute an important set of contributions to knowledge development in the dairy sector.

SO 5 To improve the nutritional status of children through dairy consumption

Dairy development and nutrition have a number of important linkages and can increase consumption of milk and processed dairy products within the household creating nutritional outcomes. The thrust of EDGET project's work on nutrition was the testing and piloting of approaches to SBCC. This came about after the initial nutrition strategy was found to be unviable.

Awareness raising Campaigns and Nutrition Pilot

The EDGET nutrition strategy (2015) included awareness-raising quality nutrition and milk products in diversified diets; and milk fortification as a solution to micronutrient deficiencies in children under 2 and pregnant and lactating women. EDGET focused on the implementation of a nutritional behaviour-change communications strategy and a pilot directed at behavior-change at the household level. Awareness raising campaigns in 2016 and 2017 built on past experiences including 'World milk day' with the Livestock Resource Development and Promotion Agency.

The Nutrition Pilot

EDGET commissioned quantitative and qualitative research in 2017 on key nutritional indicators for women, infants and young children, identifying barriers to improved outcomes and opportunities to design an effective nutrition Social and Behavioral Change Communication (SBCC) intervention. Results showed only 39.4% of children in the sample met the required dietary diversity, that minimum dietary diversity for women showed only 4.3% meeting a minimum of five food groups out of 10 for consumption, 67.9% received information on infant and young child feeding practices and 58% mentioned health education by health workers. To test potential messages for use in the SBCC intervention, EDGET project commission EUREKA Health Services to conduct a Trial of Improved Practices (TIPs) in 2017. This pilot tested the compatibility of SBCC message-materials-channels strategy, i.e. six major infant and young child feeding recommendations identified at the formative research stage.

While the study was not without limitations, it was used to inform a nutrition SBCC Strategy and Scale up Plan for the promotion of appropriate nutrition focused on the 'first 1000 days'. The SBCC Strategy builds on insights generated from the nutrition pilot and the TIPs report and is also integrated with project intervention and outcomes. Most of the objectives and indicators referenced in the plan are now outdated (time-bound to December 2017) (Behavioral M&E process objectives and indicators). The proportion of SNV-EDGET supported households with less than two children is 20%. It will therefore be challenging to reach 65,000 households with a women-child (<2 years) with MIYVN messages that have concurrently been supported on dairy production, processing and marketing - building synergies with the dairy and nutrition component. Furthermore, an independent external and

rigorous evaluation of outcomes and campaign effectiveness are sensible steps before large scale roll-out of activities.

Cross-cutting Strategies

Cross-cutting strategies include the promotion of women and youth entrepreneurship and climate change. This section focuses specifically on the women and youth entrepreneurship component since the climate change component is addressed in relation to SO1 and the adoption of climate smart practices by dairy farmers.

Women and youth entrepreneurship

EDGET project has sought to promote women and youth entrepreneurship in the dairy value chain through promoting local business initiatives inclusive of unemployed women and youth in input supply, seed multiplication and dairy processing activities. A study to assess gender integration in the project led to the development of a new gender and youth strategy for EDGET. In 2015, 13 DPUs had at least one female board member plus one women out of two technicians hired for milk processing. For AgIDs, women applicants were given priority. But due to limited number of applications from women, only 6 out of 51 AgIDs were actually women-led in 2015. In 2016, only three women groups and 6 youth groups were established for forage seed multiplication and marketing, short of the targeted 36 women/youth dairy groups. By end of 2016, an assessment on how to engage women and youth for the project was completed, showing for instance that women struggle to acquire improved breeds (EDGET Programme Gender and Youth Mainstreaming Strategy report in SNNP regional state, 2016). A pilot for gender and youth ran in 2017. By the project end, 43 women and youth enterprises had been established (86% of the target).

While the promotion of women and youth-led enterprises and initiatives, clearly has an important role to play, evidence from the endline survey and the qualitative survey suggest that household level gender dynamics and norms are in need of elucidation. Most findings show that women carry out the major share of dairy related activities (looking after the cows, milking them and producing milk products) at the household level, adding significantly to their existing work load. Women were also found to participate less in trainings than men and have less of a role in economic decision-making such as the purchase of inputs and the marketing of milk products. Despite this, an in-depth assessment of the effectiveness or sustainability of the women and youth enterprise development component was not carried out as part of this evaluation. Analysis is compounded by the absence of a gender strategy during the initial stages of the intervention and delays in strategic implementation.

Conclusion

The evaluation found that the EDGET project has made significant and valuable contributions to strengthening inclusive dairy value chains in Ethiopia. The project has tested and demonstrated approaches for a number of key subsystems of the dairy value chain, encompassing extension, input supply, forage production, institutional services and milk aggregation and marketing.

Overall the quantitative study at the endline demonstrated positive results, particularly the adoption of improved practices. Milk production and net income from milk were also found to be significantly higher than at baseline. Unfortunately, however, issues with the baseline data limited the extent to which strong quantitative conclusions regarding the relative gain in intervention woredas compared to comparison woredas could be made for a range of indicators, including milk production and net income. However, the endline results are encouraging. The qualitative part of the evaluation revealed that most of the efforts to strengthen key subsystems of the dairy value chain were highly relevant and effective. Some risks to sustainability have been identified and require attention when considering future inclusive dairy value chain interventions.

More broadly, the evaluation concludes that future interventions would benefit from an increased focus at both strategic and measurement levels on understanding the key interdependencies between different value chain components; careful consideration of the key factors that drive sustainability and performance for each of the actors in the value chain; and a stratified/segmented approach that devises differentiated approaches for woredas with different levels of dairy potential.

1. Introduction

1.2. Overview of EDGET project

The five-year project (2013-2017) is funded by the Embassy of the Kingdom of the Netherlands and works on the different components of the rural milk value chain in three regions - Oromiya, Amhara and SNNPR. It covers 10 zones, 51 districts/woredas with dairy potential and around 353 kebeles, targeting 65,000 smallholder households. The EDGET project is implemented by SNV Netherlands Development Organization in close collaboration with the Ministry of Livestock and Fisheries (MOLF - formerly it was Ministry of Agriculture) and its line bureaus in three regions.

The project aims at unlocking the potential of dairy development in Ethiopia "t**o improve household income and the nutritional status of children through increased dairy production and enhanced dairy processing & marketing**". Specific objectives of the project include:

SO 1: To enhance sustainable dairy production and productivity, input supply and related services;
SO 2: To increase processing and marketing of dairy products;
SO 3: To contribute to development of institutions and to dairy sector-wide initiatives;
SO 4: To develop a knowledge base on dairy related issues and
SO 5: To improve nutritional status of children through dairy consumption.
Cross-cutting: a) To promote women and youth entrepreneurship and b) climate change

These objectives are achieved through five principal strategies that address

(i) input and production systems;

(ii) milk collection processing and marketing arrangements;

(iii) women and youth entrepreneurship within dairy value chains;

(iv) dairy-related institutional development; and

(v) wider knowledge development for the dairy sector in Ethiopia.

Input and production systems: EDEGT promotes increased forage production, increased access to supplemental feeds, strengthening agro-input marketing systems, and promotes the use of improved milk transportation equipment to achieve hygienic collection and safe transportation of milk to processing units and ultimately output markets. This is achieved through strengthening the public extensions system, establishing DFEGs for farmer-to-farmer extension, supporting Agro Input Dealers and promoting household level forage production.

Milk collection processing and marketing arrangements: The project creates or establishes Dairy Processing Units (DPU) in areas where a) there is a demand for products b) there is a potential for local sourcing of raw milk, to establish sustainable businesses which employ adapted equipment and best practices. The project also engages the wider system of dairy value chain actors associated with DPUs,

such as dairy farmer organisations, small and medium enterprises and cooperatives, as appropriate to each context.

Women and youth entrepreneurship within dairy value chains is encouraged across the value-chain by promoting the involvement of these groups in such organisations, with a view to strengthening their role in the provision of dairy extension services, input marketing, milk collection and processing and the marketing of milk and milk products. The project also aims to ensure that it has a positive impact on children's nutrition through a dedicated awareness campaign, though this has only recently been rolled out (2017).

At the sectoral level, **dairy institutional development** is fostered by working closely with dairy sector institutions such as regional artificial insemination centres and agricultural research centers.

Finally, the project puts emphasis on **knowledge development** that includes farmer-to-farmer learning, documentation and development of good practices through write shops and the design and dissemination of knowledge products.

1.2. This evaluation

The EDGET project board commissioned ALINe to conduct a final and independent evaluation of the EDGET project from December 2017- March 2018. The focus of the evaluation was on assessing the achievements of project in terms of results (output, outcome and impact), assessing its overall contribution to strengthening dairy value chains in Ethiopia, and capturing lesson learnt for upcoming similar dairy programs/interventions. As part of this, the evaluation also assesses the relevance, effectiveness, and sustainability of interventions and their outcomes for key dairy value chain sub-systems (e.g. extension, agro input dealers, forage system, etc.). More specifically, the evaluation seeks to address the following key aspects:

Table 1 Evaluation focus and evaluation objectives

Three Areas of Focus	**Evaluation Objectives as numbered in the TORS**
Evaluation of performance and approach	(1) To assess whether and to what extent the project achieved its output, outcome and impact results; (5) To assess appropriateness and effectiveness of strategies and approaches used in the project to realise the intended results;
Measurement of change/impact and beneficiary voice	(2) To assess impact on key dairy value chain actors/stakeholders who have benefited from the project interventions; (4) To assess the project contribution to economic & social empowerment of women and climate change adaptation & mitigation;
Learning, wider impact and replication/scaling	(3) To assess wider relevance & contribution of the project to dairy development in Ethiopia; (6) To identify and document lessons learnt for the design and implementation of a future project for smallholder dairy farmers, and, development of the dairy sector in Ethiopia.

2. Methodology

Detailed evaluation methodology is reported in the Inception Report and field level data collection implementation is in the Field Report. In the following section, summaries of both reports are included along with the limitations to quantitative and qualitative data analysis and interpretation.

2.1. Overview of methodology

In response to the specifications set out in the TORs and the evaluation and learning questions, a mixed methods evaluation approach was proposed comprising the following components:

- A quantitative component focused on the income component of the results chain through a household survey covering treatment and comparison woredas;
- A qualitative survey of all the key actors in the dairy value chain across the three regions, from the regional level through to the kebele level covering government officials involved in the extension delivery system, Dairy Processing Units, various categories of input dealers/suppliers and other key institutions and project partners;
- A review of secondary data, including project documents and M&E data as well as wider documentation related to the dairy sector in Ethiopia;
- An analysis of the relevance, effectiveness, efficiency and sustainability of all the key project components (see table below for a summary of how these will be considered) as well as the overall approach adopted by EDGET in strengthening the dairy value chain;
- A synthesis of the evidence, insights and lessons learned that will inform scaling-up and or further development of the approach in a second phase of the project in Ethiopia.

Quantitative component

The quantitative component included an endline household survey targeting both beneficiary and comparison group farmers. Data available from the beginning of the project (baseline data) allowed some comparison of changes in indicators, such as income or milk production per household, within a quasi-experimental design. Analysis included descriptive statistics, tests for statistical significance and an approach using a Difference-in-Differences (DID) analysis. Results will be disaggregated for male and female-headed households.

DID relies on making a comparison in key indicators between the baseline and endline for a treatment and comparison group. It entails comparing the change in income in the comparison group (without exposure to the EDGET project) with the change in income in the intervention group (with exposure to the EDGET project), as shown in Figure 1, below.

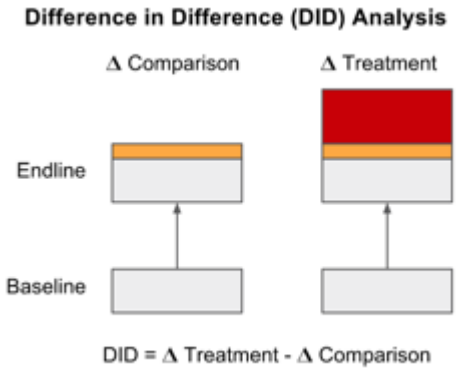

Figure 1 Difference in Difference Analysis

Sample size estimation

The minimum required sample size for the endline was estimated based on the impact indicator "average increment of annual dairy income of targeted dairy households". Assuming we want to see a 100% increase in net income from the baseline and assuming that the comparison group will see an increase of net income of 10% between 2013 and 2017, we would like to detect a difference of at least 2,454 Birr between the two groups. In order to detect a difference of this magnitude that is significant with 90% confidence and a power of 80%, the required sample size for each group is 95. With a design effect of 2, the required sample size for each group is 190. This is smaller than the proposed sample size of 432 for treatment and 218 for comparison, indicating that the proposed sample size is sufficient.[1]

Sampling procedure

A three-stage sample selection procedure was used to select the households to be interviewed for this evaluation. The process is explained in more detail in the Table below. The final election of comparison and intervention woredas and kebeles can be requested for from SNV EDGET Project.

Table 2 Stages in sampling procedure

	Intervention group	Comparison group
1st Stage	A total of 12 project woredas were drawn from the list of the 51 project woredas. For this, woredas in each region were categorised into three strata based on their project based performance (low, medium, high). Woredas were then randomly selected using a probability-proportional-to-size (PPS) sampling procedure, with the number of woredas selected from each region and each strata being proportional to the number of woredas in the region and strata.	It was agreed to use the same 5 woredas as per the baseline study based on dairy potential.

[1] https://select-statistics.co.uk/calculators/sample-size-calculator-two-means/

	Intervention group	Comparison group
2nd Stage	3 project kebeles were selected from each woreda, at random.	Hence, we selected 4 kebeles at random from the 35 kebeles of each of the 5 woredas.
3rd Stage	12 project households were randomly selected in each kebele for interviewing. This accounts for a total of 36 project households per woreda. ALINe used the lists of farmers provided through the EDGET project M&E specialist to identify individual households.	11 households will be randomly selected from each kebele, amounting to a total of 220 comparison households. The team of enumerators will closely work with woreda or kebele level officials to prepare list of households who have dairy cows. The selected households in comparison woredas were given incentive for interview in terms of consumable items (soap, sugar, etc.) to compensate for their time.

Household survey tool

The quantitative component of the study used a household questionnaire. The household questionnaire was administered to the household head along with one other person who is primarily involved in dairy related activities, typically of the opposite sex.

The household survey was structured as set out in Table below. The final household questionnaire can be requested for from SNV EDGET Project.

Table 3 modules and key topics covered for the household survey

Module	Key topics
Background information	• Info on the survey respondents (sex, age, etc.)
HH profile/ socio-demographics	• HH type (male or female headed), size and children 6-23 months • Primary source of income • Land ownership and cultivation (including forage) and change over last 4 years • Group membership • Dairy assets
Livestock ownership	• Current ownership • Change in ownership over last 4 years • Who manages dairy cattle
Participation in project activities	• Participation in training (by topic) • Receipt of coaching/follow-up support (by topic)

Module	Key topics
Adoption of practices	• Breeding • Health • Forage seed • Feeding • Calf management • Housing and manure management • Climate change • Milking practices • Other inputs
Dairy production, processing and marketing	• Annual milk production • Marketing of raw milk • Processing of milk and marketing processed milk products
Non-dairy produce/income	• Sale of cattle • Sale of feed/seeds • Sale of manure • Sale of breeding services
Household consumption of dairy products	• Purchase of milk • Milk and dairy product consumption (by age group) • Milk given away, milk wasted
Key constraints to dairy expansion	• Listing of constraints and ranking
Impacts on women's labour	• Changes in women's time allocation to dairy activities

Secondary data

Secondary data was collected on a limited number of indicators from Agro-Input Dealers, Dairy Processing Units and Woreda Livestock Offices. This was analysed with simple descriptive statistics (including mean and % increases). Issues related to the availability of the data in a suitable format for capture limited the extent to which this data could be used. Results were integrated into case studies and the overall qualitative analysis.

Table 4 Overview of quantitative and qualitative data collected

	Quantitative			Qualitative	
Region	**Type**	**# Households**	**# Organisations for secondary data**	**Key Informant Interviews**	**Focus Group Discussions**
Amhara	Intervention	144	18	19	8
	Comparison	88			
Oromia	Intervention	180	14	22	8

	Quantitative			Qualitative	
Region	**Type**	**# Households**	**# Organisations for secondary data**	**Key Informant Interviews**	**Focus Group Discussions**
	Comparison	88			
SNNP	Intervention	108	14	11	4
	Comparison	44			
Total	Intervention	432	46	52	20
	Comparison	220			

Qualitative component

Five qualitative case studies at the woreda level were compiled, each, covered six foci including; the extension system, the forage production system, agro-input dealers, dairy collection, processing and marketing, and institutional development support.

Dangla (Amhara), Machakel (Amhara), Lemu Bilbilo (Oromia), Wuchake (Oromia) and Aleta Wondo (SNNPR) were selected for the case studies. The woredas were selected on the basis of their diversity to enable learning across the spectrum. They differ in their performance and the support received for dairy extension services, cooperatives with Dairy Processing Units (DPUs), and Agro-Input Dealers. The assessment of project woredas used to inform the selection of case study woredas was conducted by EDGET project officers.

Case studies were assembled through mapping of key dairy value chain actors, conducting Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs) with them, and by gathering records from cooperatives and DAs that described the nature and scale of their operations. A total of 52 Key Informant Interviews were held with Development Agents, Dairy Processing Unit committees, as well as Agro Input Dealers. In addition, 20 Focus Group Discussions were held with DFEG members and DFEG lead farmer respondents.

In addition, 17 interviews were conducted directly with project staff to get more information about the project performance, context and lessons learned. These stakeholders included MOLF State Minister, Dutch Embassy representative, project and regional managers of EDGET project, business partners, and staff of the Ethiopian Bureau of Finance & Economic Development and regional officers at the Bureau of Livestock and Fisheries.

A series of interview guides for all KIIs and FGDs were developed to ensure the range and depth of information sought. Data was summarized by field staff and shared in prepared categories for additional analysis.

Key limitations to the evaluation methodology

Quantitative data

- It was apparent that there were inconsistencies and gaps in time-series secondary data obtained from AgIDs, WLOs, DPUs on key metrics (e.g. volume of inputs produced, milk collected, payments made to coop members, etc.). AgIDs and DPUs often had incomplete records in place or were hesitant to share secondary data with field interviewers. Furthermore, the data from the AgID and DPU records was generally not available in a form that could be readily inserted in the forms for secondary data capture. In many cases this made the extraction of secondary data impractical, particularly given the time constraints.
- There was poor cooperation with government staff to provide adequate and detailed secondary data on time. Secondary data requested from kebeles in Kuyu and Wuchale woreda are still outstanding but we do not expect to receive them.
- The sampling decisions for the quantitative household survey component of this evaluation were made on the basis of (1) the priority comparisons that were required (intervention and comparison, baseline and endline); (2) estimates of the variance in priority variables based on the baseline data; (3) the assumed suitability of the comparison woredas selected at the baseline stage; and (4) the feasibility of alternatives for creating a counterfactual group. These choices were made under considerable time pressure and with limited opportunity to fully interrogate points (2) and (3). It has since emerged that the baseline results that the evaluation team had access to contained errors and that the comparison woredas had a combination of historic and ongoing livestock/dairy interventions and, as such, also underwent considerable change during the project period. This significantly limits the extent to which the comparison group can be used to measure the effect of the EDGET project.
- The endline survey was carried out in December 2017. It is worth noting that implementation of project activities was carried out most intensively and at the greatest scale during 2016 and 2017, with a good proportion of woredas not having received all planned interventions (such as supply of equipment to cooperatives with DPUs) until well into 2017. As a result, it would be reasonable to expect that the full extent of benefits of participation in the project for dairy farmers would not yet have materialised. This could limit the extent to which project-related changes to variables such as milk production and income might be observed.
- The endline questionnaire differed from the baseline for a number of questions. While this allowed us to have clearer questions formulated in the manner required at the endline, it limited comparability of the baseline and endline data in some cases.

Status of the Baseline Household Data

- The baseline dataset provided to ALINe was found to have a set of issues that significantly impacted on its credibility and usability. Key issues include:
    - Poor cleaning of the data with many extreme values not removed;
    - Complex format of the data;
    - Significant errors in automatically calculated fields (e.g. totals);

  - Large number of cases with missing values without clarity on how they should be treated;
  - Some variables had no zero-values but missing values instead.
- As a result of this, the evaluation team had to spend an inordinate amount of time engaging with the baseline data, reorganising it, cleaning it, addressing missing values, etc. This consumed a considerable amount of time for the evaluation team and detracted from other types of analysis.
- Ultimately - and where possible - the evaluation team transformed (recalculated from raw figures) the baseline data in order to make it comparable. These transformations are based on best practice (e.g. when substituting missing values) but also on best judgement (e.g. when deciding if a blank value should be considered 'missing' or taken as zero). This left significant room for error given our limited understanding and opportunity to interrogate how baseline data was actually collected, its quality and an assessment that it was neither cleaned nor documented using principles of best practice.[2] It is important that the interpretation of findings that reflect base- and endline comparisons should be made with caution.

Qualitative data

- The qualitative tools were delayed in their finalisation due to significant revision up until the day before fieldwork commenced. Additional tools required more extensive discussion and took more time than has been planned. Qualitative data collection in three woredas (Yirga Chefe, Enemay and Kuyu) was done using tools that were penultimate versions of tools that were later updated.

[2] Please see Email from ALINe to EDGET from 30.01.2018 for further details.

3. Context

Ethiopia is a fast-growing economy ranking 9th in population growth in Africa and 14th in terms of GDP per capita growth. Agriculture contributes 35.8% to economic GDP with the dairy sector contributing 12-16% within that.[3] The Ethiopian government aspires to double domestic milk production between 2015-2020 to reduce its current dependency on imports of dairy products.

National strategy

The national Growth and Transformation Plan II of 2015-2020 prioritizes transformation of the agricultural sector including a Livestock Master Plan. In relation to the dairy sector, the Cow Dairy Development Roadmap (2015/16 - 2019/20) specifies '*raising total cattle milk production to 7967 million litres by 2020 through genetics, feed and health interventions to improve traditional family cow dairy production and expand and improve specialised dairy production units*' (cf. page 17, Roadmap for growth and transformation). For smallholder dairy farming interventions the Roadmap proposes cross-breeding efforts with exotic dairy breeds through AI and synchronization, improved feed and use of veterinary services.[4]

Milk production

11.33 million milking cows in Ethiopia produced a total of 3.06 billion litres of milk annually (2015/16)[5] with stark variations across different regions. The Ethiopian 'milk-sheds' exist in Adama-Asella, Greater Addis, Mekele, Ambo-Woliso, Humera, Bahir Dar, Hawassa, Dire Dawa and Jimma. The vast majority of milk (97%) is produced by smallholder farmers (95% own less than 5 cattle) who are mostly pastoral, agro-pastoral farmers or in mixed-crop livestock systems, i.e. traditional highland mixed farming. Milk production is predominantly from indigenous breeds (97%) rather than the more productive crossbreeds or pure grade exotic cattle (3%).[6]

Rural milk production in Ethiopia faces a number of challenges. Feed and forage (seed) for dairy cows are expensive and scarcely available to smallholders. Farmers face a lack of accessibility to land which can be difficult to obtain from the government. Cross-bred cows are more expensive. AI services are often difficult to access and may be of variable quality. Private AI providers (i.e. Addis Livestock Production and Productivity Improvement Service) are perceived to offer higher quality services over public AI service providers (i.e. National Artificial Insemination Center).

Milk quality is often poor due to inadequate adoption of hygienic practices as well as a lack of adequate equipment for milking, storage and transport. Milk may be diluted to increase the quantity for sale.

[3] CIA World Factbook, 2017.

[4] Investment opportunities in the Ethiopian Dairy sector (2015)

[5] Investment opportunities in the Ethiopian Dairy sector (2015)

[6] Investment opportunities in the Ethiopian Dairy sector (2015)

Collection and processing

Dairy cooperatives collect and sell milk to processors, sell raw milk directly to consumers or process milk in-house. Private milk collectors and processors may also collect milk from farmers directly. Most, milk processing companies in Ethiopia are concentrated around Addis Ababa. The processing capacity of their plants exceeds the available raw milk supplies of nearby collection sites.

Milk collection and processing is variable depending on the expertise/experience of staff, the availability of equipment and access to road infrastructure. Many organisations do not have chilled storage or transport equipment, insufficient quality checks and lack quality based payment systems.

Consumption

Human consumption of milk produced is 68% whereby the remainder is wasted or utilised by calves in consumption. Only 6.6% of milk produced actually enters the formal (e.g. via cooperatives) or informal output market (urban sales or sales to neighbors). The majority of milk is consumed (48.5%) or processed (44.6%) by the milk-producing-household directly.[7]

The price per litre of processed milk in supermarkets in Addis Ababa is 1.02 EUR and average per capita consumption 51.9 litres annually. Milk consumption is significantly lower in rural areas with 1.3 litres consumed per year, many middle and low income consumers consider prices too high. Per capita milk consumption has been increasing by 2.2% per year from 2010-2015.[8]

Growth of the urban middle class with greater purchasing power will likely lead to an increased demand for dairy products over the next decade.[9] Consumer demand for milk fluctuates according to the Orthodox fasting periods, whilst, media reports suggesting the negative health impacts of Aflatoxin contamination in milk in 2014/15 led to a decrease in demand for milk.

[7] Investment opportunities in the Ethiopian Dairy sector (2015)

[8] Hemme, T. (ed.), 2016. IFCN DAIRY REPORT 2016. IFCN, Kiel, Germany.

[9] Practice Brief Dairy BISS project (2017)

4. Evaluation findings

Evaluation finding presented below are done so according to key components of EDGET project's dairy value chain interventions. The overview section describes the dairy value chain setup relevant to the EDGET project, indicating the different components. The following section provides an overview of the socio-demographic profile of households surveyed at the baseline and endline.

Subsequent sections (1) provide an overview of the component, (2) provide a summary of the implementation of activities and achievement of outputs drawn from EDGET project's M&E system, annual reports and, in some cases, internal studies; (3) present the findings from the baseline and/or household surveys pertinent to the section in question; and (4) highlight findings from the qualitative case studies. These individual pieces of evidence compiled together provide the evidence used to arrive at an assessment of the relevance, effectiveness and sustainability of each component. A final section provides an overall assessment of the contribution of the project to strengthening the functionality of the dairy value chain as a whole.

4.1 Overall dairy value chain setup

The figure below provides an overview of the dairy value chain, with a particular emphasis on the woreda level. The grey boxes with dotted borders represent key subsystems of the dairy value chain that the EDGET project engages with, albeit to varying extents. These include:

1. The regulatory and policy framework
2. Regional and national actors higher up in the dairy value chain
3. Extension system
4. Forage system
5. Institutional support
6. Agro Input Dealers
7. Dairy Cooperatives and DPUs
8. Household production, processing sale and consumption

Key actors who have a role to play are indicated in boxes 3 to 8. Actor boxes with dotted borders indicate that either the actor has a role to play but is not directly a part of the EDGET project (e.g. Animal Health Service providers, Private milk buyers/traders) or else is part of the EDGET project but is not found in all locations (e.g. Milk Collection Centres). Due to the high level of variation and complexity within the dairy value chain and across woredas, the diagram below offers a simplified picture that aims to convey the main focus areas of the EDGET project and the key actors relevant to EDGET project's intervention. A more detailed view of each component is included in the narrative sections within each component.

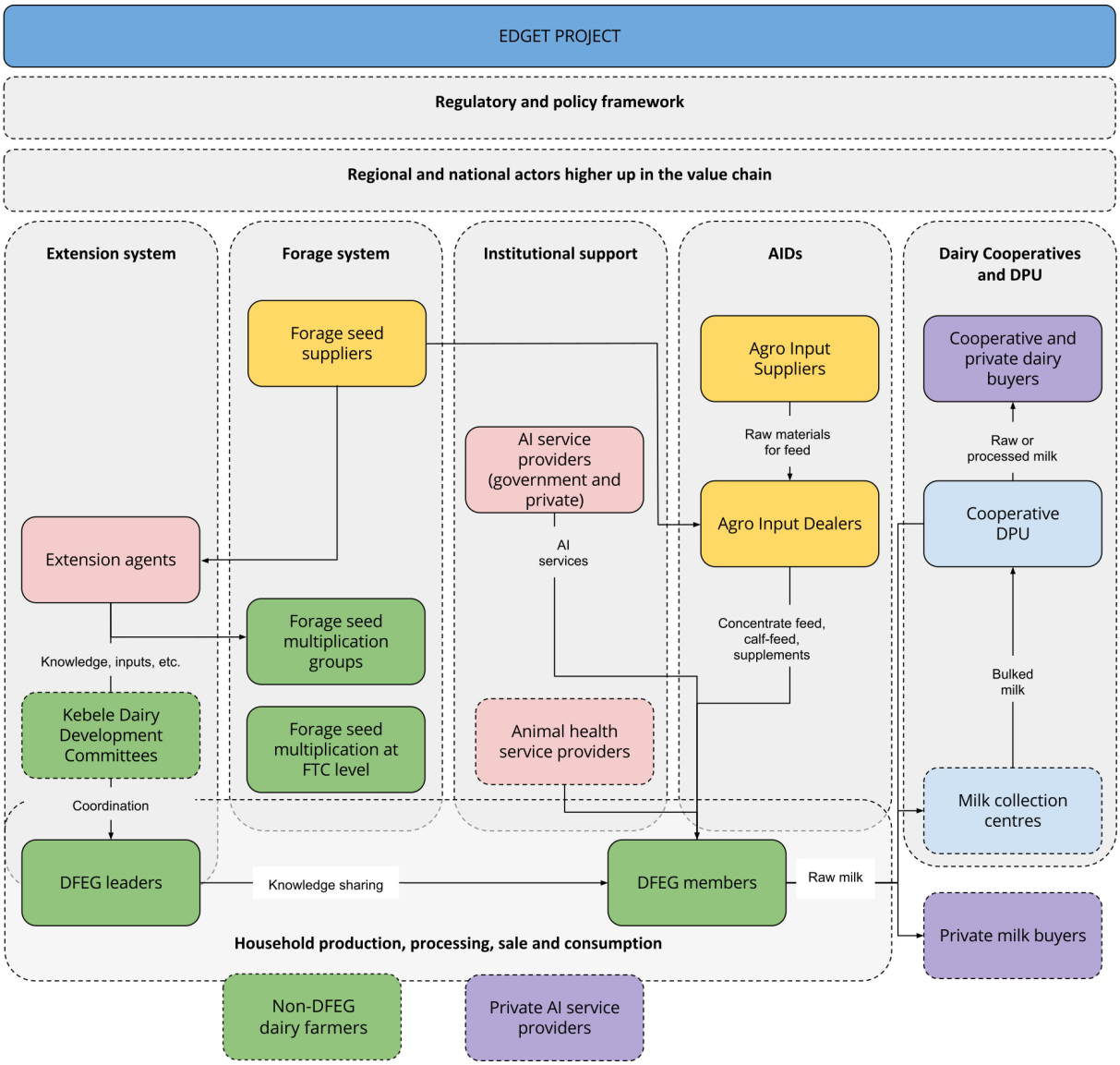

Figure 2 Overview of the dairy value chain in EthiopiaOverview of the household survey

Socio-economic profile of farmers at baseline and endline

Table 5 and Table 6 provide an overview of the socio-economic profile of the comparison and intervention group for baseline and endline survey. Estimates for the population of target farmers and comparison group are not reported but significant differences between intervention and comparison group, including over time, are reported.

At baseline, the majority of household heads were male (88-89%) and on average 45-46 years old. There are no statistically significant differences between intervention and comparison groups for age and sex. We can see a 10% reduction in proportion of male headed household at the project's endline (77-80%) while average age stays similar to the project's outset. The number of household members is higher in the intervention group than in the comparison for both, baseline and endline, and there is an

overall increase in household size over time. The proportion of households with children under two is the same for intervention and comparison group, but there is a 5% increase from base- to endline.

With regard to the education levels of household heads, at baseline there are more illiterate people in the comparison than in the intervention group. The proportion of illiterate household heads decreases at the endline in favor of a higher percentage with primary education. These changes are more pronounced for the comparison group.

We see several differences across time; a reduction in the percentage of male headed households by approximately 10% as well as a reduced percentage of illiterate household heads. The number of household members and the proportion of households with children under two goes up.

Table 5 Socio-demographic background data for comparison and intervention group at base- and endline

	Baseline		**Endline**	
	Comparison (n=400)	**Intervention** (n=1200)	**Comparison** (n=220)	**Intervention** (n=432)
Sex - head of household	88% Male	89.1% Male	79.5% Male	76.9% Male
Age - head of household (mean average, min, max)[10]	45 years, min = 20, max = 85	46 years, min = 21, max = 90	45.9, min = 22, max = 80	47.5 years, min = 20, max = 92
Education - head of household [a]				
Illiterate / no education	45.8%	33.4%	23.6%	27.3%
Primary school (1-4 and 5-8)	36.0%	43.4%	44.6%	45%
Secondary school	8.2%	10.3%	11.4%	10.2%
Adult Basic education	NA	NA	15.5%	13%
Other (specify)	9.8%	5.9%	5%	4.7%
Number of household members [a, c, d]	5.5	6	5.9	6.3
Number of households with children under 2, in % [c, d]	14.2%	15.8%	20%	20.6%

[a] Significant differences in mean averages or cell distribution for baseline intervention and comparison, Chi-square test statistic or Two-sample T-Test, p<0.05
[c] Significant differences in mean averages or cell distribution between baseline and endline for intervention group, Chi-square test statistic or Two-sample T-Test, p<0.05
[d] Significant differences in mean averages or cell distribution between baseline and endline for comparison group, Chi-square test statistic or Two-sample T-Test, p<0.05

[10] There are significant differences between male and female headed households in terms of age. Women are in average 47.8 and men 45.8 years old. Similarly, statistically significant differences exist for education.

Differences between intervention and comparison households surveyed can be seen in respect to education at baseline and number of household members especially for both base- and end line.

The households' main source of income is crop farming at the baseline as well as at the end of the EDGET project. Dairy farming as a source of income was only asked at the endline, but the apparent differences between comparison and intervention group are not statistically significant.

With regard to land ownership, we see that farmers in comparison group own more total land than intervention farmers at end- but not at baseline. These differences at endline derive from different land sizes dedicated to crops and will be further discussed under section 'Forage and Forage Seed Production - Land allocation'.

Table 6 Socio-economic data for comparison and intervention group at base- and endline

	Baseline		**Endline**	
	Comparison (n=400)	**Intervention** (n=1200)	**Comparison** (n=220)	**Intervention** (n=432)
Main source of income of the household [11]				
Dairy farming	NA	NA	3.6%	8.3%
Crop farming	95%	92%	95%	88.9%
Other	4.8%	7.9%	1.4%	2.7%
Land ownership[12]				
Average total cultivated land, in ha [b]	2.35	2.3	2.59	2.21

[b] Significant differences in mean averages or cell distribution for endline intervention and comparison, Chi-square test statistic or Two-sample T-Test, $p<0.05$

The results for cattle ownership show some surprising trends between the baseline and endline:

- Overall cattle herd size appears to have reduced marginally, albeit more so for intervention households;
- The initial proportion of households with crossbred cows in the comparison woredas is just 4%, which appears to be strikingly low, both when compared with the intervention woredas at baseline and when compared with the comparison woredas at endline. It is not possible to ascertain why this is the case but possible reasons could include: poor selection of comparison woredas at baseline (i.e. not actually similar to intervention woredas), issues with the baseline data collection (errors) and/or presence of intensive (non-EDGET) AI interventions in comparison woredas.

[11] Categories between base- and endline survey differ slightly.

[12] Due to a misunderstanding by one enumerator regarding land ownership question, we excluded his/her interviews from the analysis for this variable resulting in a decrease of the sample size by 59; Comparison group n = 200, Intervention group n = 393

Table 7 Cattle and dairy cow ownership comparison and intervention group at base- and endline

	Baseline		Endline	
	Comparison (n=400)	**Intervention** (n=1200)	**Comparison** (n=220)	**Intervention** (n=432)
Average cattle herd size, per household	6.39	6.73	6.28	6.10
Average number of cows that produced milk in the last year, per household			1.74	1.72
Average number of crossbred cows per household	0.05	0.37	1.6	1.4
% of households with crossbred cows [a, b]	4%	28%	43%	31%

[a] Significant differences in mean averages or cell distribution for baseline intervention and comparison, Chi-square test statistic or Two-sample T-Test, p<0.05

[b] Significant differences in mean averages or cell distribution for endline intervention and comparison, Chi-square test statistic or Two-sample T-Test, p<0.05

Gendered division of roles in dairy activities

The distribution of dairy related activities among women and men in a household can be seen in Table 8 below. Both, men and women, are involved in looking after the cow (56%) but women only to a greater extent than men only. Women are more likely than men to be exclusively responsible for looking after the cows (35% women compared to 9% men) milking and processing milk (around 60% compared to around 8-9% of men) and for transporting the milk to markets (around 55% of women compared to 8% of men). In just over 30% of cases, households reported that both men and women are involved in these activities. Compared to other practices, the purchase of inputs has the highest percentage of households in which men are exclusively responsible (29.1%). This suggests that women are generally more involved than men in dairy related activities except when related to investment decisions (i.e. purchase of inputs) where involvement is the same.

Table 8 Responsibilities for different dairy related activities in the households[13]

Responsibility for:	**... looking after the cow**	**... purchasing dairy inputs**	**... milking and processing**	**... for transport and marketing milk**	**... for transport and marketing processed products**
Women only	34.5%	27.0%	60.9%	59.3%	55.4%
Both men and women	56.1%	43.8%	30.5%	32.0%	36.3%
Man only	9.2%	29.1%	8.6%	8.5%	8.1%
Hired labour	0.2%	0.2%	-	0.2%	0.2%

[13] Significant differences between intervention and comparison group farmers were not found which is why they are not reported here.

4.2 Strategic Objective 1: To enhance sustainable dairy production and productivity, input supply and related services

Strategic Objective 1 covers a series of extension related EDGET project interventions to promote dairy development. These interventions focus on:

1. The extension system
2. Agro Input Dealers (AgIDs)
3. Forage system development

The diagram below provides an overview of the timeline for implementation of these activities.

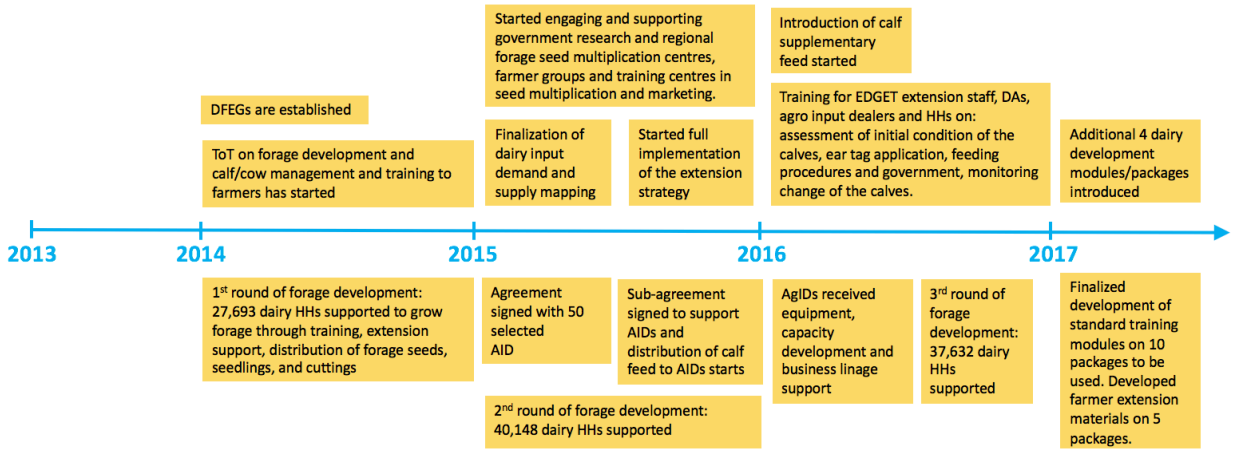

Figure 3 Timeline of SO1 implementation[14]

The extension system

Overview of component

EDGET project's support on strengthening the extension system can be divided into the following sub-components:

1. Strengthening the capacity of government extension service providers at the woreda (Woreda Livestock Offices) and kebele (Development Agent) levels.
2. Establishing and strengthening Dairy Farmer Extension Groups (DFEGs) as a farmer-to-farmer extension model
3. Developing and distributing extension materials (manuals) as well as other key inputs (calf feed, Milk Transportation System (MTS) and forage seed).

The extension component of the EDGET project works primarily through the government extension structures. Regional livestock experts provided trainings to government livestock experts at the zone

[14] Please note that activities with relation to developing a knowledge base are reported under SO4. But some key fact may be reported under this SO1, too.

and woreda and zone levels as well as to project Zonal Dairy Community Mobilisers (ZDCM) and Dairy Extension Promoters (DEPs). These actors together provided trainings to the government DAs , who in turn - and with technical and facilitation support from the ZDCMs, DEPs, and woreda livestock officers - deliver trainings and coaching/follow-up support to the farmers through the Dairy Farmer Extension Groups (DFEGs). The trainings encompassed orientation on the project and technical capacity development for the implementation of project activities. The EDGET project also developed a series of illustrated training materials, translated into Amharic and Afan Oromo for use by extension service providers as well as DFEG members. The ZDCMs, DEPs and Woreda Livestock Officers also play a facilitation role to support the distribution of project related materials and inputs (such as manuals and forage seed) through DAs and DFEGs.

DFEGs provide a mechanism for reaching a larger number of farmers than would otherwise be possible and leverages the potential of peer learning amongst farmers. Each DFEG comprises approximately 25 dairy farmer members. Five of the members in a group are 'lead farmers' (often but not necessarily coinciding with the more institutionalised 'model farmers') and they are the primary recipients of the trainings provided by the DAs and DEPs. Each DFEG lead farmer is then expected to exchange knowledge with others in their group (sometimes referred to as 'follow farmers') and take other steps to promote and strengthen dairy development. They also support the DAs to coordinate and carry out activities such as trainings and exchange visits for their group members and play a role in the distribution of project inputs.

In SNNPR and Amhara, DFEGs are federated into Kebele Dairy Development Committees. The committees are composed of 3 elected members in most cases, drawn from the pool of DFEG leaders, and include both men and women. The role of these committees is to facilitate coordination across DFEGs and to facilitate the exchange of information amongst members. They may also play additional roles related to milk collection and accessing/purchasing inputs.

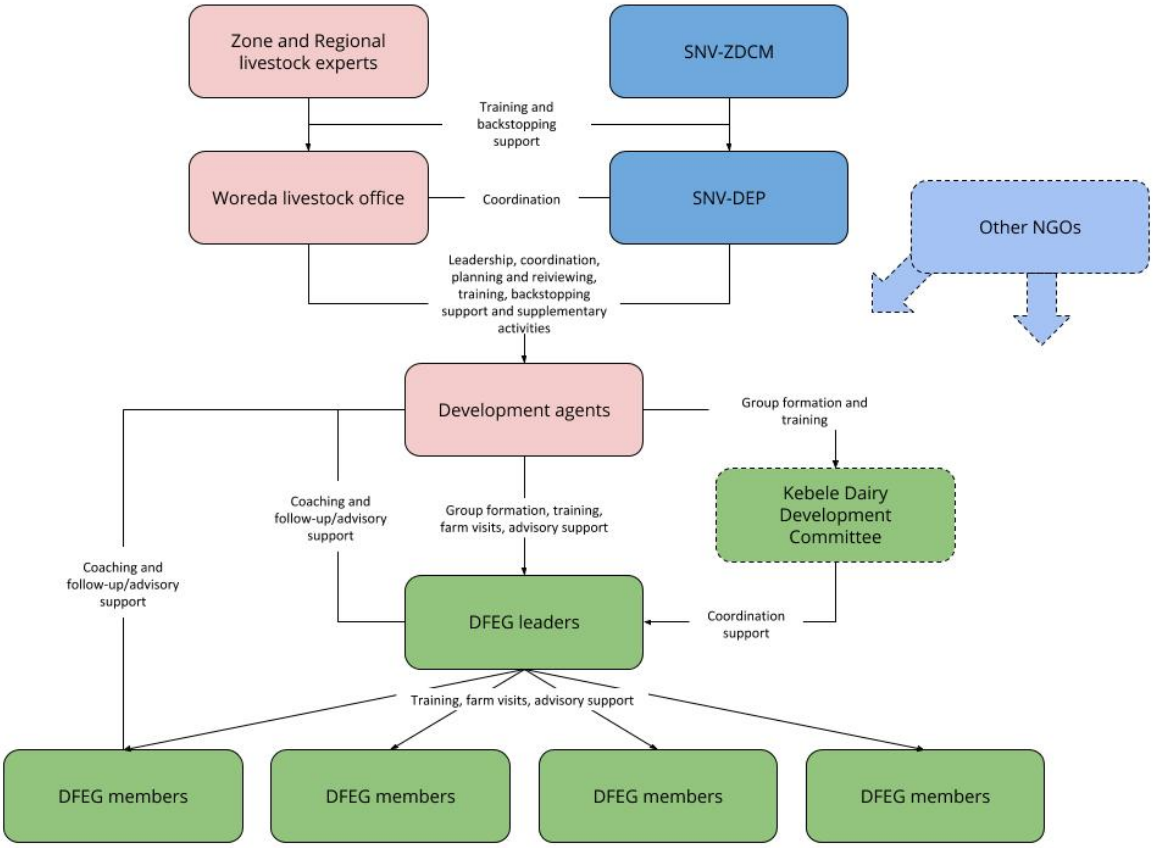

Figure 4 Actor map of the extension component

Implementation: planned vs actual

Table 9 below, based on data from EDGET's M&E system and reports summarises the achievement of outputs related to the extension system.

Table 9 Extension system activities: achievement of output targets

Output description	**Indicator**	**Achievement end of project**	**End of project revised and (original) targets[15]**
Dairy Farmer Groups promoting milk production and marketing organized and strengthened	Number of dairy farmer groups promoting milk production and marketing organized and strengthened	>3,236 / 124%	2,600 (2600)
	Number of Dairy Extension service providers who received TOT Training on different dairy training packages	1,476 / 301%	490 (490)

[15] Some targets were repeatedly revised downwards, some indicators have been removed or added. Here we report the revised targets as per the EDGET Performance M&E data 2014-2017. Original targets from reports are in parentheses.

Output description	Indicator	Achievement end of project	End of project revised and (original) targets[15]
	Number of dairy farmers who received training and extension support on dairy development	56,107 / 86%	65,000 (65,000)

Building capacity of dairy farmers and extension system

In 2014, the EDGET project conducted Training of Trainers (TOT) trainings on forage development as well as calf and cow management for 486 DAs, 122 woreda and zonal livestock experts and 51 project DEPs. Over 30,200 farmers subsequently received a 1-day training, 110% as per the target for that year. The project also initiated the establishment and training of the DFEGs.

TOT trainings continued in 2015, with 1,162 DAs, 266 woreda and zonal livestock experts and 49 project DEPs and ZDCMs. Subsequently over 56,000 dairy farmers (86% as per target) received training. This year, EDGET project implemented its extension strategy for field level coaching and advisory services to farmers. As a result, farmers started receiving technical follow-up support and coaching on dairy development through the DFEGs.

By 2016, once the EDGET project had become better established, the model for extension support focused on working through the DFEGs - i.e. trainings were delivered to DFEG leaders who in turn reached out to the other DFEG members. By this year, a total of 2,600 DFEGs had been established. 1,433 DAs, livestock experts and DCMs/DEPs trained over 12,690 lead farmers (including 1,462 female lead farmers). The lead farmers with support from the DAs and DEPs provided further extension support to more than 54,600 farmers (84% as per planned target).

By 2017, cumulative achievements for extension service providers receiving TOT trainings was 1,476 (DAs, livestock experts, DCMs, DEPs) - above the targets originally set. However, the number of unique households reached through this model, as reported by the EDGET project, was 56,107, which amounts to 86% of the total EDGET project target. Due to issues with accurately tracking the number of farmers reached and avoiding duplication, the figure used is the highest number reached in a single year.

Results from an evaluation conducted by the Bureau of Finance and Economic Development (BOFED) in 2016, indicated that farmers who attended the EDGET project training sessions adopted good calf management practices and showed changes in terms of Knowledge Attitude and Practices (KAP) related to feed management and overall dairy management. However, performance of the extension delivery was found to be variable across woredas.

Findings from the household survey

The household survey gathered data on respondent's participation in various types of dairy-related extension activities, including training and coaching support.

Trainings

Overall, intervention group farmers received the **training activities** to a greater extent than farmers from comparison group. 68% of intervention group farmers reported participating in at least one dairy-related training or exposure visit activity, as compared to 11% of comparison group farmers. These

figures are the same for both female and male headed households. However, when asked who in the household (i.e. men, women or both) participated in the training, only 23% of households responded with 'woman'. This is despite the fact that women are to a greater extent involved in milk collection and processing activities (see Table 8 above).

The training topics that farmers recalled were forage development and feed improvement (26%), calf and cow management (19%), hygienic milk production (17%), feed and feeding management (16%), as well as housing and manure management (14%). Farmers reported participating in dairy business management trainings (4%) and experience sharing visits (2%) to a lesser extent.

The fact that 11% comparison group farmers reported receiving dairy-related trainings suggests that dairy development activities are also ongoing in the comparison woredas, albeit with a much-reduced intensity[16].

Advice and follow-up support

47% of intervention group farmers received **advice and follow-up support** as compared to 6% of comparison group farmers. This is regardless of whether the household was female or male headed. In terms of sources of advice and follow-up, intervention group farmers reported SNV / DEP in 78% of cases and government or public service providers in 21% of the cases. The content included forage development and feed improvement (28%), calf and cow management (19%), hygienic milk production (17%), feeding and feeding management (18%), as well as housing and manure management (13%). Farmers received advice and follow-on support in dairy business management (3%) and experience sharing visits (2%) to a much lesser extent.

The perceived benefit of advice and follow-up support is predominantly improved knowledge (56%) and information (36%) rather than change in practices (2%) or nothing (7%). While the farmers in the comparison group were asked this question, too, they referred to support received in different instances or other actors. Notably, this support seems to be perceived as less effective with 11% for comparison group instead of 1% for intervention group farmers saying they gained 'nothing' from the support. Adoption results are presented in more detail in the section on 'Household adoption of inputs and practices.'

Table 10 Receipt of trainings, advice and follow-up support

	Endline	
	Comparison (n=220)	**Intervention** (n=432)
Exposure to trainings		
% of household received training on dairy or experience sharing activities over last four years [b]	11.4%	68.1%
% of female headed household received training on dairy or experience sharing activities over last four years	-	67.9%

[16] This may cause confounding effects when analysing results on outcomes between the comparison and intervention groups.

	Endline	
	Comparison (n=220)	**Intervention** (n=432)
% of women participating in trainings		22.6%
Exposure to advisory support		
% of households receiving advisory or follow up support on dairy production	6.3%	47.1%
...by government/public service provider[17]	94.9%	20.6%
...by cooperative/farmer group	2.6%	1.6%
… by SNV / DEP	-	77.6%
… by other	2.6%	0.2%
Perceived benefits of training and advisory support[18]		
% reporting 'none'	10.5%	1.2%
% reporting 'improved knowledge'	65.8%	55.0%
% reporting 'new information'	18.4%	37.1%
% reporting 'improved practice'	5.3%	6.7%

[b] Significant differences in mean averages or cell distribution for endline intervention and comparison, Chi-square test statistic or Two-sample T-Test, p<0.05

Group memberships

At the endline, 68% of intervention farmers were found to be members of DFEGs. At baseline, since DFEGs had not yet been formed, farmer group membership refers to membership of a cooperative or any other type of farmer group/association. Membership levels were 47% for the intervention group and 50% for the comparison group.

Table 11 Group memberships

	Baseline		Endline	
	Comparison (n=400)	**Intervention** (n=1200)	**Comparison** (n=220)	**Intervention** (n=432)
% of households **farmer group membership**	49.5%	47.2%	NA	NA
% of households with **DFEG membership**	NA	NA	NA	68.3%

[17] Please note that figures for comparison group have to be caveated by a very small n = 13 for this variable and below

[18] Please note that figures for comparison group have to be caveated by a very small n = 38

Project inputs supply: Forage seed, calf feed and MTS

The EDGET project provided households with forage seed, calf feed and MTS. A total of 64.4% of households in the intervention group reported receiving the MTS, compared to 0.6% in the comparison group. 33% of intervention group households reported receiving forage seed (compared to 13.9% in the comparison group) and 32% reported receiving calf feed (compared to 8% in the comparison group). These figures indicate that input provision activities are being carried out in the comparison woredas, albeit with a reduced coverage. Please see respective sections on forage and forage seed production, and AgIDs for more a granular analysis.

Table 12 Percent of households receiving various types of input

	Endline	
	Comparison (n=220)	**Treatment** (n=432)
% of households receiving MTS at least once [b]	0.6%	64.4%
% of households receiving forage seed at least once [b]	13.9%	32.6%
% of households receiving calf feed at least once [b]	7.8%[19]	32%

[b] Significant differences in mean averages or cell distribution for endline intervention and comparison, Chi-square test statistic or Two-sample T-Test, $p<0.05$

Findings from qualitative assessment by sub-component

The table below presents the findings from the qualitative assessment by sub-component. Unless specific woredas are stated, the strengths and weaknesses are generalised across all the woredas.

[19] As reported by these farmers. These may be completely unrelated to SNV's interventions.

Table 13 Qualitative findings regarding the extension system

Sub-component	Strengths	Weaknesses
Developing capacity of extension providers (WLO, DA)	There is widespread appreciation across the woredas for the role played by the DEPs in relation to extension. This encompasses group formation, distribution of inputs (forage seeds, training materials), technical trainings and follow-up. Almost all DAs have been playing their roles proactively. Overall, DAs feel that their knowledge on dairy related activities has been enhanced through the support that they were provided - particularly in terms of technical trainings related to dairying. They reported that this has helped them to play their role more effectively and bring about positive changes for farmers. They also reported finding the extension materials they were provided with to be useful.	Continuity in the supply of inputs (Wuchale, WLO) The model of DAs varies across regions. In Oromiya, DAs divide their kebele into three areas and serve the farmers in their assigned area. As a result DAs who are not livestock specialists have to provide advice on dairying and reported having less confidence. More generally, across the woredas, DAs were reported to be overstretched (an issue validated by multiple actors), having to cover a very large geographical area, thereby limiting their ability to provide the required support. Other actors occasionally found DAs to be excessively driven by political incentives rather than serving farmers. DFEG members reported mixed views about the roles of DAs, with some appreciating their role in strengthening dairy activities (e.g. Aleta Wondo) and others feeling that the DAs either lacked knowledge or were too busy with other work to play their role. In some cases (e.g. Lemu Bilbilo), it appears that the DEP was seen by DFEG members as a much more important contributor than the DA to extension activities, suggesting that the DEP steps in to fill in gaps in the DA's role. In some cases it was noted that DAs require incentives to play their roles. In some cases DAs were also reported to have distributed inputs (forage seed/cuttings/splits) to non-target households. In other cases, follow up by the DAs and DEPs was perceived to be very limited (e.g. Lemu Bilbilo, Wuchale). As they are perceived to have more knowledge than DFEG leaders, DFEG members felt that reliance on DFEG leaders was limiting their access to accurate and quality knowledge/advice. DAs are also expected to play a role in bringing AI services; however, they are seen as being somewhat indifferent in this regard.
Establishing and strengthening DFEGs	DFEGs appear to have been successfully established across the case study woredas. The DFEGs do appear to be delivering a number of benefits to farmers, though there is considerable variation in how they operate and the extent to which they are effective. More specifically, there is a mixed pattern across and within woredas in terms of how DFEG members engage with DFEG leaders. In some cases DFEGs hold regular monthly meetings, in others they do not and interactions are more ad hoc or informal. In most cases there is a combination of both. During DFEG meetings, extension materials appear to be used/discussed - though in some cases this does not happen. It was commonly reported that DFEG members would approach their leaders to seek advice when they need it. Where DFEGs are working well, members reported valuing the group as a means of gaining knowledge and learning from other farmers. Exposure visits to others' farms, particularly DFEG leaders, were frequently cited as a source	The positive attributes of DFEGs notwithstanding, a number of issues and challenges were identified by different actors. In some cases, DEP's raised concerns about the selection of households, which they felt should have been done by experts during design of project. In Lemu Bilbilo, for example, some households have not even collected the MTS yet. In other cases, DFEG members do not own crossbreed cows. DFEG leaders play a crucial role in the functioning of the DFEGs. In some cases, DFEG leaders did not appear clear about their roles and responsibilities (e.g. Wuchale). Across the woredas, DEPs and in some cases DFEG members too, reported unwillingness of DFEG leaders to share knowledge with, provide advice to or show their farms to other farmers. Variable levels of knowledge and practice amongst DFEG leaders may limit the quality of knowledge transfer amongst farmers (e.g. Dangila, Lemu Bilbilo).While DFEG leaders can

Sub-component	Strengths	Weaknesses
	of motivation and learning about new practices. Members also associate DFEGs with the ability to gain access to key inputs such various types of forage seeds as well as equipment such as the MTS. For service providers such as the WLO and the DA, DFEG leaders provide a simplified point of contact and make service delivery more manageable. DFEG leaders serve as distributed demonstration sites to help spread knowledge to DFEG members and serve as a bridge between DAs and DFEG members. The groups have also allowed a large number of farmers to be reached within a short amount of time. In a small number of cases (e.g. in one DFEG in Aleta Wondo and another in Lemu Bilbilo) , often due to individual leadership, DFEGs have created a dynamic relationship with their group and use their collective strength to be more efficient in accessing government services (e.g. AI services, forage seeds) as well as other inputs (e.g. clubbing together to get feed or medicines). However, this practice remains somewhat limited. DFEG members generally rated the support they had received from the DEPs quite highly across the woredas.	be helpful for experience sharing, extension requires more than this. In some cases, DFEG leaders were perceived as requiring further support and not playing their roles. Where DFEGs were less functional, members could not recall activities that were carried out and some were not clear who the leader of their DFEG was. In a number of cases DFEG meetings were not held regularly, and DFEG members felt that their leaders were not reaching out to them. DFEG members often feel that 'some members' (this was not made explicit, but we presume they were referring to DFEG leaders) get more visits, training, support and benefits from the DEP and DA than others. They feel that this is not fair. This reinforces the notion that, on the one hand, that they do not understand the purpose/function of the DFEGs and, on the other, that leaders are not playing their role effectively. One DA reported that the fact EDGET approach did not use the government's existing 1:5 network was an issue. However, it was not clear why this was an issue. Farmers continue to expect free inputs in some cases. In some cases (e.g. in one kebele in Aleta Wondo), DFEG members have not read or engaged with any of the training materials. Collective action amongst DFEG members - such as jointly purchasing feed or medicines - appears to be somewhat limited, except where DFEG leaders are particularly dynamic. In some cases, DAs find that DFEG members are unwilling to attend meetings when called. In the same case, DFEG members find the DA unhelpful. This suggests there may be underlying issues in the relationships between actors that hamper the expected roles of both groups.
Establishing and strengthening KDDC	Kebele Dairy Development Committees were operational in 3 out of 5 woredas, as expected (i.e. in all the Amhara and SNNPR woredas). These bodies play a coordination role with respect to DFEGs. Where they have been established, the KDDCs appear to be functional.	In some cases, the distinction between the KDDC and the DFEG leaders was unclear to DFEG leaders and members, suggesting that there remains some ambiguity about the respective roles of each. Some KDDC members reported that they were overloaded with work and responsibilities.
Extension materials, content and adoption of practices	DFEG members frequently noted the fact that extension materials are clear and useful. In particular they find the illustrations helpful as well as the fact that the materials are available in local languages. Overall DFEG members reported that the new knowledge and inputs supplied through the project have helped them to increase their milk production. An increased trend in the adoption of improved practices related to calf management, housing, feeding practices (zero grazing, improving quality and type of feed/forage), clean milk production, use of crossbreeds has been	Some DFEG members felt that the costs of adopting certain practices or accessing the required inputs (such as improved feed) could be prohibitive. In some places (e.g. Lemu Bilbilo), dairy is a relatively new activity for farmers - and this slows the uptake of new practices.

Sub-component	Strengths	Weaknesses
	reported across all the woredas by all types of actors. Across the actors and woredas there was a recognition of increased awareness about biogas. Some farmers started using biogas and composting for fertilizer methods due to the training. Open grazing is still common practice.	
Overall extension approach	The overall extension approach is seen by most actors across all the woredas to have been positively changed as a result of the EDGET project. It has shifted from a theoretical to a practical focus, particularly as a result of the focus on ensuring availability of inputs. The number of farmers reached increased as a result of working through DFEGs and the capacity of all key extension players has been seen to increase. Some actors feel that the training and awareness component is the most significant contributor to change as it has significantly changed people's attitudes toward dairy farming in a positive manner. The overall extension activities are also seen as having gained considerable momentum over the course of the project as the benefits became evident and more farmers came on board. Farmers knowledge of and attitude toward dairy farming has changed significantly Across the board, respondents view the extension activities as having contributed to increased milk production and milk quality (less rejection, also because of sanitary conditions). Calves are growing faster and reaching maturity at an earlier age; calving intervals have also reduced, as has the age of fertility; Where good management and housing practices have been put in place, the problem of diseases has reduced Knowledge of dairy farming as a business (costs and returns) has also improved Farmers are shifting from a crop-based farming system to a mixed (dairy + crop) based farming system Milk sales have increased	Provision of inputs by the project was perceived to be insufficient in quantity by a number of actors. Some respondents felt that the EDGET project should reach out to a larger number of beneficiaries. Some farmers don't yet have cross-breed cows, limiting the relevance of some project activities. Inadequate supply of veterinary medicines was also identified as an issue by a number of actors, including both institutional actors and DFEG members. Competition of dairy with other agricultural activities - e.g. coffee farming in Aleta Wondo (DFEG members become unresponsive during coffee harvest time) - risks undermining dairy value chain activities. Farmer Training Centres were often found to lack resources and inputs, limiting their utility. One respondent noted that the EDGET model was helping to address this and that the government should learn from the SNV approach. Water scarcity was identified as an important constraint in Dangila and Machakel woredas, which impacts negatively on dairy activities (e.g. washing cows, forage production). Disease outbreaks in some cases, posed challenges and impacted on milk production and cattle health. Appropriate measures for addressing disease outbreaks are required to manage the problem when it arises.

Assessment of relevance

Developing capacity of extension providers (WLO, DA)

Overall the support to developing the capacity of public extension providers was found to be highly relevant. According to WLOs and DAs, the trainings and training material provided to them were relevant and helped them play their roles more effectively. DAs reported knowledge gains more than WLOs, whereas WLOs tended to emphasise the advantages of the extension approach promoted by the EDGET project.

Establishing and strengthening DFEGs

Given the constraints in the ability of DAs to reach their target farmers, DFEGs were found to provide a viable mechanism for reaching a larger number of farmers with improved knowledge. However, their relevance depends heavily on the demand for new information by members and the capacity and motivation of leaders to play their envisioned roles. It appears that this may vary considerably across woredas and kebeles.

Training materials

The training materials produced by the EDGET project were found to be useful and relevant. The use of illustrations was particularly appreciated. Where training materials have been translated into local languages - i.e. Amharic in Amhara and SNNPR, and Afan Oromo in Oromia - their relevance is perceived to be higher. However, some respondents noted that if there are changes to the extension approach in the future, then the materials may need to get updated again.

Overall

The relevance of the extension component may be highest in those areas that are not already relatively well-established in terms of dairy development. In some cases, farmers felt that the extension support was not very useful to them and that their primary need was support in getting access to the required inputs.

Assessment of effectiveness

Developing capacity of extension providers (WLO, DA)

While objective measures of performance for extension service providers did not form a part of this evaluation, recipients of the training interviewed through the qualitative work frequently reported gains in knowledge - both with respect to the overall dairy development approach and on specific topics.

Establishing and strengthening DFEGs

Overall, the DFEG model appears to have worked relatively well on the whole, despite the challenges and limitations discussed in the findings from the qualitative study. In particular, the introduction of the DFEG model extended the reach of DAs, allowing a far greater number of farmers to benefit from the dairy extension activities than might otherwise be possible. The evaluation team considers the inclusion of non-model farmers (i.e. not drawn from the pool of existing 'model farmers' used in the government extension system) as DFEG lead farmers to be a positive move, allowing more farmers to

play a role and helping to overcome entrenched power relations associated with existing model farmers who are often politically selected. The key constraints to effectiveness relate to weak leadership of the DFEG in some cases and a lack of motivation or willingness to share knowledge with other farmers. Gaps in the understanding of the function and purpose of the DFEGs amongst some members are also key issues in this regard.

Assessment of sustainability

Developing capacity of extension providers (WLO, DA)

The EDGET project's approach of working through and building the capacity of the well-established government extension system - i.e. through WLOs and DAs - ensures a certain degree of sustainability. The DAs constitute a long-term, paid, skilled workforce that can play a critical role in strengthening dairy development beyond the life of the project. The knowledge acquired by DAs and their access to training materials, means that they should be capable of providing extension advice beyond the life of the project.

However, a number of risks to sustainability include:

- High rates of DA turnover, excessive workload and in some cases low levels of motivation all combine to mitigate the contribution of DAs. This is a well-recognised and enduring issue in the Ethiopian context and it may be beyond the scope of the project to address.
- Some DAs do not appear to have fully embraced their roles in dairy development, which has presented a challenge to the successful implementation of activities.
- WLOs and DAs have clearly depended significantly on the SNV DEPs in order to be able to play their roles. This has not been limited only to the provision of trainings and the supply of equipment but has included direct involvement with DFEG leaders and DFEG members. This is generally the case, but particularly so where DAs have not performed as well. In some cases, DFEG members and leaders rate the DEPs as having played a much more central role in supporting them than the DAs. While this may be particularly the case where capacity of DAs is weak, it does raise risks for sustainability and scaling post-EDGET project support.

Establishing and strengthening DFEGs

While there are clearly examples of DFEGs functioning well, the overall sustainability of this model faces some significant risks. Key issues to consider include:

- A number of DFEG leaders said they would continue to play their roles if the project continues to support them (ambiguous whether this refers to material support or general coordination and backstopping support), but in some cases, they said that without support they would not continue to play their role. While WLOs and DAs generally said they would continue to provide support after the project ends, they also cited various constraints (such as budget) that might restrict their ability to provide such support.
- Incentives for DFEG leaders to play their envisioned roles appear to be weak. There appears to be little formal/direct recognition of their role amongst DFEG members and there do not appear to be any clear financial returns.

- The DFEG model hinges critically on the motivation and capacity of DFEG leaders to play their roles in facilitating knowledge exchange with and amongst DFEG members. The motivation for DFEG leaders to play their roles are mostly articulated in terms of wanting to support fellow farmers. At a more fundamental level, however, all farmers stand to benefit from an increase in the production of quality milk as this increases the overall viability of the dairy value chain.
- Where DFEG leaders are not playing their roles (or DFEGs are not found to be functional) an in-depth appraisal needs to be carried out. This may result, for example, in changes to the DFEG leadership.

Having acknowledged the risks above, in many cases DFEG leaders appear to be well-established in their communities, have enduring relationships with their neighbours and other dairy farmers in the kebele/DFEG and are motivated to support their fellow-farmers. This signals a significant level of variation in the attitudes and roles of DFEG leaders.

Key issues for consideration in a second phase

What is the long-term vision for DFEGs and DFEG leaders? Is there scope for introducing some form of rotation amongst leaders that provide other high performing dairy farmers to play the role and relieves the pressure on existing DFEG leaders? How will these groups be continuously motivated and sustained without additional project support being forthcoming?

Reliance on the DEPs. To date, SNV has had a significant field presence with a DEP posted at each project woreda. As noted above, these DEPs are frequently seen to have played a very important role, in some cases complementing DAs and in others even having to compensate for their shortcomings. If the EDGET project extension approach is to be replicated and scaled up, the viability of having such a large cadre of DEPs may come into question.

The combination of theoretical training with the provision of inputs is highlighted as a key to the success of the extension model. In the absence of an adequate supply of affordable inputs (including through the market) interest in the trainings may be limited.

Forage and forage seed production

Overview of component

The EDGET project has sought to increase the availability and use of improved and appropriate green forage to enhance milk production and quality. This has been pursued through: (1) direct provision of various types of forage seed, cuttings and splits to farmers; (2) promotion of forage crop cultivation by dairy farmers (through technical trainings and motivating farmers); (3) promotion of forage seed multiplication by individual farmers, through seed producer groups and at the Farmer Training Centre (FTC) sites. The direct provision of forage seed was accompanied by trainings on both forage development and forage seed multiplication.

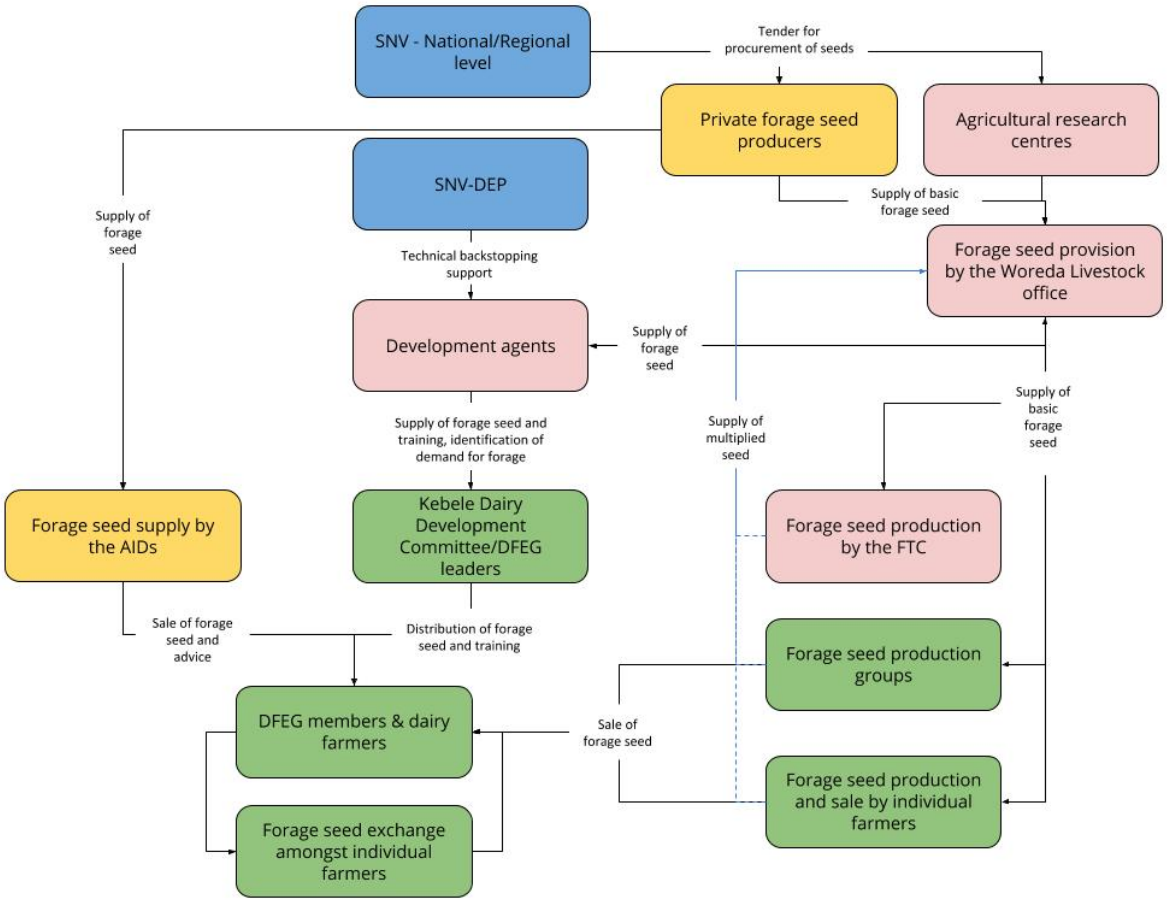

Figure 5 Actor map of the forage production and forage seed system (requires review)

Implementation: planned vs actual

The table below, based on data from EDGET project's M&E system and reports, summarises the achievement of outputs related to forage development and forage seed multiplication.

Table 14 Provision of inputs on forage development and forage seed multiplication

Output	Indicators	Target (%) achieved)	Original and (revised) target
Better quality inputs & services to targeted farmers and VC actors available	Number of Dairy HHs benefited from forage input supply support	53,950 / 83%	65,000 (65,000)
	Quantity of Dairy inputs distributed to Dairy HHs	Forage seed: 406,565 kg Cuttings & splits: 22,325,596	No targets for quantity set.

Feed and forage solutions

The EDGET project employed different strategies to address the constraints in feed and forage development in dairy production. Households were supported to grow different forage types, adopt improved feeding techniques, use supplementary concentrate and other industrial by-products and improve their feed, for example, with urea or effective microorganism (EM) treatment.

In 2014, EDGET project supported 27,693 households through free-of-charge distribution of forage seed, seedlings, cuttings and splits to grow different forage types (101% of target). As a result, households planted an estimated 1578ha of forage (SNV EDGET project Annual Report 2014).

In 2015, 40,148 households (i.e. 96% of target) were supported with forage development, planting at least two to three types of forage on 3785ha. Seed input supply was difficult for the EDGET project due to the limited number of seed suppliers, quality issues and the absence of a market based planting material supply chain. Hence, individual farmers, 10 farmer groups and 32 kebele level Farmer Training Centres were engaged for seed multiplication and the development of planting material to address the forage seed supply bottleneck.

The third round of forage development in 2016 reached 30,008 households (133% of annual target), resulting in 6,753ha covered under forage development. DFEG's took on an important role in forage development support, i.e. forage seed and splits, cutting exchange and free provision. According to SNV's own data, 80% of targeted HHs were reported able to produce at least one type of forage by the end of 2016. This represents a 47% increase on the baseline figure, resulting in the project achieving its 5-year target one year early (SNV EDGET project Annual Report 2016, Page 9). This is reported to have led to an improvement in feed supply resulted.

Additionally, SNV reported that farmers have been are able to save money previously used for buying hay and additional feed supplements; and generated new income by selling forage seeds and splits to other farmers (SNV EDGET project Annual Report 2016, P9). In 2016, EDGET project also supported 36 individual farmers, 6 farmer groups and 57 FTCs for seed multiplication.

By 2017, the EDGET project had supported the production and distribution of 406,566 kg of forage seed and 22,325,596 forage cuttings and splits.

Findings from the HH Survey:

The household survey gathered data on respondent's allocation of land, uptake of various forage development and seed multiplication activities.

Land allocation

With regard to land ownership, we see that farmers in comparison group own more total land than intervention farmers at end- but not at baseline. These differences at endline derive from different land sizes dedicated to crops. Allocation of land for forage production and grazing is the same between the groups. Over time we see a reduction in the average area of land allocated to the following categories: (1) fallow and grazing; (2) pasture; and (3) forage crop production.

Table 15 Land ownership and allocation for base- and endline data grouped by intervention and comparison group

	Baseline		**Endline**	
	Comparison (n=400)	**Intervention** (n=1200)	**Comparison** (n=220)	**Intervention** (n=432)
Average area covered by **forage production four years ago**, in ha [b]	NA	NA	0.05	0.16

	Baseline		Endline	
	Comparison (n=400)	**Intervention** (n=1200)	**Comparison** (n=220)	**Intervention** (n=432)
Average area of **homestead or backyard**, in ha	0.11	0.13	0.18	0.19
Average area of **fallow land**, in ha	0.17	0.20	0.01	0.02
Average area of **land covered by forage crops**, in ha [a]	0.07	0.19	0.06	0.09
Average area of **grazing or pasture land**, in ha [a]	0.71	0.47	0.30	0.22
Average area of **land covered by crops**, in ha [b]	1.29	1.31	2.03	1.65
Average total cultivated land, in ha [b]	**2.35**	**2.3**	**2.59**	**2.21**

[a] Significant differences in mean averages or cell distribution for baseline intervention and comparison, Chi-square test statistic or Two-sample T-Test, p<0.05

[b] Significant differences in mean averages or cell distribution for endline intervention and comparison, Chi-square test statistic or Two-sample T-Test, p<0.05

Regarding forage crop production, this decrease over time for the intervention group is consistent when comparing data from baseline to endline, but also when comparing perception of respondent as to 'Average area covered by forage production four years ago'. Please note that we are not able to calculate statistical differences for effects between base- and endline. Investigating this issue further, we looked at the number of households who actually said they cultivated forage crops. We compared percentages between 'Average area covered by forage production four years ago' and growing forage crops now.

Figure 6 shows that for intervention vs comparison group the percentage of respondents growing forage crops is 33% vs. 23%. When asked about cultivation of forage crops four years ago, the percentages are 20% vs. 13.2% respectively. The data shows an increasing trend in forage cultivation for both groups.

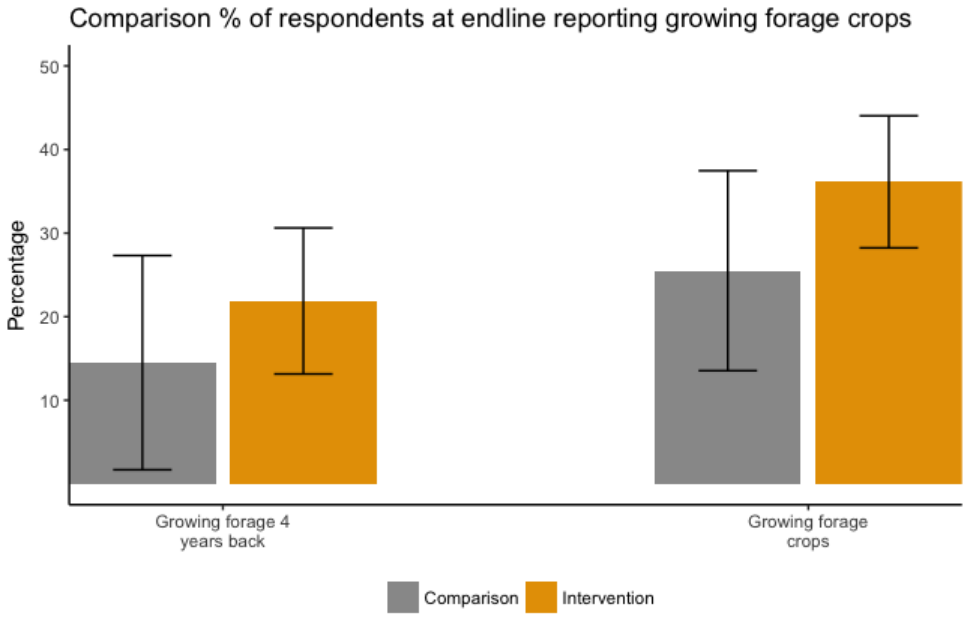

Figure 6 Bar-plot with interval estimate of population proportions (CI 95%) for proportion of farmers allocation land to forage production now and four years back

Forage production

The survey found that 47.2% of intervention group households were producing forage legumes and grasses during the last 12 months, compared to 40% in the comparison group (statistically significant at the 90% level). 27.5% of intervention group households reported engaging in backyard forage production, compared to 18.2% in the comparison group (statistically significant at the 5% level).

Of the 47.2% of intervention group households involved in forage production, 32.4% of were found to be producing more than one variety, 14.6% more than two varieties and 2.3% producing more than 3 varieties. While the baseline did not include data on the number of farmers growing more than 2 or 3 varieties, the results for farmers growing more than 1 forage crop shows a significant change between baseline and endline from 6.5% to 32.4% in intervention woredas and from 6.4% to 20% for comparison woredas. This suggests that the project has contributed to increased diversification of forage production.

Table 16 Overview of adoption of feeding practices[20]

	Baseline		**Endline**	
	Comparison (n=400)	**Intervention** (n=1200)	**Comparison** (n=220)	**Intervention** (n=432)
% of households engaged in farmer-to-farmer seeds exchange [b]			0.0%	9.3%

[20] Please note that baseline measures were not asked in the same way as in endline and comparisons over time are hence difficult.

	Baseline		Endline	
	Comparison (n=400)	**Intervention** (n=1200)	**Comparison** (n=220)	**Intervention** (n=432)
% of households engaged in forage seed multiplication [b]			3.2%	19.4%
% of households engaged in forage seed production [b]			8.6%	32.6%
% of households growing at least 1 forage crop	23.0%	47.1%	40.0%	47.2%
% of households growing more than 1 forage crop	6.41%	6.5%	20%	32.4%
% of households growing more than 2 forage crops			5.5%	14.6%
% of households growing more than 3 forage crops			2.7%	2.3%

[b] Significant differences in mean averages or cell distribution for endline intervention and comparison, Chi-square test statistic or Two-sample T-Test, p<0.05

Forage seed production

In terms of forage seed production, 19% of households in the intervention group were found to be involved in seed production, compared to just 3.2% in the comparison group. While the practice of farmer-to-farmer seed exchange was not observed at all in the comparison woredas, 9% of households surveyed in the intervention woredas reported engaging in this practice.

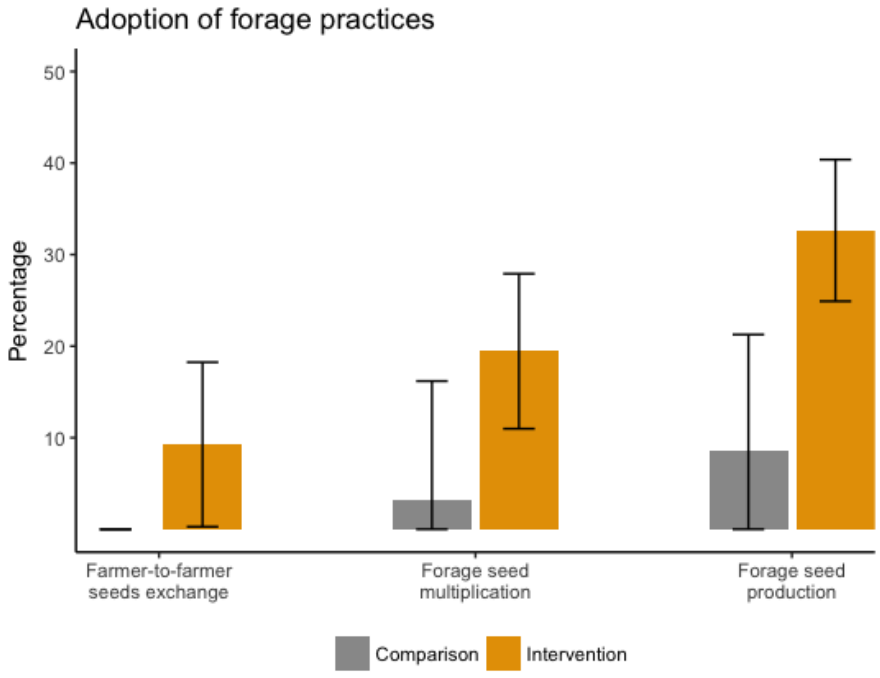

Figure 7 Bar-plot with interval estimate of population proportions (CI 95%) for adoption of forage seed production practices in comparison and intervention group

As shown in Table 12, 32.6% of households in the intervention woredas reported receiving forage seed at least once in the past four years, compared to 13.9% in the comparison group. There were some

notable differences between intervention and comparison group households in terms of the source of forage seeds. Intervention group households involved in forage seed production, were more likely to report AgIDs as a source of forage seed (24.1%) than in the comparison group (0% reported AgIDs). However, for both groups, own production (36.5% to 43.7%) and government agents[21] (31.1% to 46.8%) were the most common sources of forage seed. 2.5% of farmers reported getting their forage seed from a cooperative or farmer group in the intervention woredas compared to 0% in the comparison woreda. Private dealers were reported as the source for around 5% of households in both groups.

In order to better understand the project contribution, respondents were asked to report the number of years that they had adopted each of the above practices. Respondents were most likely to cite 2 or 3 years ago, which coincides with the project period and suggests the project played a role in promoting these practices.

When asked about perceived changes in forage seed production, households in the intervention group were more likely to report an increase over the last 4 years (52.6%) than households in the comparison group (36.8%).

Households from the comparison group did not report earning any income from the sale of forage seed, improved forage or natural grass/pasture. Only 11 households, i.e. less than 3%, from the intervention group did. The average income earned from selling forage seed (n=1), improved forage (n=5) or natural grass / pasture (n=5) for these 11 households, is 2951.5 Birr. There is a great variation in the average earnings from each of these sources.

Findings from qualitative assessment by sub-component

The table below presents the findings from the qualitative assessment by sub-component. Unless specific woredas are state the positive and negative findings are generalised across all the woredas.

[21] The questionnaire did not distinguish whether the inputs provided by government agents were from the EDGET project or somewhere else.

Table 17 Qualitative findings on the forage production and seed system

Sub-component	Strengths	Weaknesses
Forage seed distribution and training	Forage seed distribution was successful. Farmers received different varieties of forage seed (Desho grass, elephant grass, mulato, alfalfa) and used them to produce forage. The varieties were generally perceived (e.g. by the woreda livestock office in Lemu Bilbilo) to be appropriate as per the agro-ecological zone. Varieties such as Desho grass were also appreciated for their ability to be grown year-round (provided moisture is available). Trainings were also provided on forage development and these were well received. All stakeholders appreciated the combination of the training with the provision of inputs. In a number of woredas, respondents noted in particular the willingness of farmers to use the new seed varieties, perhaps signalling a higher than usual readiness of farmers to adopt/trial new varieties. Overall the project is seen as having led to increased forage seed availability and forage production, although in Wuchale there appears to be some question regarding the project's contribution to this. Farmers have been exchanging forage seed with each other to secure access to a sufficient diversity of forage types. This happens either one or two times per year (e.g. Aleta Wondo and Dangila). This appears to be a relatively new practice that is gradually gaining acceptance. Initially through training and then subsequently through direct observation and experience sharing, farmers recognise the value of producing and providing appropriate varieties of forage to their cows, particularly in terms of increased quantity and quality of milk production. Moreover, the forage varieties were found to be palatable for calves as well as cows. In addition to milk production, improved forage was seen as a contributor to an earlier age of fertility for cows and reduction in disease. As a result farmers are more eager to continue producing forage on their land and to feed it to their cows. For some farmers, seed production has also become an income generating activity, as they are able to sell seeds to other farmers. In Machakel woreda, forage production was seen as one of the most successful components of the project, and a trend in shifting land allocation from crop production to forage production was also noted by some respondents. The increased allocation of land to forage production was also highlighted in all woredas, although there appears to be some variation across farmers. The increased forage development is also seen as a positive trend with respect to enabling farmers to shift to a zero-grazing model for feeding their livestock. In Lemu Bilbilo, the practice of drying and storing forage appears to have been	Although there have been clear positive developments related to forage production, the key challenge - reported across all woredas - is related to the availability of seed. In some cases, this was framed in terms of the total quantity of seed distributed by the project (e.g. Aleta Wondo), the project not continuing to supply improved seed varieties (e.g. Dangila, Machakel) or the unavailability of seeds in general (e.g. Machakel, Wuchale). The lack of sustained seed supply availability has created a constraint to forage production by farmers. This is exacerbated by the fact that farmers do not always keep seeds for replanting (despite being trained on this). Rather they continue to expect that new seeds will be provided by the government or the project. As a result of constraints in the availability of forage seed, some farmers (e.g. Dangila and Machakel) have reported challenges in providing their cows with adequate forage. This was reported to have led to a reduction in milk production and associated income. While farmers are engaging in the exchange of seed, some did not see this practice as a long-term solution. Resource constraints were also highlighted as an issue when it comes to forage production, particularly land and water (e.g. Dangila, Machakel) In Wuchale and Lemu Bilbilo woredas, the suitability of the seeds to the local agro-ecology was raised. In Wuchale, in particular, cold weather and the requirement for continuous moisture availability led to forage crops dying. In other cases (e.g. Lemu Bilbilo and Machakel), farmers highlighted a lack of availability of sufficient varieties of seed and challenges faced particularly during the dry season. In one of the kebeles in Wuchale, members from one of the surveyed DFEGs (the majority of whom had joined in 2017) reported that work on forage had not yet been carried out. They noted that the woreda livestock office had done some work but that it remained theoretical and hard to access as woreda officials did not come to the Kebele. In this woreda, the lack of available seed and limited suitability of the variety has meant that farmers have not continued with forage production. Another DFEG from the same woreda, reported that forage seeds had been introduced but were not well suited to the local conditions and were no longer available. In Lemu Bilbilo one respondent noted that seeds had been provided by the DA to non-target farmers. The DA also noted that the seed did not perform well and that this had created some resistance from farmers. In the same woreda the Woreda Livestock Office reported that melilotus had been incorrectly distributed as alfalfa. Some DFEG members also felt that DFEG leaders had not provided a sufficient quantity of seed to their members.

Sub-component	Strengths	Weaknesses
	taken up.	In areas where there is a good market for non-forage crops - e.g. barley for beer or potatoes for the local market - farmers interest in allocating land to forage is limited. Forage preservation for dry seasons has proven to be challenging, with limited adoption in some cases. According to some of the regional input suppliers, farmers' demand for forage seed on the market is undermined by the fact that free/subsidized materials are provided by NGOs and government projects.
Forage seed multiplication	In some cases (e.g. Lemu Bilbilo, Machakel), FTCs have been engaged in allocating land for forage seed multiplication. This is seen as having contributed to an improvement in the availability of forage seeds. However, it appears that in Lemu Bilbilo, while forage seeds were multiplied in 2016, this was not the case in 2017 as a result of crop-rotation practice at the FTC site.	Continuity in the production of forage seed by FTCs has proved to be an issue as (a) the FTC sites compete with other kinds of (non-dairy) demonstration activities; (b) crop rotation is practiced so fodder crop cultivation gets discontinued. More generally, the market for forage seed remains very underdeveloped.

Assessment of relevance

The forage seed and forage development component has a critical role to play in the dairy production system. Thanks to project activities, there is growing and relatively widespread recognition across value chain actors of the contribution that feeding appropriate types of forage can play, particularly in relation to increasing the quantity and quality of milk.

Assessment of effectiveness

There are relatively successful cases of forage seed development through FTCs and through farmers themselves. In the case of FTCs, institutional, financial and manpower limitations curbs the viability of the approach at scale - and while this approach may be useful for demonstration purposes, it is unlikely that it can adequately address the demand. The practice of farmers themselves multiplying, exchanging and selling seed, either individually or through seed multiplication groups, holds promise and is contributing to the availability of forage seed. However, for these farmers and their groups who are involved in producing forage seed, access to quality seed will be essential for them to be able to replenish the genetic stock of their forage seed over multiple years.

Assessment of sustainability

Overall the establishment of a sustainable forage production system is premised on a number of key elements:

1. Continuous supply of improved/certified forage seeds appropriate to the agro-ecological conditions for decentralised multiplication. This is the primary bottleneck since the supply of forage seeds is the primary constraint to production.
2. Demand for forage from dairy farmers. This appears to be well established since the project has enhanced dairy farmers' appreciation of the benefits of providing forage to cattle, through both trainings and exchange visits and reflections on experience.
3. Capacity and motivation to produce and/or buy forage amongst farmers. This is seen to be on an upward trend. Farmers have produced forage from the seed provided to them, often allocating land that was formerly used for food crop production to forage cultivation.
4. Functional systems for forage seed multiplication, whether through FTCs, individual farmers, seed producer groups or other commercial setups:
    - FTCs face institutional barriers (e.g. competing pressures with other land uses, crop rotation), that may limit their viability as seed multiplication sites.
    - Farmers face land and water constraints, limiting production capacity

Considering the above, the overall sustainability of the forage component remains in question. While significant progress has been made and the model of farmer/group based multiplication appears to be a successful model of addressing green forage supply constraints in the short term(provided farmers have access to seed, land and water) a larger scale solution will be required to create a sustainable system for forage seed.

Key issues for consideration in a second phase

However, to date, the forage production system, including the production, distribution/sale/exchange and uptake of forage seeds has some critical bottlenecks that limit the extent to which the full benefit of improved forage varieties is being realised. This in turn places limits on the further development of the dairy value chain. These barriers will need to be overcome in order for further development of the dairy value chain to function and to be sustained. In Dangila, the DPU is considering playing a more proactive role in forage seed production.

Other key issues to consider include:

- Focus on the supply of forage seeds and the diversification of models for producing it affordably
- The cost of forage seed/forage production can be prohibitive for some farmers
- Continue existing activities related to forage multiplication and increase the scale of them
- Consider how to enhance forage cultivation in the overall land use and natural resource planning processes in the Kebele

Agro Input Dealers

Overview of component

The EDGET project has sought to support the establishment and/or strengthening of Agro Input Dealers in order to increase the supply of quality, affordable dairy farming inputs for smallholder farmers. The AgIDs could be private businesses or cooperatives and could be new agencies or existing ones. The project invited proposals from interested parties and used these to select suitable candidates. Support provided to the AgIDs include trainings and guidelines, the provision of equipment and materials, exposure visits and business to business linkages. By routing the supply of key inputs (e.g. calf feed) and equipment (e.g. the MTS) through the AgIDs, the project sought to help AgIDs to establish their networks and distribution channels in order to reach farmers.

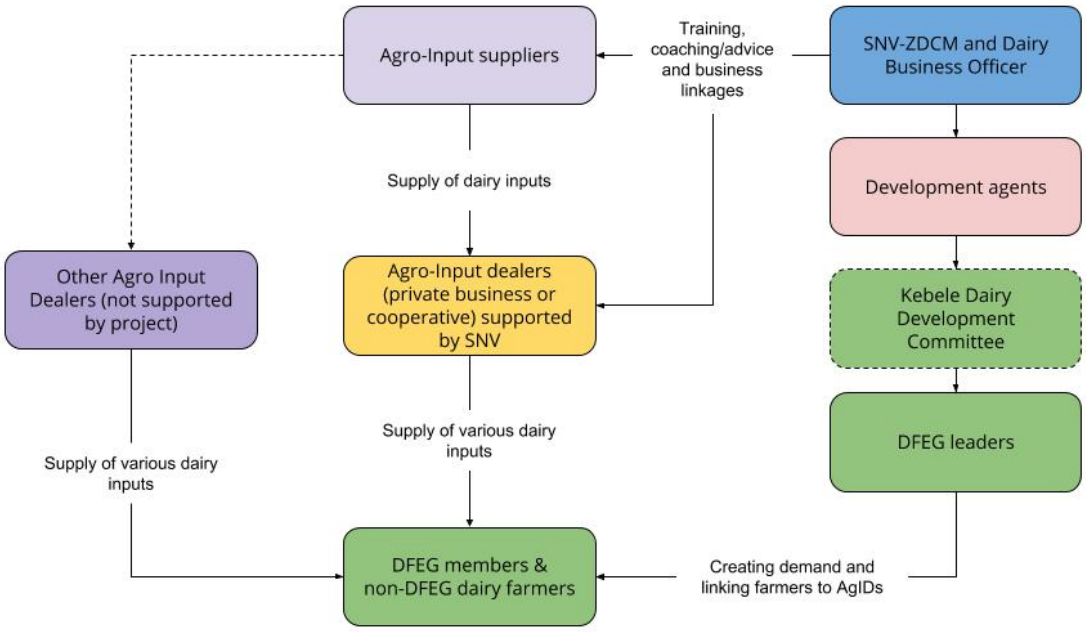

Figure 8 Actor map of the Agro Input Dealer system

Implementation: planned vs actual

Table 18 Agro Input Dealers

Output	Indicator	Achievement of target (as %)	Revised target (original target)
Better quality inputs & services to targeted farmers and VC actors available	Number of Input suppliers/dealers supported/strengthened	50 (98%)	51 (51)

Agro-Input Dealers

In order to create a sustainable solution to addressing the shortage of quality and affordable dairy inputs, the EDGET project supported a total 50 Agro Input Dealers (AgIDs). Suitable AgIDs were identified in 2014, and their capacity was built through various types of trainings, material support (e.g. display tables, shelves, signboard and uniforms), business advice/coaching and the facilitation of business to business linkages. 51 AgIDs were selected in 2015, one of which withdrew in 2016. The selection of one AgID in Gozamn woreda was cancelled since there were irregularities in the selection procedure and the project could not identify a suitable replacement.

As part of the business linkage support, the project facilitated Business to Business (B2B) networking events (also at national level in 2017) between AgIDs, national and regional dairy input suppliers, and microfinance institutions (MFIs). Reportedly, MFIs showed an interest in developing a credit facility for AgIDs.

AgIDs also served as an important mechanism for providing farmers with access to key inputs, such as forage seed and calf feed (neither of which were widely utilised in the project target area). By working through AgIDs, the EDGET project helped the AgIDs to establish relationships with farmers and build their distribution networks while also providing access to key inputs. After establishing linkages with suppliers, the EDGET project introduced a pro-poor voucher system for supplementary calf feed, the Milk Transportation Systems (MTS), forage seeds and other inputs (see Table 12 for details). The vouchers were supposed to incentivise and subsidize risk-averse farmers to try out and adopt new technologies and practices. AgIDs received commission from the EDGET project for providing inputs to farmers, redeemable upon submission of the vouchers. Details on the MTS and calf feed are discussed below, whereas forage seed distribution was covered in the previous section on the forage production system.

Milk Transportation System (MTS)

In 2013, EDGET project secured a sub-licensing agreement to manufacture 500,000 units of MTS (locally referred to as 'Mazzican') - a high quality food grade plastic container with lid, filter and measurement gauge - to improve the hygienic collection and transportation of milk for farmers. Universal Plastics in Addis Ababa was contracted in 2014 and received an up-front payment by SNV EDGET project to buy a machine that could produce the cans. It was not until 2016 that 26,271 MTSs were produced and distributed through AgIDs to the target households. Non-project households expressed interest in MTS as well. As a consequence and to create additional demand for the MTS, 35,000 units were to be distributed to non-targeted farmers as well. By 2017, a total of 95,000 MTS were distributed (95% of the new target).

The delay in production and distribution of MTS during the first years of the project were related to several challenges for the producer Universal Plastics. These include a shortage of foreign currency for buying the appropriate machinery and raw materials from international markets, secure timely technical input from an Italian company for the newly acquired machinery, as well as frequent electric power cuts.

Interview data suggests that the Mazzican is a high-quality product fulfilling quality standards and perceived as such by companies when exhibited. But for farmers, the benefits may not be quite so obvious. The MTS quality comes with a higher price (e.g. compared to simple buckets or cans which cost a fourth of the MTS) and at a weight of 900g. Especially, the lid of the MTS was said to be too large and may require adjustment in future prototypes. As a result – as reported by Universal Plastics – the current product would be difficult to sell on the market and therefore relies on government/project support for ongoing production and distribution.

Feed supplement strategy

Under the aforementioned scheme to use AgIDs as a distribution system for calf feed, AgIDs distributed the calf feed they received from suppliers to households with female cross-breed calves in exchange for vouchers. EDGET project extension staff, DAs and AgIDs were trained on assessing conditions of calves, ear tag applications, and other topics to be able to identify eligible calves for

supplementary feed. Households then received vouchers for feed supplements promoting also the linkage between the dairy farmers and the agro-input dealer in the woreda.

In 2016, 13,755 households received 70-100 kg supplementary feed per calf for a total of 16,492 calves. DAs and DEPs carried out weekly calf girth and height measurements subsequent to the calf feed distribution. This was reported by SNV to have demonstrated that the use of supplementary calf feed had brought fast growth and improved health and body condition and, thereby, to have changed the perception amongst dairy farmers of the value of proper calf feeding and management practices. An informal survey carried out by the project found that the age at which female calves were ready for their 1st AI service had reduced from around 24-36 months to 14-18 months (SNV EDGET project Annual Report 2016, P10).

The EDGET project faced some delays with regard to the distribution of supplementary calf feed, missing the target of 32,500 households for 2015. The delay, due to the process of mapping supply and demand of calf feed in early 2015, entailed inventarising crossbred calves at the household level, and then identifying calf feed suppliers through a tendering process. Calf feed was then distributed through the network of AgIDs starting in early 2016. By 2017, the EDGET project had supported the distribution of 14,176 quintal of calf feed to 14,683 households (30% of original target). In addition to the delays in 2015, the higher than expected cost of calf feed in 2017 also meant that coverage had to be scaled back

Findings from the HH Survey:

A series of questions were included in the household survey focusing specifically on calf feed. 78% of respondents in the intervention group reported owning calves compared to 68.6% in the comparison group. Of these a total of 27.9% of intervention group farmers reported that they had ever used supplementary calf feed, compared to 9.3% in the comparison group. Farmers who used the calf feed in both groups mostly reported that this had a very positive change (67.9% across both groups), followed by an unsatisfactory change (29.5%). 78% of farmers in the intervention group reported that they planned to continue using supplementary calf feed, compared to 66.7% in the comparison group. When those who did not plan to continue were asked to provide reasons for this, statistically significant differences in the distribution of responses were observed. Amongst the intervention group, respondents were more likely than their comparison group counterparts to cite lack of money (30.9% vs 22.9%) and waiting for free supply (14.7% vs 7.6%). On the other hand, they were less likely to report lack of information (17.4% vs 32.5%).

Findings from qualitative assessment by sub-component

Table 19 Qualitative findings on Agro Input Dealers

Sub-component	Strengths	Weaknesses
Selection and capacity development of AgIDs	SNV has provided support to various types of AgID, including existing businesses, new businesses and cooperatives. SNV's support included technical training (on running a business and bookkeeping; paying commission for the distribution of calf-feed and equipment (MTS); and providing some basic equipment (e.g. shelves). This support was perceived by AgIDs to have led to: • Better management of the business in terms of inventory, bookkeeping, and shop organisation • More hygienic handling of animal feed • Ability to pay rent (e.g. thanks to commission from EDGET project) • Introduction to suppliers and enhanced bargaining power • Ability to assess quality of inputs and ensure quality of produce • Technical knowledge regarding cow feed and associated practices, which enabled AgIDs to provide technical advice to farmers • Support to diversification of forage supply This in turn is seen to have contributed to increased profitability (see following section). From KII of DAB DRT national / regional stakeholders (Altaseb Mekbib Feed supplier): Calf-feed and MTS can be stored for a long time in our store, without relying too much on framers collect the inputs on time. In case of SNV, staff were perceived to be very efficient in their performance because they are directly located in the woreda to facilitate and support stakeholders. This is a much better model than other NGOs who just remain in Addis.	One of the larger feed suppliers commented that there may have been issues with the selection of AgIDs , as some of those they liaised with appeared to be lacking in the needed financial capacity and business acumen. Commission AgIDs get for supply of inputs to farmers is too low (Wuchale) At least one of the AgIDs reportedly developed a dependency on EDGET, expecting that they would continue to receive commission from supplying project inputs to beneficiaries and discontinuing the supply of calf feed after project support.
Linkages with regional feed suppliers	EDGET project supported the establishment of business to business (B2B) linkages through introductions and through networking events with agro input processors/suppliers and exposure visits for AgIDs. All three of the regional feed suppliers interviewed reported increased sales due to linkages with producers and AgIDs and the increased level of demand at the farmer level resulting from trainings and awareness raising activities carried out through EDGET project. They also cited the increase in the number of AgIDs (due to EDGET project support) as contributing to this growth in business. This	Delays were faced in the distribution of calf feed. One of the feed suppliers felt that the AgID selection had some issues as some of them were quite weak on business and financial management. Increases in prices are driven by increases in the prices of raw materials. One of the feed suppliers cited a number of challenges. These were related to: • Shortage of raw materials

Sub-component	Strengths	Weaknesses
	also led to an increased in the number of agents working for them. One of the suppliers reported that 'the whole of Sidama and Gedo zones have become my agents'. Another reported "upstream we were linked with feed processors and downstream to producers. We are now also known in the Woreda and in other regions in Ethiopia, like Tigray and Oromia. This a good opportunity for the future expansion of our business." One of the feed suppliers reported an increased in the number of staff. One of the interviewed feed suppliers reported that their sales of other (non-dairy) livestock feed (e.g. for cattle fattening and poultry) via the EDGET project supported AgIDs had increased. Both of the interviewed suppliers reported that the B2B linkage meetings were very useful for getting to know the other stockholders. One of the regional feed suppliers reported that the businesses would be affected by the closure of the project, they felt confident that sufficient demand had been created to keep the business profitable. There are NGOs involved in dairy working with us, EDGET project is unique in creating market linkage with producers and AgID.	• Quality of raw materials is poor • Increase of price of raw materials • Shortage of foreign currency for import of premix One of the feed suppliers reported that there could be a risk to the business if the project stops, since the same level of demand may not be maintained in the absence of the same scale and intensity of project activities. Another reported delays in the collection of MTS and calf feed. Decline in the demand for forage seed was also reported, though no reason was cited.
AgID operations	As presented above, the five EDGET project-supported AgIDs reported benefiting from their involvement in the EDGET project. For the most part, they appear to have successfully expanded their scale of operations and the range of inputs that they provide. Overall, the AgIDs feel that farmers are happy with the products they are selling (note that this view i not always shared by farmers and other actors). According to secondary data gathered from the AgIDs, three of the five AgIDs reported an increase in the quantity of calf feed concentrate sold after EDGET project support. Four of the AgIDs reported an increased in the number of farmers coming to buy calf feed after EDGET project support. Dairy related inputs are the main source of revenue for four of the AgIDs, while for one (Lemu Bilbilo) it is crop related inputs. The AgID in Machakel is also involved in buying milk, which is proving to be a profitable business for them. All of the AgIDs recruited additional staff during the project period. Some of the key benefits reported by other stakeholders related to the AgIDs and their services are summarised below: ● There is greater availability of forage/feed at the kebele level; but is also accessible to farmers who can go directly to the shop. ● The AgID shop is open more and they are providing increased quality, range and quantity of inputs (e.g. including ureas and	In some cases, price, quality and variety of feed supplied by the AgIDs are not perceived positively by some actors (DAs, DEPs, DFEG members). More generally, however, the price of feed is often perceived to be quite high for some farmers (E.g. Machakel, Lemu Bilbilo, Dangila), particularly when considered in relation to the price of milk. Increases in the prices charged by the raw input suppliers and the agro-dealers contributes to this (e.g. Lemu Bilbilo). At times, specific feed/inputs sought by farmers - e.g. molasses, calf feed, etc. - are not available with the AgID. In some cases (e.g. Dangila) it was reported that the demand from farmers is somewhat weak or that some farmers do not buy their forage from the EDGET-supported AgID (Machakel). In many cases, farmers continue to rely on non-EDGET private feed providers and traders. Although they often provide door-stop service and their products are relatively cheap, the quality of the feed is generally perceived to be quite poor. Transportation of feed to farmers, particularly those living far away from the AgID shop can be an issue in some cases (e.g. Lemu Bilbilo). In Machakel, coverage by the SNV-supported AgID was seen to be weak. Some respondents reported that certain AgIDs were not strictly following the SNV/EDGET project guidelines - e.g. regarding warehouse, shelving and storage (e.g. Lemu Bilbilo, feed production, Dangila). This is seen as having a negative impact on the quality of the feed mixes which has financial and potentially reputational

Sub-component	Strengths	Weaknesses
	molasses) ● The AgID provides feed on credit ● In some cases the AgIDs are not only providing feed but also technical advice to farmers on use of the feed. ● The availability of improved forage/feed has also led to an increase in the practice of stall feeding and zero-grazing DFEG leaders reported satisfaction with the availability of feed. The introduction of calf-feed has also been an important innovation. There are also a number of other providers of forage/feed, including concentrate, molasses, urea, etc., operating in the woredas who are not supported by EDGET.	implications for the AgIDs. For example, the AID in Dangila reported losing money as a result of having to dispose of damaged feed. A number of AgIDs also noted that high taxes limit the margins that AgIDs can make. Other issues noted by project staff include the high rental cost of the shop used by the AgID and instances of non-targeted farmers trying to take concentrate calf feed that was targeted for DFEG members.

Assessment of relevance

Feed supply is a primary constraint for dairy farmers and the dairy value chain, being one of the key determinants of milk production in milking cows and having strong linkages with calf development and the age at which calves become fertile. The prevailing context in terms of feed supply can be characterised by low end traders with cheaper products that are widely perceived to be of poor quality and high end suppliers with good products that are prohibitively expensive for small-scale farmers. As such, the AgID component appears to fill a gap in the market by providing better quality feed (than the traders) at a more affordable price (than the established, high end feed businesses - such as Alema Koudijs).

Assessment of effectiveness

The EDGET project appears to have been quite effective in the establishment and further development of AgIDs, using a variety of appropriate interventions to achieve this.

- Business to business linkages - all the AgIDs interviewed found the B2B networking events to be a very useful means of striking business deals with suppliers of raw materials at competitive prices. In some cases, groups of AgIDs operating in similar geographies are reported to have collaborated to secure deliveries of inputs at even more competitive prices. This approach to networking emerges as a strong, market-based (i.e. facilitative) means of strengthening the input supply of the dairy value chain.
- Technical and business trainings were also perceived positively by the AIDs who received them. They reported increased ability to manage their stocks, handle feed properly, organise their shops better, and to run their business more effectively (including through improved record keeping).
- AgIDs as a distribution channel (establishing a relationship with customers and a distribution network)

All of the AgIDs interviewed reported that their businesses were growing successfully in terms of scale of production, expanding customer base and profitability. They envision growing demand for their inputs in the future following the further development of the dairy value chain (increased prevalence of cross-breeds, growing appreciation of dairy as a viable farm business/livelihood option, etc.).

However, a set of key issues related to either actual or perceived problems with the quality, price, variety and availability of inputs provided by agro-input dealers do indicate some limitations in the extent to which the AgIDs are proving to be an effective mechanism for meeting the demand for sufficient quantity, quality and diversity of feed. Other constraints to further business development will also need to be considered

Assessment of sustainability

The market-based nature of this component and the considerable success that has been achieved to date bodes well for the sustainability of this approach. With market-based interventions it is important to recall that market dynamics can be unpredictable and that while the success or failure of individual

businesses may vary considerably, the long-term concern is with the establishment of functional and dynamic markets that are able to adapt in order to respond to changing circumstances and the nature and pattern of demand.

Overall the AgID component appears to hold considerable potential in terms of sustainability.

- Evidence illustrates a viable business proposition for SMEs to fill a genuine gap (between traders and larger, well-established providers) in the market for feed.
- B2B networking is a proven low-cost sustainable approach to fostering market development.
- AgIDs are innovating, adding additional product lines (e.g. forage seed) and service offerings (e.g. milk collection) to their businesses which bodes well.

Key issues for consideration in a second phase

- Longer-term dynamics within the feed market. While the support to individual AgIDs through the project has been commendable in demonstrating the viability of SME-type AgIDs focused on the dairy sector in the target geographies, this approach may not prove viable for EDGET at scale. As such, it would be useful for EDGET to understand the main barriers and incentives to entry and growth for new and existing AgIDs and to focus on creating the conditions that will enable AgIDs that serve the dairy sector to multiply and thrive.
- Key constraints to further business development, particularly access to finance/credit were raised in a number of cases. This limits the ability of AgIDs to upgrade their warehouses for safe storage of feeds and for increasing the capacity of the warehouse. In the future further efforts may be required to facilitate access to finance/credit.
- Getting the pricing right continues to present a challenge as DFEG members frequently cited high prices as a barrier to purchasing more feed.
- Farmers are frequently concerned that they do not have access to quality feed. Activating the government's role in checking quality and price of feed products (for example, through a certification system) could play an important role in managing issues of mistrust in the feed sector.
- In addition to the above, the existing suite of activities targeting AgIDs – particularly business to business linkages and technical trainings should be continued. If it does not already exist, then an industry/commercial association of dairy-focused AgIDs and Agro Input Suppliers could also be established for broader governance and development of the sector.

Household adoption of inputs and practices

Drawing on evidence from the household survey, this section presents key differences between the intervention and comparison groups at the endline. Comparison with baseline data was only done for selected practices in this section where we are able to use the same question structure as the baseline or else transform the baseline data in a manner suitable for comparison. Where a comparison with baseline data is not possible, data on 'from whom did you learn this practice', and 'since when have you adopted this practice' are used to infer the project contribution.

Improved forage and animal feed

Differences in the **use of different types of animal feed** were, however, much less pronounced. Hay (80%), crop residue (64-71%) are the most used improved feeds, followed by by-products of cereals and oil seeds (25%). Multi-nutrient blocks, molasses, mixture of forage or cereal brans are used by less than 12% respectively. However, statistically significant differences were only found between the groups in the use of forage crops.

The EDGET project sought to bring about changes in the **feeding practices** including zero-grazing feeding for cross-bred and local cows, use of a cut and carry system for feed, concentrate supplements for pregnant and milking cows, and similar practices. For intervention group farmers with crossbred cows (n_{comp}= 164, n_{inter}= 387) the adoption rate of zero-grazing is marginally less than for comparison group farmers (19% vs 26%). However, intervention group farmers were marginally more likely to practice mainly grazing with some stall feeding (24% vs 16%). Around 15% in both groups reported only grazing for their crossbred cows.

Looking however into the reasons given for the adoption of zero-grazing, we can ascertain that different feeding practices more often derive from training (referring mainly to trainings from AgIDs and/or cooperatives supported by SNV/EDGET) and to a much lesser extent personal experience. For comparison group farmers it is the other way around - personal experience is cited much more frequently than training received.

Table 20 Overview of adoption of feeding practices[22]

	Baseline		**Endline**	
	Comparison (n=400)	**Intervention** (n=1200)	**Comparison** (n=220)	**Intervention** (n=432)
% of households adopting zero grazing (cross-bred cows)[b]			25.6%	18.9%
% households using cut and carry system for feed [a]	79.4%	95.9%	56.6%	61.6%
% of households using concentrate supplements for your pregnant and milking cows and heifers [a]	25.3%	49.9%	22.3%	29.7%
% of households preparing your own improved feeds such as urea straw treatment, silage, multi-nutrient block [b]		-	11.6%	25.6%
% of households varying the feeding depending on stage of lactation [a, b]	61.2%	43.4%	20.2%	34.9%
% of households monitoring cows' production [a]	67.1%	51.1%	23.3%	31.4%
% of households providing enough water to cattle [a]	92.1%	96.8%	58.4%	66.3%

[a] Significant differences in mean averages or cell distribution for baseline intervention and comparison, Chi-square test statistic or Two-sample T-Test, p<0.05

[b] Significant differences in mean averages or cell distribution for endline intervention and comparison, Chi-square test statistic or Two-sample T-Test, p<0.05

[22] Please note that baseline measures were not asked in the same way as in endline and comparisons over time are hence difficult.

With regard to other feeding practices, the most widely used practices are cut and carry systems (57% comparison vs. 62% intervention) and providing enough water for cattle (58% comparison vs. 66% intervention). Table 20 shows that significant differences between intervention and comparison group farmers exist only for 'own improved feed preparation' (12% comparison vs. 26% intervention) and 'varying feeding depending on lactation' (20% comparison vs. 35% intervention). Adoption rates for these practices are higher amongst households in the intervention group than in the comparison group (see Figure 9).

Respondents were asked to report the number of years that they had been adopting each practice. The average number of years of adoption was 3 years for 'own improved feed preparation' and over 4 years for 'varying feeding depending on lactation' for both comparison and intervention groups. Looking at Figure 10 we see that 3 years followed by 2 years is most frequently mentioned for both practices. This suggests that the main cause for these changes lies within the project period.

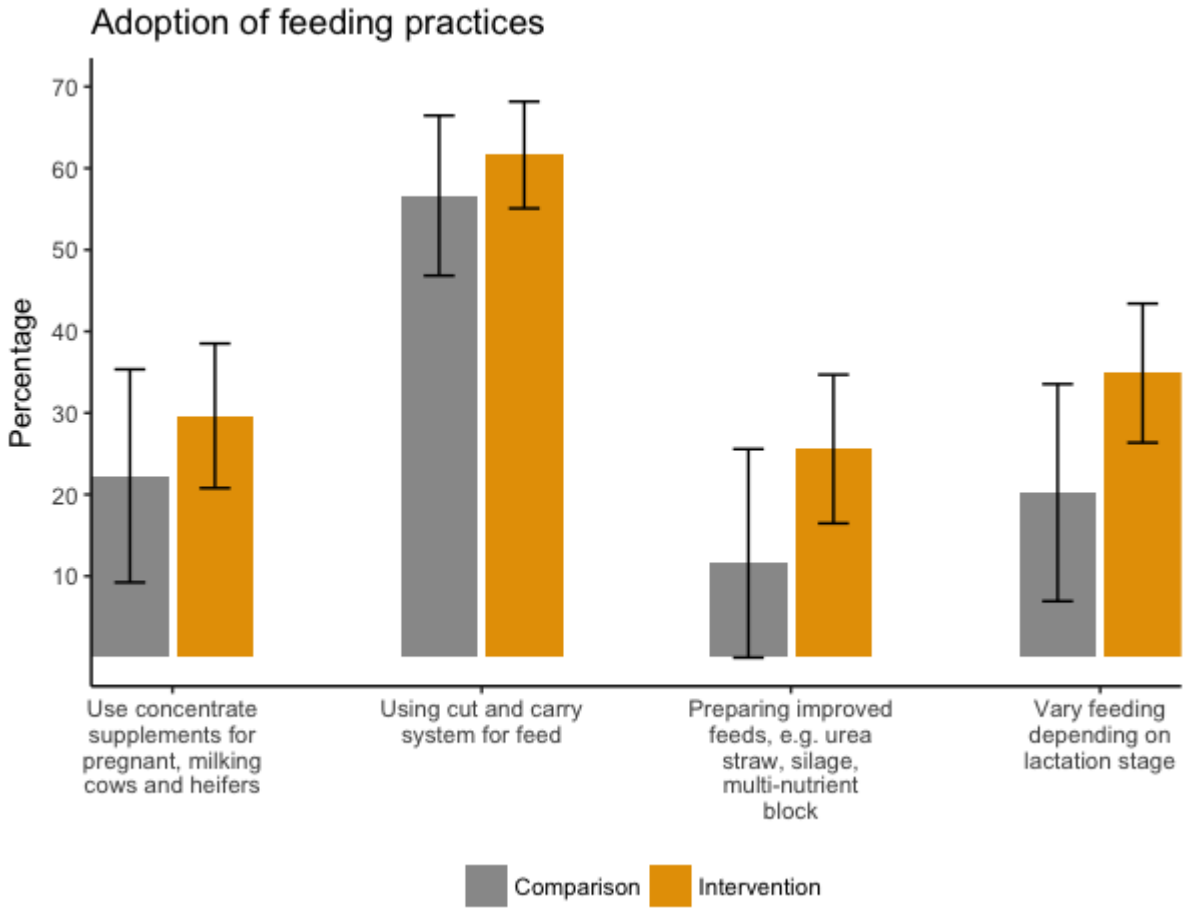

Figure 9 Bar-plot with interval estimate of population proportions (CI 95%) for adoption of feeding practices in comparison and intervention group

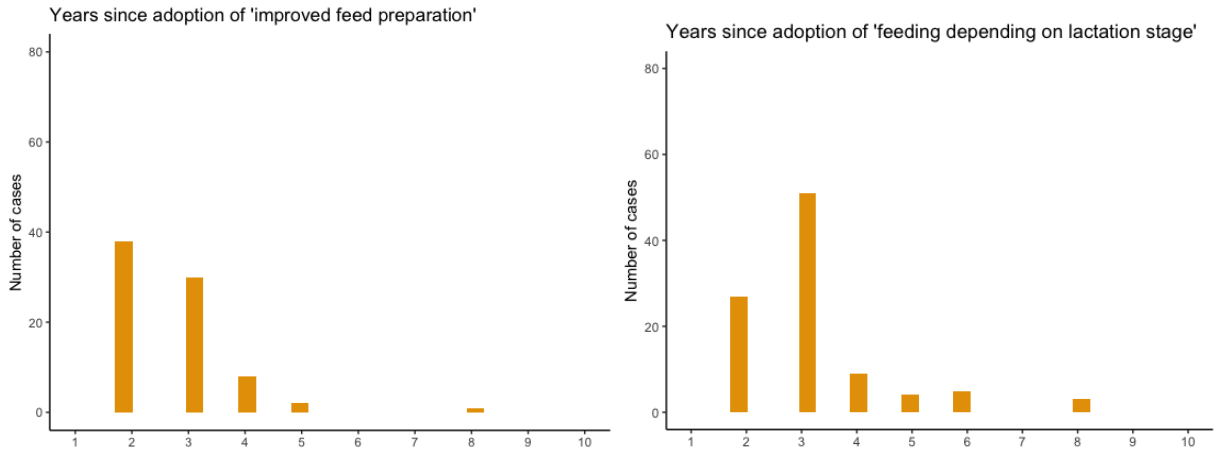

Figure 10 Histogram showing the count of years since adoption of practices for which we found significant differences between comparison and intervention group (intervention group only displayed here)

We also report baseline figures (see Table 20) on the feeding practices which are in all instances higher than endline figures. We do not suspect that a smaller proportion of farmers is using these practices now, but that the way these questions were asked was different or that there are errors in the data. This is why we do not report net effects from difference-in-difference analysis here.

Milking and milk transportation

Usage of **milking equipment** is very common among both comparison and intervention farmers. We can see 10% more comparison group farmers using milk storage equipment and circa 20% more of the intervention farmers using milk transportation equipment (see Table 21 and Figure 11). In terms of what equipment is used, clay pots and plastic jars are cited most frequently for milking, storing and transport. There are no substantial differences between comparison and intervention group (see Table 21 below).

Table 21 Overview of equipment used by comparison and intervention groups for storage, milking and transport

	Comparison (storage / transport / milking)	**Intervention** (storage / transport / milking)
Clay pot / Gourd (Kill)	37% / 13% / 45%	36% / 22% / 45%
Plastic jar/vessel[23]	59% / 79% / 52%	63% / 72% / 54%
Other	4% / 8% / 2%	1% / 6% / 1%

[23] manufactured locally for the purpose of liquid container including milk

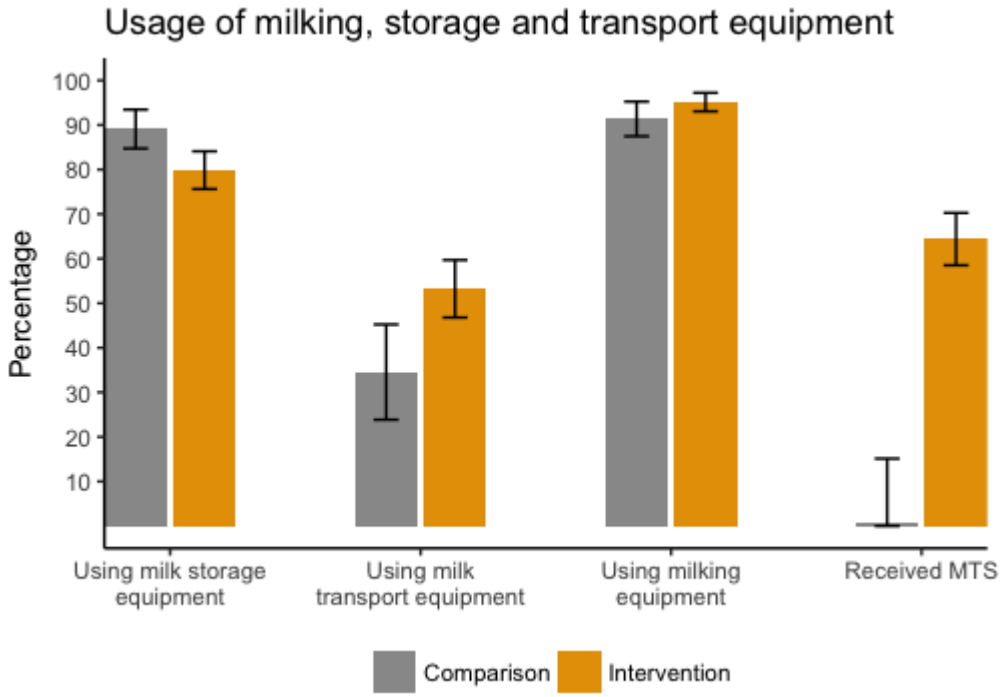

Figure 11 Bar-plot with interval estimate of population proportions (CI 95%) for usage of milking equipment in comparison and intervention group

Based on the endline survey, 64% of intervention group farmers received the **MTS** at least once during the course of the project. 67% of intervention group farmers (i.e. 277 farmers from the intervention group) reported using the MTS for milking and 47% reported using it for transportation.

Regarding **hygienic milking practices,** we can see an increase in the adoption of practices over the project period for both, comparison and intervention group. We can see that at baseline already, there were significant differences between groups with regard to cleaning of milking equipment with soap (34% comparison vs. 40% intervention), cleaning hands after milking (33% comparison vs. 42% intervention) and cleaning of cows' teat before / after milking (2% comparison vs. 10% intervention). At endline we find significant differences for cleaning hands before (52% comparison vs. 63% intervention) and after milking (46% comparison vs. 55% intervention) as well as cleaning the milking area (63% vs. 77%).

Table 22 Overview of adoption of hygienic milking practices[24]

	Baseline		Endline	
	Comparison (n=400)	**Intervention** (n=1200)	**Comparison** (n=220)	**Intervention** (n=432)
% of households cleaning milking equipment and utensils with soap [a]	33.9%	39.7%	48.2%	48.3%
% of households cleaning of hands after milking with soap [a, b]	32.5%	42.1%	46.4%	54.6%
% of households cleaning of hands before milking with soap [a, b]	27.4%	40.1%	52.3%	63.3%
% of households cleaning of milking area [c, d]	1.4%	4.8%	63.2%	77.4%
% of households cleaning the cows' teat before and after milking with soap [a]	1.7%	10.0%	35.0%	36.0%

[a] Significant differences in mean averages or cell distribution for baseline intervention and comparison, Chi-square test statistic or Two-sample T-Test, p<0.05
[b] Significant differences in mean averages or cell distribution for endline intervention and comparison, Chi-square test statistic or Two-sample T-Test, p<0.05
[c] Significant differences in mean averages or cell distribution between baseline and endline for intervention group, Chi-square test statistic or Two-sample T-Test, p<0.05
[d] Significant differences in mean averages or cell distribution between baseline and endline for comparison group, Chi-square test statistic or Two-sample T-Test, p<0.05

Hygienic milking practices are performed every day rather than after every milking. But there are differences between intervention and comparison group: Intervention group farmers perform hygienic milking practices to a greater extent after every milking than comparison group farmers.

We calculated net effects for intervention using difference-in-difference analysis looking at baseline and endline data. A positive net effect of 10.8% can be found for cleaning of the milking area. With regard to other hygienic milking practices the net intervention effect is negative, but not substantive (ranging from a reduction of 1% to 7%).

[24] Please note that baseline measures were not always asked in the same way as in endline and comparisons over time are difficult.

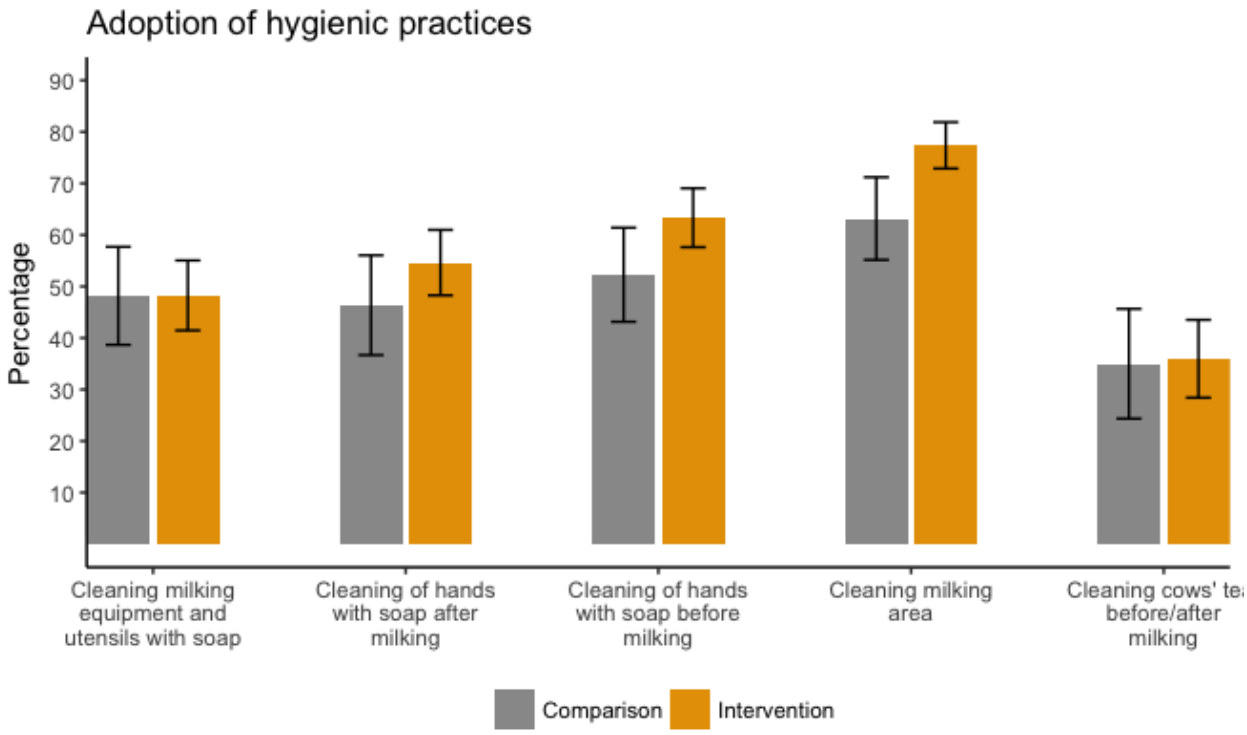

Figure 12 Bar-plot with interval estimate of population proportions (CI 95%) for adoption of hygienic practices in comparison and intervention group

Looking into the reasons behind adoption of the abovementioned practices, we can ascertain for the intervention group that they more often derive from training and to a much lesser extent personal experience. For comparison group farmers it is the other way around - personal experience is cited much more frequently than training received. In terms of non-adoption of hygienic practices, lack knowledge or technical skills is by far the most cited reason.

For practices with statistically significant differences in adoption rates between the intervention and comparison groups (namely, washing hands before and after milking, as well as cleaning milking area), 2, 3 and 4 years since adoption were the most frequently cited. This lies within the project implementation period (see Figure 13 below).

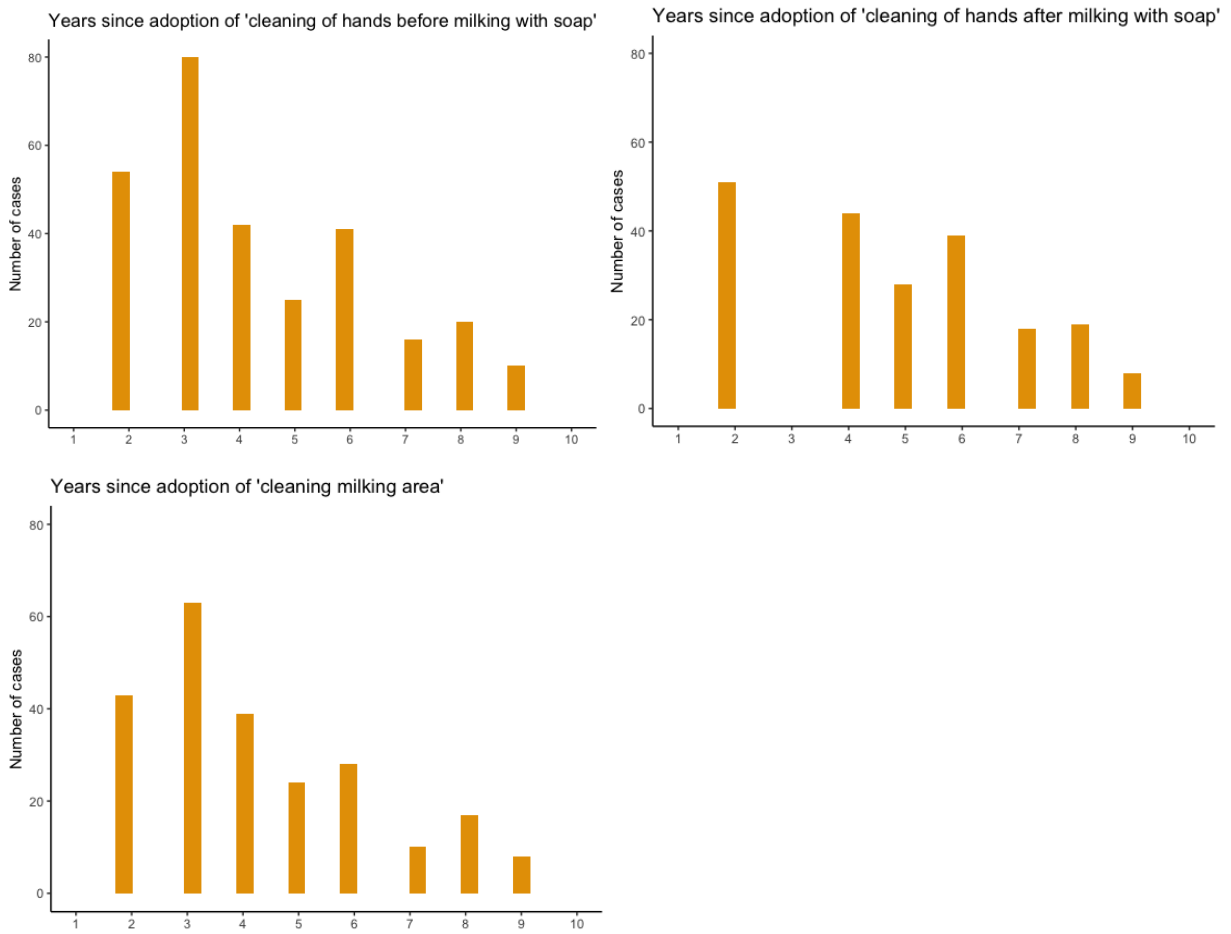

Figure 13 Histogram showing the count of years since adoption of practices for which we found significant differences between comparison and intervention group

Animal health

As for **animal health practices**, we can see a majority of farmers in both intervention and comparison groups consulting a veterinarian for prevention (57%), treating sick animals with antibiotics (62%) and undertaking regular vaccination (85%). It is only in the case of usage of antibiotics that we see a statistically significant difference in the adoption, with 66% for intervention farmers and 58% for comparison group.

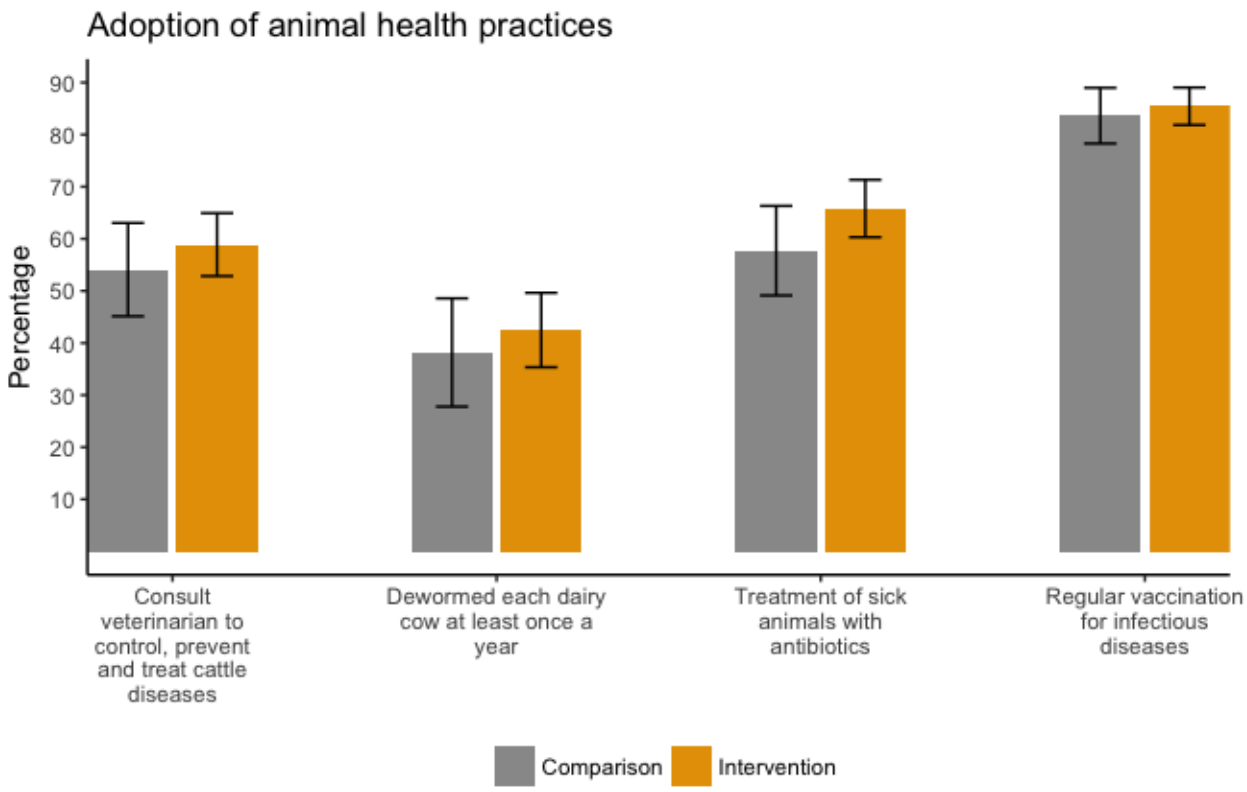

Figure 14 Bar-plot with interval estimate of population proportions (CI 95%) for adoption of animal health practices in comparison and intervention group

Table 23 Overview of adoption of animal practices[25]

	Endline	
	Comparison (n=220)	**Intervention** (n=432)
% of households consulting a veterinarian to control, prevent and treat diseases	54.1%	58.9%
% of households deworming each of dairy cow at least once per year	38.2%	42.5%
% of households treating sick animals with antibiotics [b]	57.7%	65.8%
% of households undertaking regular vaccination programs for infectious diseases	83.6%	85.5%

Calf management

For **calf management practices** (calf feeding practices are discussed in the AgID component of the SO1 section) there are up to 30% more intervention farmers allowing the calf to suckle the mother (34% vs. 53%), carrying out heart girth measurements and ear tag applications (4% vs. 33%), cleaning the calf after delivery (41% vs. 50%), feeding concentrate feed to the calf (25% vs. 37%), bucket feeding (23%

[25] Please note that baseline measures were not available for these practices.

vs. 29%) and varying the amount of milk provided to the calf when bucket feeding (21% vs. 30%, see Figure 15). All of these differences (except practicing bucket feeding) are statistically significant.

Table 24 Overview of adoption of calf management practices[26]

	Endline	
	Comparison (n=220)	**Intervention** (n=432)
% of households allowing the calf to suckle the mother [b]	33.8%	52.6%
% of households carrying out heart girth measurements and ear tag applications [b]	4.0%	33.2%
% of households cleaning the calf immediately after delivery [b]	30.5%	50.2%
% of households feeding the calf with concentrate [b]	25.2%	37.2%
% of households practice bucket feeding	22.5%	28.5%
% of households varying the volume of milk depending on the stage of lactation (if bucket feeding) [b]	21.2%	30.1%

[b] Significant differences in mean averages or cell distribution for endline intervention and comparison, Chi-square test statistic or Two-sample T-Test, $p<0.05$

Amongst the intervention group, reasons given for the adoption of these practices are most often training and to a much lesser extent personal experience. For comparison group farmers it is the other way around - personal experience is cited much more frequently than training received. Coaching, learning from other farmers and income opportunities are very rarely cited as reasons for adoption of calf management practices. When asking more specifically about who provided the training, intervention farmers cite government extension providers (DAs, woreda experts, etc.), AgIDs, DFEG leaders and other farmers whereas comparison group farmers mainly refer to government extension providers and other farmers. When asked about reasons for non-adoption, both intervention and comparison group farmers were most likely to cite lack of knowledge (ca. 60-80% of non-adopters) followed by lack of required inputs (15-35%).

[26] Please note that baseline measures were not available for these practices.

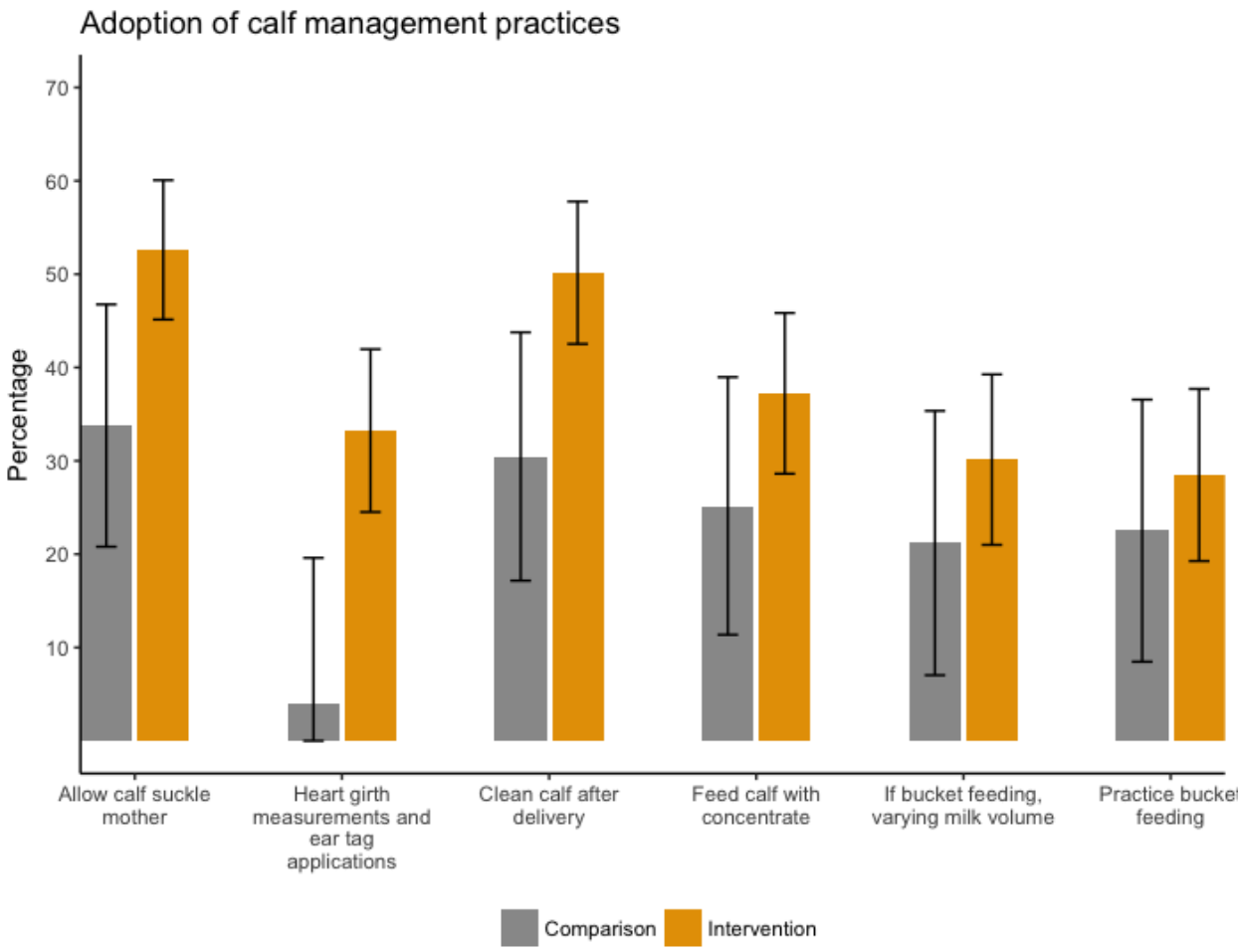

Figure 15 Bar-plot with interval estimate of population proportions (CI 95%) for adoption of calf management practices in comparison and intervention group

Looking into when calf management practices with significant differences between comparison and intervention groups were adopted, Figure 16 below shows that 2 and 3 years ago - i.e. within the implementation period of the project - were cited most frequently.

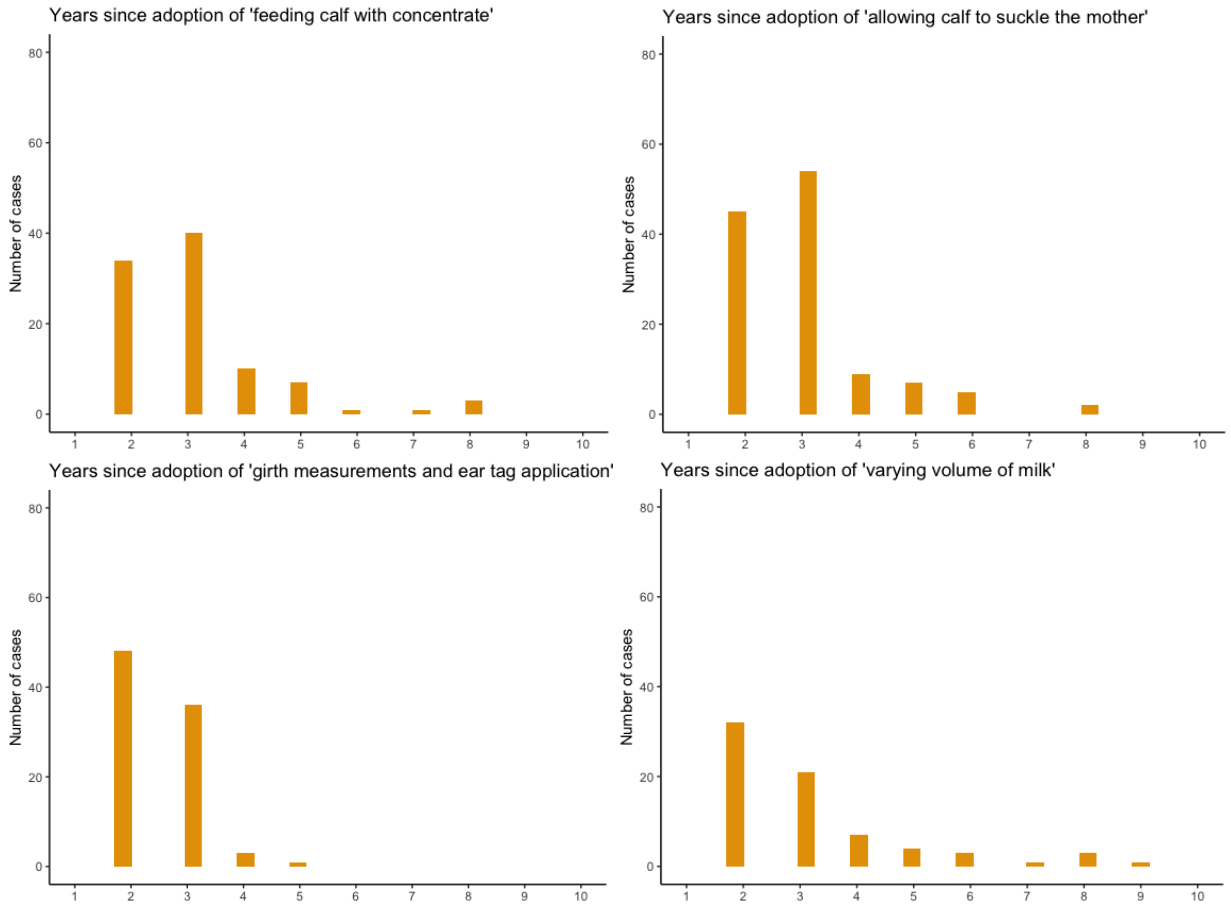

Figure 16 Histogram showing the count of years since adoption of practices for which we found significant differences between comparison and intervention group

Housing and manure management

In terms of **housing and manure management**, more than two thirds - in both intervention and comparison groups - keep their cattle in confined and clean areas, and that more than 40% keep different types of cattle in separate housing. Only about 20-25% use a constructed feeding trough accessible from inside and outside. Statistically significant differences between comparison and intervention farmers exist for 'providing adequate ventilation and lighting for cows' barn' (39% vs. 53%) and adequate storage of manure for crop application (25% vs. 34%).

Table 25 Overview of adoption of housing and manure management practices[27]

	Endline	
	Comparison (n=220)	**Intervention** (n=432)
% of households keeping cattle in confined area free from mud and manure	65.5%	70.8%
% of households storing manure adequately and then apply it to crops [b]	24.5%	34.0%
% of households having separate housing type for different cattle type	41.4%	45.8%
% of households having cows barn with adequate ventilation and lighting [b]	39.1%	53.0%
% of households using constructed feeding trough (inside and outside)	25.5%	20.6%

[b] Significant differences in mean averages or cell distribution for endline intervention and comparison, Chi-square test statistic or Two-sample T-Test, p<0.05

Reasons for adoption of practices are most often training over personal experiences for the intervention farmers and vice versa for comparison group farmers. When asked about non-adoption, both, intervention and comparison group farmers refer to a lack of knowledge, rather than a lack of required inputs or lack of advice and follow-up support. A smaller proportion also claimed high costs (<10%) as a reason for non-adoption of the different practices.

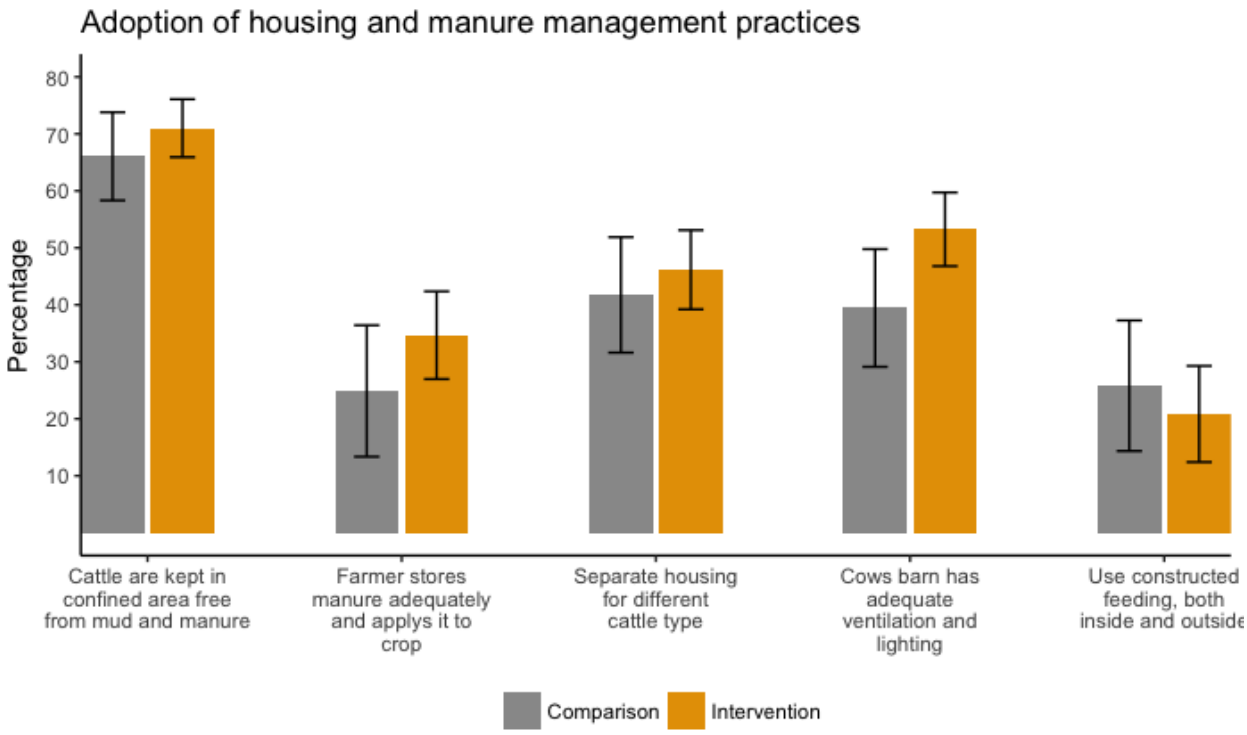

Figure 17 Bar-plot with interval estimate of population proportions (CI 95%) for adoption of housing and manure practices in comparison and intervention group

[27] Please note that baseline measures were not available for these practices.

Looking into when practices were adopted (in which we found significant differences between comparison and intervention group), Figure 18 below shows that 3 years ago was cited most frequently for housing and manure management practices. This is within the implementation period of the EDGET project.

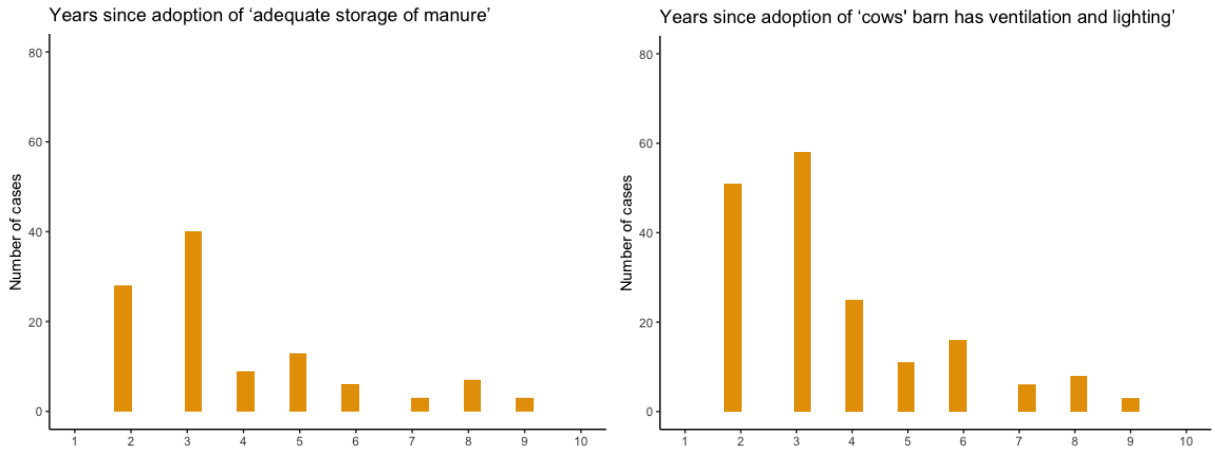

Figure 18 Histogram showing the count of years since adoption of practices for which we found significant differences between comparison and intervention group

Climate smart practices

With regard to **climate smart practices**, a very small proportion of farmers were found to be using biogas (6% comparison vs. 3% intervention) while a much larger proportion reported enriching livestock feed with agricultural byproducts (49% comparison vs. 44% intervention), and using manure to fertilize the farm (61% comparison vs. 71% intervention). There were no statistically significant differences detected between the groups. Other practices, such as the cultivation of green forage, adoption of the cut-and-carry system and a move away from open grazing also represent important steps toward more climate smart dairy practices.

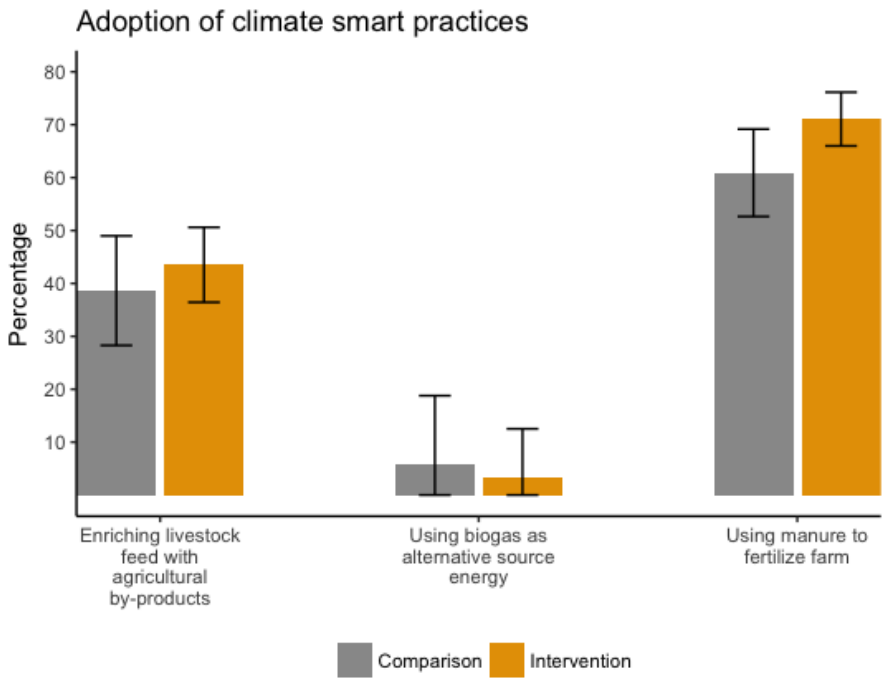

Figure 19 Bar-plot with interval estimate of population proportions (CI 95%) for adoption of climate smart practices in comparison and intervention group

Table 26 Overview of adoption of climate smart practices[28]

	Endline	
	Comparison (n=220)	**Intervention** (n=432)
% of households using manure to fertilize the farm	60.9%	71.1%
% of households enriching livestock feed with agricultural by-products	38.6%	43.5%
% of households using biogas	5.9%	3.2%

Insights from the qualitative data collection suggest that across actors and woredas there is a recognition of increased awareness about biogas. Some farmers started using biogas and composting for fertilizer methods due to the training.

Summary for adoption of practices

A total of 34 different practices related to animal health, hygienic milking practices, forage production, housing and manure management, calf management and feeding were assessed. Statistically significant differences were found for a total of 16 specific practices, i.e. where a higher proportion of intervention than comparison group farmers were found to have reported adoption of the practices. These practices include, for instance: farmers engaged in forage production, forage seed multiplication,

[28] Please note that baseline measures were not available for these practices.

cleaning of hands before/after milking with soap, measuring heart girth of the calf and providing calves with concentrate feed. Generalizations to the population of all farmers can only be made for these 16 practices for which differences were found to be statistically significant.[29]

The data shows that although the mean number of years a practice was adopted is greater than 3, the majority of adopters reported adopting the practice within the last 3-4 years, i.e. within the project implementation period. The mean, however, is skewed upwards by a smaller proportion of farmers who have adopted the practice for a larger number of years. The overview figure below also shows that the median, which separates a sample into its higher and lower half, is often lower for the intervention group than for the comparison group and that it is smaller than five years for all practices in the intervention group.

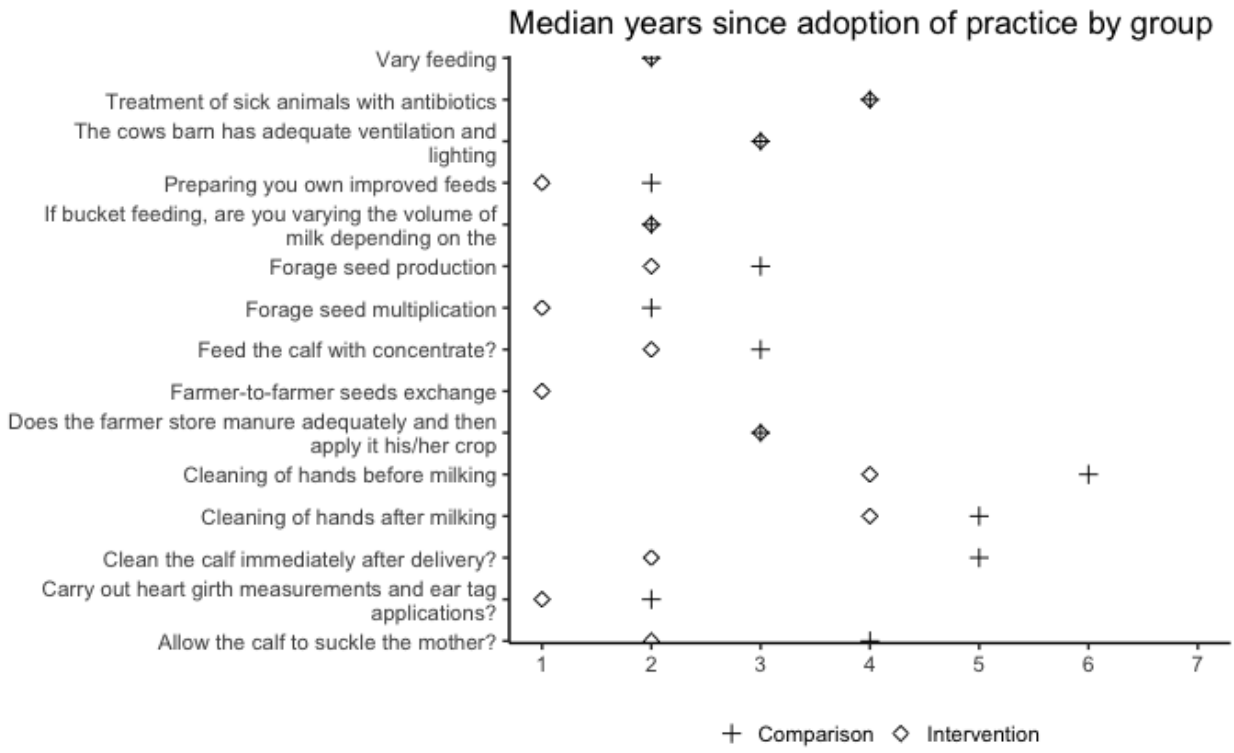

Figure 20 Median year since adoption of practices for respondents for comparison and intervention group. Only showing practices in which we found significant differences. The median is the value separating the higher half of a data sample from the lower half.

A closer look at the reasons for adoption reveals that 'training' is cited much more often and 'personal experience' to a much lesser extent for the intervention group. This is the other way around for the comparison group. This suggests that the project was a significant driver of adoptions in the project

[29] Please note that we visualised in each Figure a range within which the 'true' population estimate lies. It may not be the exact point figure as reported in the table above.

area. Looking into the providers behind the training, EDGET project supported actors (e.g. AgIDs/Cooperatives) were mentioned by the intervention group but not by the comparison group.

Milk production

Table 27: Milk production

	Baseline		Endline	
	Comparison (n=400)	**Intervention** (n=1200)	**Comparison** (n=220)	**Intervention** (n=432)
Average annual milk production **per cow** (only for **crossbreed** milking cows) [a]	519.2	971.1	1208.4	1001.9
Average annual milk production **per cow** (only for **local** milking cows) [a]	428.3	455.3	332.9	359.2
Average annual total milk production (litres) **per HH** [a]	259.3	438.3	1067.8	952.6
Average annual total milk production (litres) **per HH that produced milk** [a, c, d]	437.6	655.8	1243.0	1098.7

[a] Significant differences in mean averages or cell distribution for baseline intervention and comparison, Chi-square test statistic or Two-sample T-Test, p<0.05
[c] Significant differences in mean averages or cell distribution between baseline and endline for intervention group, Chi-square test statistic or Two-sample T-Test, p<0.05
[d] Significant differences in mean averages or cell distribution between baseline and endline for comparison group, Chi-square test statistic or Two-sample T-Test, p<0.05

By the end of the project, households from intervention and comparison woredas were found to have an average milk production of 953 and 1068 litres respectively (the difference was not found to be statistically significant). For the subset of households that had milking cows, the figures are higher, but more so for comparison villages. The differences between these figures were not, however, found to be statistically significant at the α = 95% level. Analysis at the level of individual crossbred cows shows a similar pattern as at the household level, statistically significant differences between the groups exist only at the baseline.

Looking at data on milk production by sex of the household head at endline, there is a noticeably higher volume of milk production for female-headed households (1523 litres per year) than for male headed households (1100 litres per year). This difference is statistically significant.

DID estimation milk production

We calculated net effects for the intervention using difference-in-difference analysis looking at baseline and endline data for milk production per household and milk production per households with a milking cow. As the results for the two groups are not substantially different, the analysis here focuses only on milk production per household. While overall milk production increased between baseline and endline for both groups, taking into account the different starting points for milk production between comparison and treatment at baseline, we see that milk production in the

comparison group increased by a larger amount than for intervention group[30]. The net effect or DID estimate for being in the intervention group is significant and negative with milk production going down by 294 litres. Due to the violation of necessary pre-conditions for performing DID-estimation and issues with the baseline data, these results should be treated with great caution. See and Figure 21 for more information.[31]

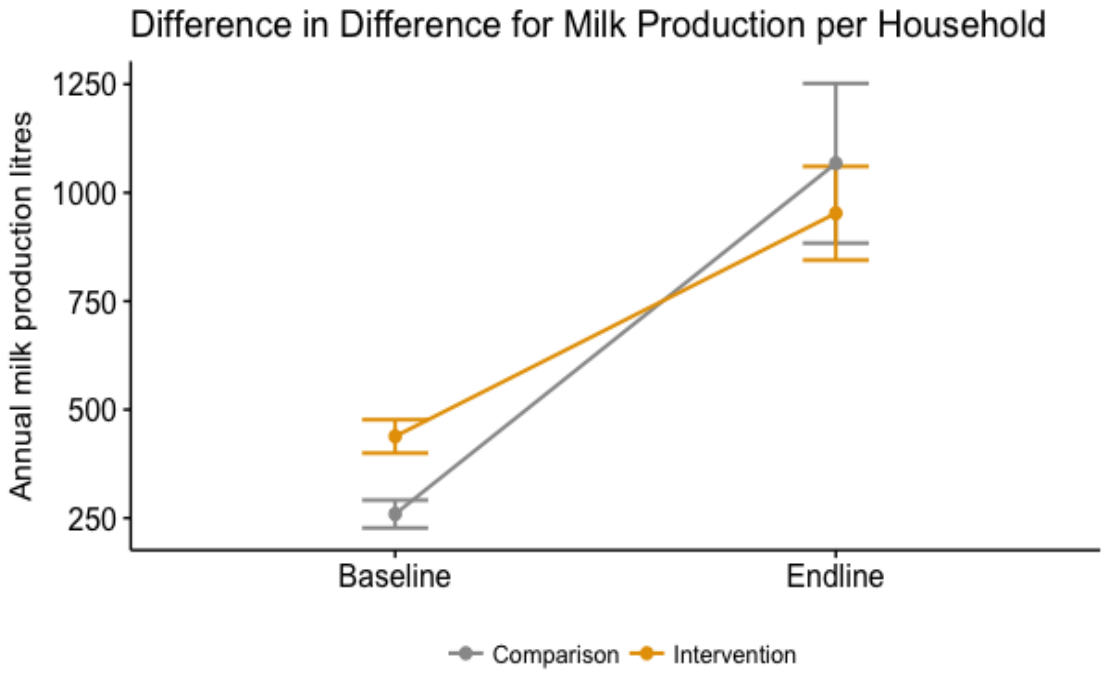

Figure 21 Differences between groups and over time for milk production per household. The 95% confidence intervals depict the range of the mean average milk production in the population

Perceived changes in milk production

Looking at perceived changes in milk production over the last years, 38% for comparison and 47% for intervention group said it increased, 34% versus 31% said it stayed the same and 28% versus 22% said it decreased (differences significant at 10% level). These differences were not found to be statistically significant at 95%. Reasons for increase were birth of calves (88% vs. 92%) and purchase of animals (12.2 vs. 4.4%). Reasons for decrease were sale of calves (38% vs. 39%), death of animals (43% vs. 51% and other (17% vs. 11%).

[30] We estimated a significant positive main effect for time (i.e. overall milk production is going up by 809 litres from base- to endline for both groups) and for group membership (i.e. milk production on average is 179 litres higher when being in the intervention group)

[31] In order to estimate the DID or net effect, pre-conditions such as homogeneity of variances and normal distribution have to be checked for. These pre-conditions are not established for milk production. There are several outlier values and variances of milk production between base- and endline are not equal. This may be due to the fact of sampling anew at endline rather than having a longitudinal approach where the same households are surveyed at base- and endline. It may also be due to different cleaning of baseline and endline data.

4.3 Strategic Objective 2: To increase processing and marketing of dairy products

Strategic objective 2 focused on increasing the processing and marketing of dairy products both at the household level and broadly within the dairy value chain. While Strategic Objective 1 provides the basis for households to achieve higher levels of milk production, Strategic Objective 2 focuses on enabling households to earn higher incomes either by selling their milk to a more remunerative market or else by producing processed/value-added dairy products that can be sold at a premium. This section begins with a presentation of findings from the baseline and endline surveys related to the sale and processing of milk and milk products and then proceeds with an analysis of EDGET project's interventions to support and strengthen Dairy Processing. The diagram below provides a high-level overview of the timeline of activities for Strategic Objective 2.

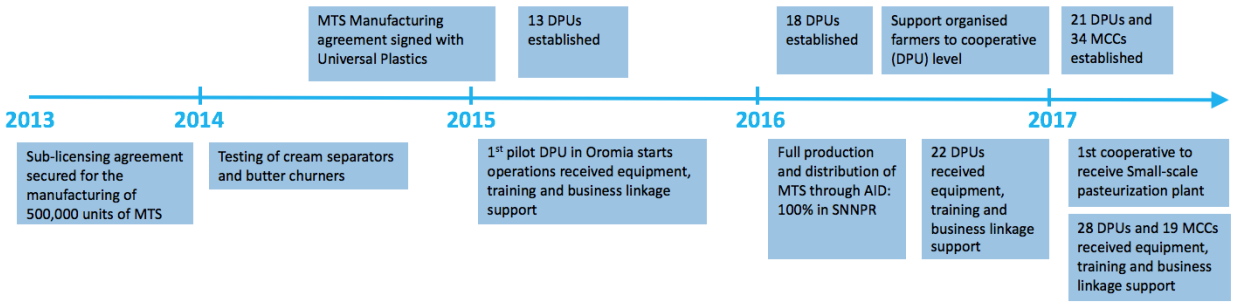

Figure 22 Timeline for implementation of SO2

Household milk processing, consumption and sale

Milk processing

The household surveys at baseline and endline gathered a variety of data on household level milk processing. This covered a proportion of households involved in processing butter, cottage cheese, soured milk and the quantities produced and sold of each processed product.

Table 28 % Households producing different types of dairy products[32]

	Baseline		Endline	
	Comparison	**Intervention**	**Comparison**	**Intervention**
Butter (% of HH)	54.3%	53.3%	64.1%	66.7%
Cottage cheese / Ayib (% of HH)	12.0%	20.2%	49.1%	46.5%
Soured milk (% of HH) [a, b]	45.5%	36.5%	27.2%	38.7%

[a] Significant differences in mean averages or cell distribution for baseline intervention and comparison, Chi-square test statistic or Two-sample T-Test, p<0.05

[b] Significant differences in mean averages or cell distribution for endline intervention and comparison, Chi-square test statistic or Two-sample T-Test, p<0.05

Endline analysis illustrated that the proportion of households involved in processing milk was very similar in both intervention and comparison villages (82% and 86% respectively), with no statistically significant difference between them. Overall, over 60% of households reported producing butter, with no statistically significant difference between comparison and intervention woredas. Cottage cheese was produced by almost half of comparison and intervention group households. Comparison households were less likely to produce soured milk (27% vs. 39%). Overall the proportion of intervention group households producing all three products increased between the baseline and endline, though substantially only for butter and cottage cheese. The proportion of comparison group farmers processing butter (54% to 64%) and cottage cheese (12% to 49%) increased over time but decreased for soured milk (46% to 27%).

Looking at the quantities produced (kg per household per year) of each type of dairy product, no statistically significant differences were detected between comparison and intervention groups at endline. But significant differences in annual production were found at the baseline between comparison and intervention group for cottage cheese (39 kg vs. 79 kg) and soured milk (66 kg vs. 103 kg). Differences between the baseline and endline data could not be tested due to problems with merging datasets.

[a] Significant differences in mean averages or cell distribution for baseline intervention and comparison, Chi-square test statistic or Two-sample T-Test, p<0.05

[b] Significant differences in mean averages or cell distribution for endline intervention and comparison, Chi-square test statistic or Two-sample T-Test, p<0.05

[32] Only households reporting a quantity greater than 0 were counted as producers. Proportions are based on complete sample size (without NAs) for subgroups. Significance statistics could not be conducted for baseline and endline comparisons due to difficulties in merging baseline and endline data.

Table 29 Average quantity of different types of processed dairy products produced by household[33]

	Baseline		Endline	
	Comparison	**Intervention**	**Comparison**	**Intervention**
Butter (kg / HH)	27.2	32.6	38	37
Cottage cheese (kg / HH) [a]	39.0	78.6	78	77
Soured Milk (kg / HH) [a]	65.93	102.09	167	147

[a] Significant differences in mean averages or cell distribution for baseline intervention and comparison, Chi-square test statistic or Two-sample T-Test, $p<0.05$

Perceived change in processing of dairy products

When asked about perceived changes in the processing of milk products, the difference in responses was found to be statistically significant. In particular, households in the intervention woredas were more likely to report an increase (51%) than households in the comparison group (39%), and households in the comparison group were almost 10% more likely to report that production had stayed the same.

Sale of raw milk

According to the endline survey, 32.4% of intervention group households had sold milk as compared to 21.5% of comparison group households. For the baseline this was 29.5% for comparison and 51% for intervention group.

Of the households who reported selling raw milk, households in the intervention woredas were marginally more likely to report selling to individuals (49% vs. 40%) and traders (22% vs. 20%) than households in the comparison woredas. Households in the comparison woredas were more likely to sell to a private company (15% vs. 5%). A much smaller difference was found in the proportion selling to cooperatives, with 24.5% of those in the comparison group selling to cooperatives compared to 21.6% in the intervention woredas. Of those selling to cooperatives in the intervention woredas, the majority (around 60%) reported selling their milk to the DPU cooperatives supported by EDGET.

On average, no significant difference was found in terms of the volume of raw milk sold by the intervention and comparison groups (1524.4 litres vs. 1505.3 litres on average). Average prices obtained during both the fasting and non-fasting seasons were also found to have little variation, generally being in the range of 10.9 to 11.4 Birr per litre.

[33] Significance statistics could not be conducted for baseline and endline comparisons due to difficulties in merging baseline and endline data.

Sale of processed dairy products

Table 30 % of households involved in sale of raw milk and processed dairy products

	Baseline		Endline	
	Comparison	**Intervention**	**Comparison**	**Intervention**
Raw milk (% of HH) [b]	23.3%	34.0%	21.5%	32.4%
Butter (% of HH) [b]	47.5%	17.5%	62.7%	53.7%
Cottage cheese (% of HH) [b]	35.0%	4.5%	22.2%	14.3%
Yoghurt (% of HH)	6.0%	0.7%	1.6%	4.1%

[b] Significant differences in mean averages or cell distribution for endline intervention and comparison, Chi-square test statistic or Two-sample T-Test, p<0.10

Butter was the most frequently sold milk product (comparison n=89, intervention n=154), followed by cottage cheese (comparison n=24, intervention n=30). Only 1 household in the comparison group reported selling soured milk compared to 6 in the intervention group.

Table 31 Quantity of dairy products sold[34]

	Baseline		Endline	
Product	**Comparison**	**Intervention**	**Comparison**	**Intervention**
Raw milk (litres sold) [a]	540.2	852.0	1505.3	1524.4
Butter (kg sold)	64.5	33.9	39.6	34.3
Cottage cheese (kg sold) [a]	118.6	35.8	67.8	91.8
Soured milk (kg sold)	98.5	47.4	48.0	254.3

[a] Significant differences in mean averages or cell distribution for baseline intervention and comparison, Chi-square test statistic or Two-sample T-Test, p<0.05

Overall who the households sold these products to did not vary significantly between comparison and intervention group households. While there were some differences in who these processed milk products were sold to, the numbers of households involved in sale of these milk products was too small to detect any statistically significant differences in the prices paid by different buyers. Overall, butter was sold at a price of 130 Birr per kg, cottage cheese at 46 Birr per kg and soured milk at 13 Birr per kg. None of the respondents reported selling any of these products to a cooperative/DPU supported by the EDGET project. Rather the main buyers were either individuals or traders, with a few households reporting that they had sold their products to a private company or a cooperative that was not supported by the EDGET project. Individuals and traders also appeared to pay the highest prices for both comparison and intervention groups.

[34] Significance statistics could not be conducted for baseline and endline comparisons due to difficulties in merging baseline and endline data.

Income from the sale of milk and processed dairy products

Table 32 below provides an overview of revenue from raw and processed dairy products per household for the endline survey only. The total revenue is based on adding the revenue from each type of product sold. This differs from the baseline methodology which used an estimate of the aggregate figure, yielding a different figure for income. This total estimate was replicated at the endline (see Table 33 below) to allow for methodological comparability between baseline and endline, despite the limitations of this method. The baseline data for income from different types of milk products had multiple errors and could not be computed reliably. In subsequent calculations of net income, these figures have been excluded in order to ensure comparability between base- and endline.

The table shows that comparison group generated a total of 7093 Birr from sale of raw milk and processed dairy products compared to 7671 Birr in the intervention group (difference is not statistically significant, p>0.1). It is observed that the most of the revenue is made up of revenue from raw milk (3780 vs. 5294 Birr) followed by butter (2883 vs. 1910 Birr). Cottage cheese and soured milk take up a much smaller proportion.

Table 32 Income earned from sale of milk, dairy products and dairy related activities

	Endline	
	Comparison	**Intervention**
Revenue from raw milk (Birr)	3780.0	5293.9
Revenue from butter (Birr)	2883.1	1910.0
Revenue from cottage cheese (Birr)	426.9	402.3
Revenue from soured milk (Birr)	3.6	64.6
Total revenue from sale of milk and dairy products	**7093.5**	**7670.9**

The Table 33 below presents the average income earned from sales of all dairy and dairy-related services. As mentioned above, the income from dairy is based on an estimate of the total rather than the addition of revenue from each type as presented in the table above. The only statistically significant difference between the comparison and intervention woredas at endline is the higher average earning from the sale of animal manure or dung in the comparison woredas. The difference between comparison an intervention group regarding total income earned from dairy related activities was not statistically significant, with an average of 6959 Birr per household per year earned in comparison woredas and 6798 Birr per household per year earned in intervention woredas at endline.

Note that income from sale of dairy animals was not considered in the income calculations at baseline. Furthermore, dairy income at baseline was not based on the sum of income from different products. For comparability, the same method has been used at endline. Consequently the income from raw milk and processed products in the table below does not add up to the total income row from sale of milk and dairy products row.

Table 33 : Income earned from sale of milk, dairy products and dairy related activities[35]

	Baseline		Endline	
	Comparison	**Intervention**	**Comparison**	**Intervention**
Total sale of milk and dairy products [a, c, d]	1439.3	3165.0.	5611.7	5856.9
Revenue bull services	0.0	3.9	81.9	251.1
Revenue dairy animals	NA	NA	3160.5	2755.0
Revenue animal manure or dung [b, d]	6.6	16.4	437.0	147.7
Revenue other			830.7	528.6
Total dairy income [a, c, d]	**1445.8**	**3185.3**	**6959.2**	**6798.0**
Total dairy income including dairy animals			**10119.7**	**9553.0**

[a] Significant differences in mean averages or cell distribution for baseline intervention and comparison, Chi-square test statistic or Two-sample T-Test, p<0.05

[b] Significant differences in mean averages or cell distribution for endline intervention and comparison, Chi-square test statistic or Two-sample T-Test, p<0.05

[c] Significant differences in mean averages or cell distribution between baseline and endline for intervention group, Chi-square test statistic or Two-sample T-Test, p<0.05

[d] Significant differences in mean averages or cell distribution between baseline and endline for comparison group, Chi-square test statistic or Two-sample T-Test, p<0.05

There are significant increases over time for total sale of milk and dairy products, sale of manure / dung for comparison group and total dairy income for comparison and intervention groups (please also see DID estimation further below).

Costs of production

The household surveys collected data on costs associated with dairy production. The costs considered in this calculation include breeding services, hired labour, interest payments on loans and health services. At the endline an 'other' category was included as well. The major driver for the change in costs is feed, which saw a substantial increase in both comparison and intervention woredas, albeit more so in comparison woredas. It should be noted that the baseline data contains unrealistically high values for costs associated with breeding services.

Table 34 Costs of dairy production. Please note fairly small n for some of the variables presented[36]

	Baseline		Endline	
Type of cost	**Comparison**	**Intervention**	**Comparison**	**Intervention**
Breeding service (Birr) [c, d]	941.2	1103.1	12.1	45.5

[35] For comparability purposes, baseline data has been transformed so that all NAs received 0 values. Please see methodology section for the limitations and problems with this approach. Further, total sale of milk and dairy products do not add up from revenue of individual products. This is because the total revenue has been asked on the one the one hand as a general question (for comparability purposes with baseline data) and in a more detailed question for each dairy product respectively. It is due to inconsistencies in these responses that figures do not add up. Baseline figures where completely un-realistic which is why they are not reported here.

[36] For comparability purposes, baseline data has been transformed so that all NAs received 0 values. Please see methodology section for the limitations and problems with this approach.

	Baseline		Endline	
Type of cost	**Comparison**	**Intervention**	**Comparison**	**Intervention**
Hired labour (Birr) [c, d]	2.0	70.7	325.3	260.4
Interest payment on loan (Birr)	0.0	1.5	0.0	192.6
Other costs during the year (Birr)			19.6	97.1
Health service/VET (Birr) [a, d]	41.5	154.0	272.7	257.5
Feed (Birr) [a, c, d]	206.2	1064.6	2965.0	2471.5
Total cost (Birr) [a, d]	**1191.0**	**2393.7**	**3594.8**	**3324.5**

[a] Significant differences in mean averages or cell distribution for baseline intervention and comparison, Chi-square test statistic or Two-sample T-Test, p<0.05
[c] Significant differences in mean averages or cell distribution between baseline and endline for intervention group, Chi-square test statistic or Two-sample T-Test, p<0.05
[d] Significant differences in mean averages or cell distribution between baseline and endline for comparison group, Chi-square test statistic or Two-sample T-Test, p<0.05

Perceived changes to costs and income

When asked to comment on reasons for perceived changes in costs over the last four years, differences in the proportion reporting that their income increased, stayed the same, or decreased were found to be statistically significant at the 90% level only. 41.6% of households in the comparison group reported an increase as compared to 50.0% in the intervention group.

Where people reported increased costs, significant differences were not found in the reasons for the change given. Reasons comprise more cows (40% vs. 36%), buying better quality feeds (55% versus 57.3%) and other (4% versus 7%) for increased costs and less cows (67% versus 57%), reduced quality of feed (28% versus 25% and less veterinary costs (6% versus 14%) for decreased costs.

Net income from dairy

Average net income from dairy at the endline was found to be 6269 Birr for intervention and 6128 Birr comparison groups. The difference between comparison and intervention groups was not found to be statistically significant. However, a significant difference was found in the net income between baseline and endline for both groups. The average costs incurred in the comparison group increased significantly from 1192 Birr per household to 3595 Birr per household in the comparison group, but had not changed significantly for the intervention group (2393.7 to 3324.5 Birr) over time.

Average net income in intervention group increased from 792 to 2937 Birr per household, equivalent to a total increase of 3.7 times. For the comparison group, net income was found to have increased from 254 to 2534 Birr, equivalent to a total increase of 10 times. Please note that the net income calculation is based on the estimate of total dairy income, not the addition of income from each type of dairy product.

Table 35 Net income in Birr from dairy related activities[37]

	Baseline		Endline	
	Comparison	**Intervention**	**Comparison**	**Intervention**
Total dairy income [a, c, d]	1445.8	3185.3	6128.5	6269.4
Total cost [a, d]	1191.0	2393.7	3594.8	3324.5
Net income [c, d]	254.8	791.6	2533.8	2937.2

[a] Significant differences in mean averages or cell distribution for baseline intervention and comparison, Chi-square test statistic or Two-sample T-Test, p<0.05

[c] Significant differences in mean averages or cell distribution between baseline and endline for intervention group, Chi-square test statistic or Two-sample T-Test, p<0.05

[d] Significant differences in mean averages or cell distribution between baseline and endline for comparison group, Chi-square test statistic or Two-sample T-Test, p<0.05

DID estimation net income

We calculated net effects of net income for the intervention using difference-in-difference analysis looking at baseline and endline data. We estimate a significant main effect of time (i.e. net income increased by 2279 Birr from base- to endline). We do not see a significant main effect for being in the treatment group, nor can we see a significant effect for the DID-estimator (i.e. net effect for net income change). Due to the violation of necessary pre-conditions for performing DID-estimation, these results should be treated with caution.[38] Please see

Table 35 and Figure 23 for more information.

[37] For comparability purposes, baseline data has been transformed so that all NAs received 0 values. Please see methodology section for the limitations and problems with this approach.

[38] In order to estimate the DID or net effect, pre-conditions such as homogeneity of variances and normal distribution have to be checked for. These pre-conditions are not established for net income. There are several outlier values and variances of milk production between base- and endline are not equal. This may be due to the fact of sampling anew at endline rather than having a longitudinal approach where the same households are surveyed at base- and endline. Or due to substitution of NA values in the baseline dataset with 0 or inconsistent cleaning of end- and baseline datasets.

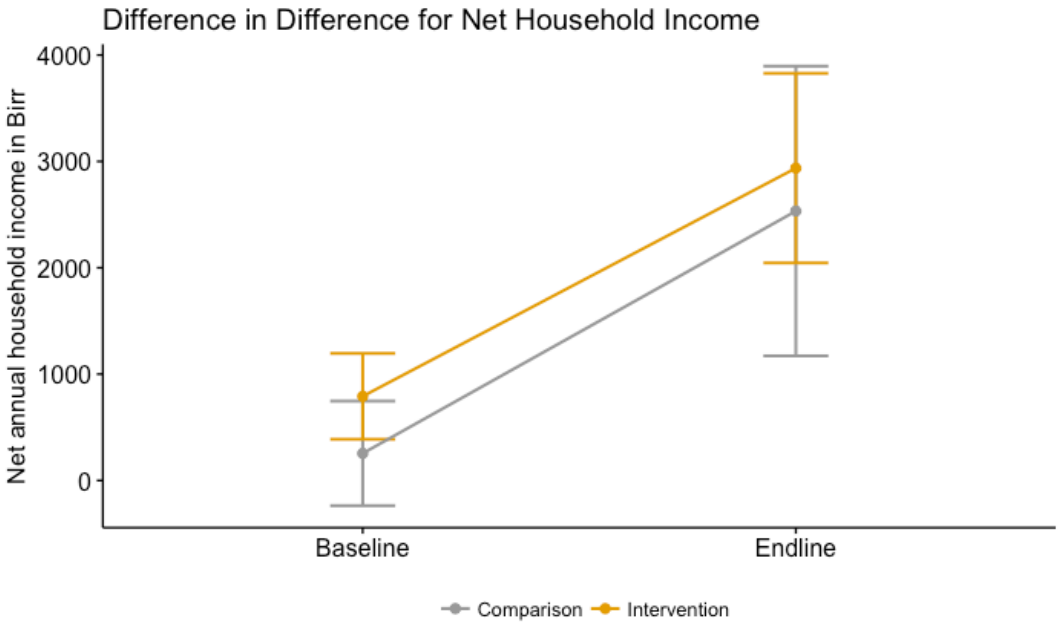

Figure 23 Differences between groups and over time for annual net income per household. The 95% confidence intervals depict the range of the mean average net income in the population.

Cooperatives with Dairy Processing Units

Overview of component

EDGET project's approach to developing output markets for milk and milk products focuses primarily on the establishment of Dairy Processing Units (DPUs) - at the woreda and in some cases, at the kebele level. Dairy Processing Units are facilities that are attached to a cooperative and managed by a dedicated management committee. Dairy farmers in the woreda can become members of the cooperative, whether they are members of a DFEG or not. EDGET project provides training to the management committees (on management, bookkeeping, hygienic milk production, milk quality testing, marketing, etc.) and equipment for milk collection, storage, testing and processing. EDGET project also provides trainings to the woreda cooperative agency and the woreda livestock office to orient them on the DPU's and get their support in key technical, legal and operational matters.

Where the catchment of the DPUs are large, EDGET project has promoted the establishment of decentralised Milk Collection Centres (MCCs) to facilitate the aggregation of milk from individual dairy farmers to the cooperative. Cooperatives with DPUs sell either raw milk or processed milk products to private sector or institutional buyers, including other milk cooperatives/milk unions and larger scale milk processors. EDGET project and the Woreda Cooperative Agencies play a role in facilitating linkages between the DPUs and these other agencies. Farmers are typically paid for the milk they provide on a monthly or two-weekly basis and in some cases also receive annual or bi-annual dividends.

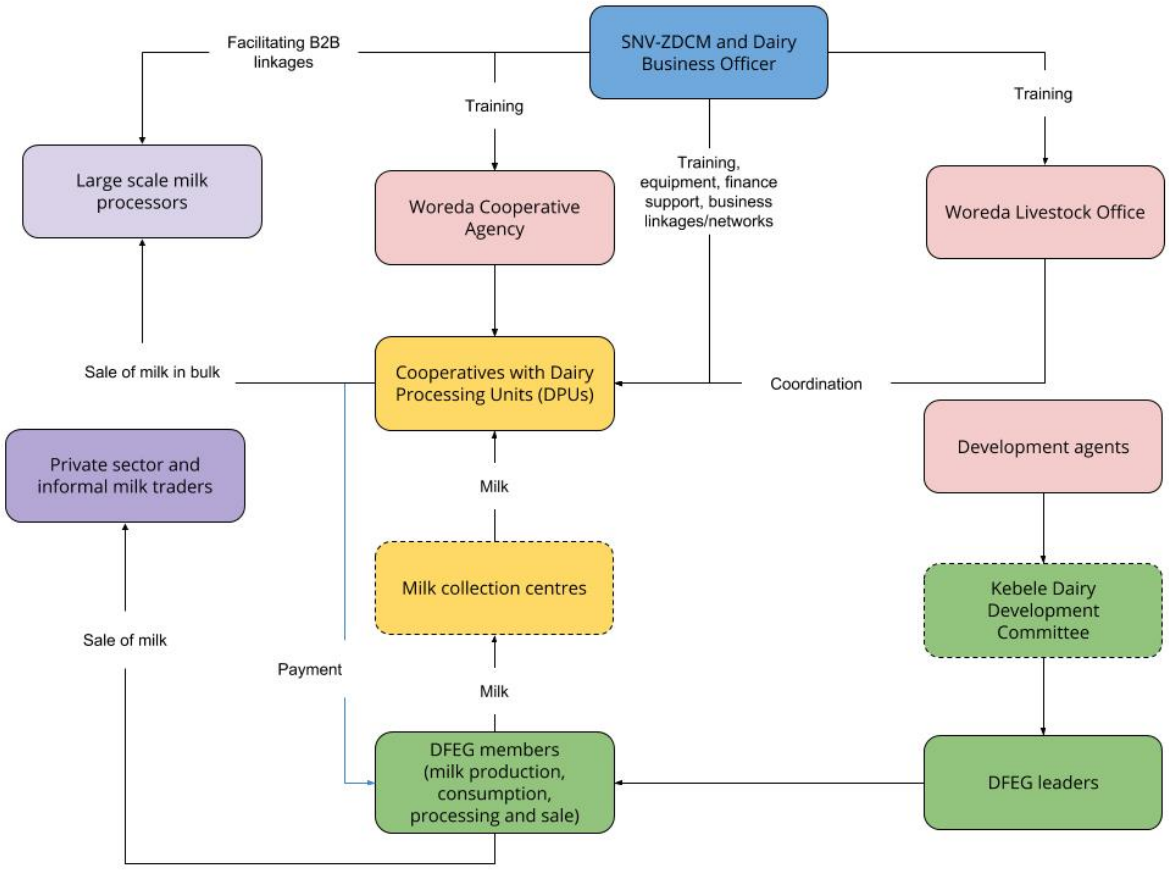

Figure 24 Actor map of the DPU cooperative and MCC component

Implementation: planned vs actual

Table 36 Achievement of project outputs for cooperatives and DPUs

Output description	**Indicator**	**Achievement end of project**	**End of project revised and (original) targets**
Milk collection and cooperative enterprise processing centres established	Number of milk collection and processing centres established	86 / 95% (52 DPUs + 34 MCCs)	91, i.e. 53 DPUs + 38 MCCs (160)
	Number of milk collection and processing centres leaders/workers who received training on milk quality and handling	378 / 118%	318 (NA)
Development of technologies &	Number of dairy farmer groups/FOs received processing	70 / 77%	92 (170)

Output description	Indicator	Achievement end of project	End of project revised and (original) targets
strategies in processing and marketing supported	and marketing technology support		
	Small scale Processing Technology support	70 / 78%	91 (160)
	In packet pasteurization support	0 / 0%	1 (10)
Business relationships & investment in production, processing and marketing supported	Number of processing units addressed in business linkage facilitation support	44 / 83%	53 (160)
	Number of targeted Dairy HHs linked with formal milk market	3,198 / 20%	16,000 (16,000)

Key focus areas for the EDGET project under this strategic objective were the establishment and upgrading of cooperatives with Dairy Processing Units (DPU) and milk collection centres.

Milk Collection Centres (MCCs) and Dairy Processing Units (DPUs)

The EDGET project wanted to set up 38 milk collection centres and 53 processing units. A collection centre (DPU) services around 100 farmers and is managed through a cooperative. It is intended as a central collection for members to supply their milk to. It was intended that quality control would be administered and that milk supply is recorded. Payment for milk would be periodical (e.g. every two weeks) or as agreed among the members. The DPU is managed by a committee. Collection centres can sell raw milk on retail or in bulk to wholesalers/processors. Processing centres (MCCs) are collection centres with an additional facility for skimming milk, butter churning or similar facilities. These centres can sell raw skimmed milk, butter and cottage cheese (cf. Strategy for Establishing Dairy Processing Units for the EDGET project, 2014)

The EDGET project conducted market studies in Woredas in which DPUs and MCCs were to be supported with capacity development, storage and processing technology and market linkage support. The resulting strategy was piloted in Oromia in 2015.

By end of 2015, a total of 13 DPUs had been established across Oromia, Amhara and SNNPR (38 short of target). In 2016, 18 DPUs were further established and / or re-organised (17 short of target, no milk processing centres established). A total of 22 DPUs received processing equipment and relevant training by 2016. Six DPUs received support on business linkages. In 2017, 34 Milk Collection Centres (MCCs) and further 21 DPUs were established.

The reasons for the difficulties in establishing and supporting existing milk collection and processing centers lie in the slow process of membership mobilization and registration as a cooperative, fulfilling the necessary prerequisites for a dairy processing unit (such us housing, etc.) and foreign currency

problems when importing cream separators and churners from abroad. Establishing or supporting an existing DPU took significantly more time and resources than anticipated during initial project planning which is why targets were revised.[39]

Overall, the number of established MCCs and DPUs was 86 (96% of revised target) with small-scale technology support for 70 of them (76% of revised target). 44 DPUs (83% of revised target) received business linkages support. The first cooperative is expecting to receive a small-scale pasteurization plant technology in early 2018. By the project end, a total of 3,198 dairy households (20% of target) were linked with the formal milk market through the DPUs and MCCs.

[39] Targets for establishing MCCs and DPUs as well as for in-packet pasteurization support were significantly revised due to changes in project approach, practical challenges such as delay of technology imports, and feasibility of establishing and supporting DPUs.

Findings from the qualitative assessment

Table 37 Qualitative findings on coops and dairy processing units

Sub-component	Strengths	Weaknesses
Institutional linkages (e.g. with woreda livestock office and woreda cooperative agency)	As part of its support to the Dairy Processing Units, SNV worked with the Woreda Cooperative Promotion Agencies (WCA) and Woreda Livestock and Fisheries Resource Development Offices (WLO) in each woreda, to orient them on the project, train them on how to support the DPUs and to facilitate linkages. The WCAs play a crucial role in formation/registration of the cooperatives, establishing by-laws, auditing them, resolving disputes and facilitating their linkages to other cooperatives and unions (e.g. Lemu Bilbilo coop agency linked 6 DPUs to Asela milk union). In all 5 of the woredas, the WCA is seen - at least to some extent - to have played its role in supporting the DPUs and providing some of the key areas of support outlined above. While the WLO's have a less direct role with respect to the DPUs from an organisational/operational perspective, their overall role in strengthening dairy value chains means they are an important stakeholder. The project has engaged them in trainings, oriented them on the DPUs and helped to establish a platform for them to coordinate and liaise with the Woreda Cooperative Agencies (e.g. as mentioned in Aleta Wondo and Lemu Bilbilo)	Some actors felt that the WCAs still lack capacity, particularly in relation to helping to establish market linkages for the DPU (Aleta Wondo, Lemu Bilbilo, etc.). In Lemu Bilbilo, the WCA was reported to have only conducted an audit in 2016 and not in 2017. Some actors in some woredas (e.g. Aleta Wondo and Lemu Bilbilo) feel that the WLOs are more focused on crops (e.g. coffee in Aleta Wondo), particularly during harvest time, rather than dairy. The multiple competing priorities are associated with poor performance of the DPUs.
Establishment and strengthening of the woreda dairy cooperatives/ DPU	EDGET project provided various types of support to woreda dairy cooperatives to support the establishment and strengthening of DPUs. This included the following items: Trainings on ● Milk quality and hygiene ● Business development for coops ● Book-keeping ● Milk processing ● Milk marketing ● Exposure visits to other DPUs Provision of equipment for the DPU: ● Lactometer ● Alcohol testing kit	DPUs are often inefficient. Lack sufficient supply of milk. Lack of decisions due to interests. Competition with traders (e.g. Wuchale, Lemu Bilbilo[40]) There was mention of committees overcharging on transport costs and take advantage per diems.

[40] The DPUs in Lemu Bilbilo were not established by EDGET project rather they were rehabilitated. They existed before EDGE project intervention.

Sub-component	Strengths	Weaknesses
	• MTS (not provided to DPU but helps the DPU) • Cream separator • Butter churner • Refrigerator • Refurbishment of buildings Facilitating business to business linkages • Through networking events • By scoping out markets and making introductions Monitoring support, quality inspection Organisational development • Marketing • Membership • Establishment and capacity development of MCC (in SNNPR and Amhara) Beyond this SNV's overall support to strengthening the dairy value chain through extension activities (training farmers on clean milk production, etc.), provision of MTS, support to AgIDs and increasing the availability of forage seeds are all seen as important contributors to the DPUs as well, since they help to increase the supply of quality milk.	
Informal traders	Informal traders provide an avenue for farmers to sell their milk often at competitive rates, with door-step collection and without much regard for quality. From the farmers' perspective, they provide an important avenue for the sale of milk.	In most of the woredas there is a very large number of Informal traders as well as small scale buyers like cafeterias and tea shops. Their lack of attention to the quality of milk and the good prices they pay are perceived as a threat to more formal, regulated milk markets. Moreover, their sheer number means that the government institution, with their limited capacity, are unable to regulate them. As a result, not only DPU cooperatives but also milk processors are often unable to get access to the volumes of quality milk that they required to operate.
MCCs	Where MCCs were operational, they seem to be working well on the most part and facilitating the timely flow of milk from farmers to the DPUs.	Perceptions of cheating in milk measurement and price was cited by one group of DFEG members in Dangila. Delays in milk provision to the MCC by member farmers adversely affects the supply of milk from the MCC to the DPU. This is in part linked to limitations on the side of farmers but also to low levels of milk production linked to the high costs of inputs
Functioning of the DPUs	4 out of the 5 woredas were reported to be functional, with one having stopped milk collection during the last year due to internal dynamics. DPU reported various benefits resulting from the support provided by EDGET project.	Not all DPUs are reported to be functional in terms of buying and selling milk from farmers. The DPU in Lemu Bilbilo was perceived not to be playing its role by multiple actors as a function of week commitment by the DPU committee, poor market linkages and a lack of support from the WCA and the WLO. The DPU in Wuchale was also seen to be operating quite poorly.

Sub-component	Strengths	Weaknesses
	Benefits reported include: ● Increased regularity of payments to farmers (e.g. Lemu Bilbilo) ● Improved working environment for DPU committees ● Reduced wastage and return of milk ● Regular monitoring of milk quantity and price ● Increased understanding of and capacity to fulfil the role of the DPU ● Increase in the supply of milk ● Improved management of the cooperatives ● Improvement in the quality of milk supplied by farmers (as a result of training and testing of milk) ● Equipment in the DPU is well maintained ● In some cases (e.g. Dangila), the DPU reported that the demand for milk from buyers had increased as a result of recognition of the improved quality ● DPUs are able to buy collect milk even during the fasting season (Dangila) ● Increased diversity of milk products are being produced Some DPUs have better reporting and management practices in place. (Machakel)	The lack of linkages with milk buyers appears to be the major impediment, though it is a bigger issue in some woredas (e.g. Aleta Wondo, Lemu Bilbilo) than others. In some cases this is because of limitations on the part of the DPU and other agencies, in others it appears to be due to the weak status of the market for milk in the area. Often it is a combination of both. Milk purchasing can sometimes reduce significantly during the fasting season, with obvious negative implications for dairy farmers. In Wuchale, DFEG members reported that the DPU rigs the alcohol tests to reject more milk during the fasting season. Transportation issues (i.e. getting the milk from farmers to the DPU) also affects the ability of DPU to collect milk from all the dairy farmers in the community (e.g. Machakel, Lemu Bilbilo, Wuchale). Similarly, poor road connectivity in Machakel is seen as a significant constraint to the ability of the DPU to sell milk to outside buyers. In Lemu Bilbilo, it was reported that farmers were supplying adulterated milk. Poor performance of the DPU (milk collection, expanding membership, making payments) negatively impacts on the DA's ability to play their role. Low demand for milk in the wider markets was reported as an issue. Farmers reported a bad experience in Wuchale and Machakel due to bankruptcy of the local milk union (not the cooperative/DPU) which resulted in non-payment to farmers who had supplied milk. This has lowered farmers' trust and interest in working collectively. According to DPU committee representatives from Dangila and Wuchale, the main reasons for milk rejection were related to: ● Health condition of the cow; ● Distance of milk collecting centre ● Hygiene of milk equipment ● Insufficient fat content and/or absence of cream in the milk ● Milk combined with powdered milk
Regional level milk processors	The SNNPR regional milk processor reported receiving trainings from EDGET project and support in establishing linkages with farmers. These trainings helped the processors to collect quality milk and advise their suppliers on how to produce quality milk. Overall the demand for processed milk was reported to be increasing as a result of increasing urbanisation. The Embet milk processor reported that EDGET project had tried to link them with farmers but that it was uneconomical to transport milk from so far away. As a result	The regional milk processor from SNNPR reported challenges in securing a sufficient supply of quality milk. For example, Almi Asmamaw reported that their plant has a capacity of 20,000 litres per day but is currently only collecting 50% of its capacity. Roads are of poor quality and make milk transportation difficult. Suitable packaging materials were also reported to be very costly, pushing prices of milk up and reduces demand, with many consumers preferring raw milk or

Sub-component	Strengths	Weaknesses
	they reported that their business did not benefit from EDGET project support.	unpacked processed products. Media propaganda surrounding aflatoxin issues in 2015 was reported to have had a negative impact on milk demand. Limited operational budgets and difficulties in obtaining loans from banks limits business development.

Assessment of relevance

DPUs address a key gap in the existing output markets for milk and milk products since there is an absence of buyers with quality standards at the woreda and kebele level who can purchase from smallholder dairy farmers.

MCCs are also relevant in that they facilitate the supply of milk from dairy farmers to the DPU, thereby overcoming key bottlenecks related to milk collection and transportation.

The activities carried out by SNV to support the development of the DPUs (institutional linkages, trainings, equipment provision, formation of MCCs, etc.) are all found to be highly relevant.

Contextual factors (prevalence of crossbreed cows, existence of viable milk markets, infrastructure, etc.) however are major drivers of the functional potential of DPUs.

Assessment of effectiveness

Overall SNV's support in establishing and developing DPUs has been mostly effective. The key challenge is that market development is not a linear process and contextual factors have posed a challenge.

Delays in the provision of equipment have limited the extent to which the dairy cooperatives supported with DPUs have been able to function as intended.

DPUs are not all functioning well. Some were even found to have stopped collection at the time of the evaluation.

Despite these issues DPUs have led to increased interest in dairy farming and an increased recognition of the importance of milk quality. Their contribution to increased incomes for dairy farmers, however, remains questionable.

The main issues faced by DPUs are:

- Difficulty in establishing market linkages: Limiting the DPU's ability to purchase and sell-on the milk that is produced by farmers
- Management issues: These can easily undermine the functionality of the DPUs.
- Lack of equipment: Without relevant facilities and equipment the DPUs cannot function effectively

Assessment of sustainability

The evaluation found that the DPUs were heavily reliant on external support for their functioning - both in terms of management and operations and the establishment of market linkages.

The capacity of the Woreda Cooperative Agencies to effectively play their roles in supporting the development of DPUs appears to be somewhat limited, as perceived by key project actors.

Even if market linkages are established, the development of dairy cooperatives into effective organisations is a long-term process, beset with risks and challenges. Without ongoing organisational

and institutional support, extending well-beyond the end of the EDGET project, the prospect for sustainability of the cooperatives is likely to be quite limited.

If DPUs are not able to purchase and sell milk as per dairy farmers' production capacity (all year round), the gap opens up the opportunity for informal traders to step in. While this may be beneficial for farmers in the short-term because of convenience in collection and low milk quality standards, it also risks undermining the vision of a high-quality milk value chain that lends itself to commercialisation.

Key issues for consideration in a second phase

Targeting and selection of woredas and kebeles for establishment of DPUs: care needs to be taken to ensure that DPUs are established in locations where they have sufficient potential to develop. This means that issues such as road connectivity, electricity supply as well as access to viable markets and a sufficient actual volume of milk production in the catchment area should be carefully assessed. Failure to adequately consider all these factors limits the ability of cooperatives with DPUs to succeed and risks contributing to negative perceptions about their relevance/utility amongst dairy farmers.

Linkages with buyers: Cooperatives with DPUs can only serve their purpose if they have stable relationships with buyers who can (a) absorb the volume of milk that farmers need to supply and (b) offer a competitive price. The capacity of the cooperatives to establish these linkages themselves can be quite limited. A thorough market assessment and clear commitments from potential buyers may be a prerequisite to successful development of the cooperatives with DPUs.

Organisational capacity: The organisational development of DPUs is likely to be a long-term challenge. Appropriate mechanisms for providing business, technical and management support to the cooperatives is essential. However, the requirements my well be beyond what the Woreda Cooperative Agencies are capable of providing. As such, alternative support organisations may need to be established that can play the required role across multiple woredas, creating alignment in the approach and facilitating standards and best practices across these cooperatives. This is a role that could even be played by larger private players who decide to link up with the DPU/cooperatives.

Sequencing of DPU development activities: In many ways a reiteration of what has already been said, the sequencing of DPU development activities should be carefully managed. DPUs need to have simultaneous access to appropriate equipment (e.g. for refrigeration) and larger scale buyers in order to offer a viable milk market for dairy farmers. Failures on either front can undermine the overall functioning of the DPU.

4.4 Strategic Objective 3: To contribute to development of institutions and to dairy sector-wide initiatives

Strategic Objective 3 encompasses a range of interventions that engage with a variety of dairy value chain actors at the regional and national levels as well as with woreda livestock offices. Preliminary discussions with relevant institutions (e.g. SARC and zonal agricultural bureaus in SNNPR and Amhara) were held in 2014 to explore opportunities and needs for capacity strengthening. A needs assessment was conducted in 2014 and led to the following areas of support:

- Institutional support to woreda livestock offices
- Engagement with regional/national forage seed producers and multipliers

Institutional support to woreda livestock offices

Overview of component

As part of its support to the development of pro-smallholder dairy value chains, EDGET project provided institutional support to woreda livestock offices above and beyond the core support on extension service delivery. The focus of the support provided was on addressing some of the important constraints faced by the woreda livestock office. Particular attention was given to the role of the woreda livestock office in providing Artificial Insemination services - with the provision of motorcycles and large and small liquid nitrogen flasks for storage at the woreda livestock office and for transportation by motorbike. In addition to this technical trainings and capacity development support were provided to the woreda level AI technicians to enhance their ability to play their role.

While animal health services are also a key responsibility of the woreda livestock office, this was not identified as a priority area for project support by the woreda livestock office.

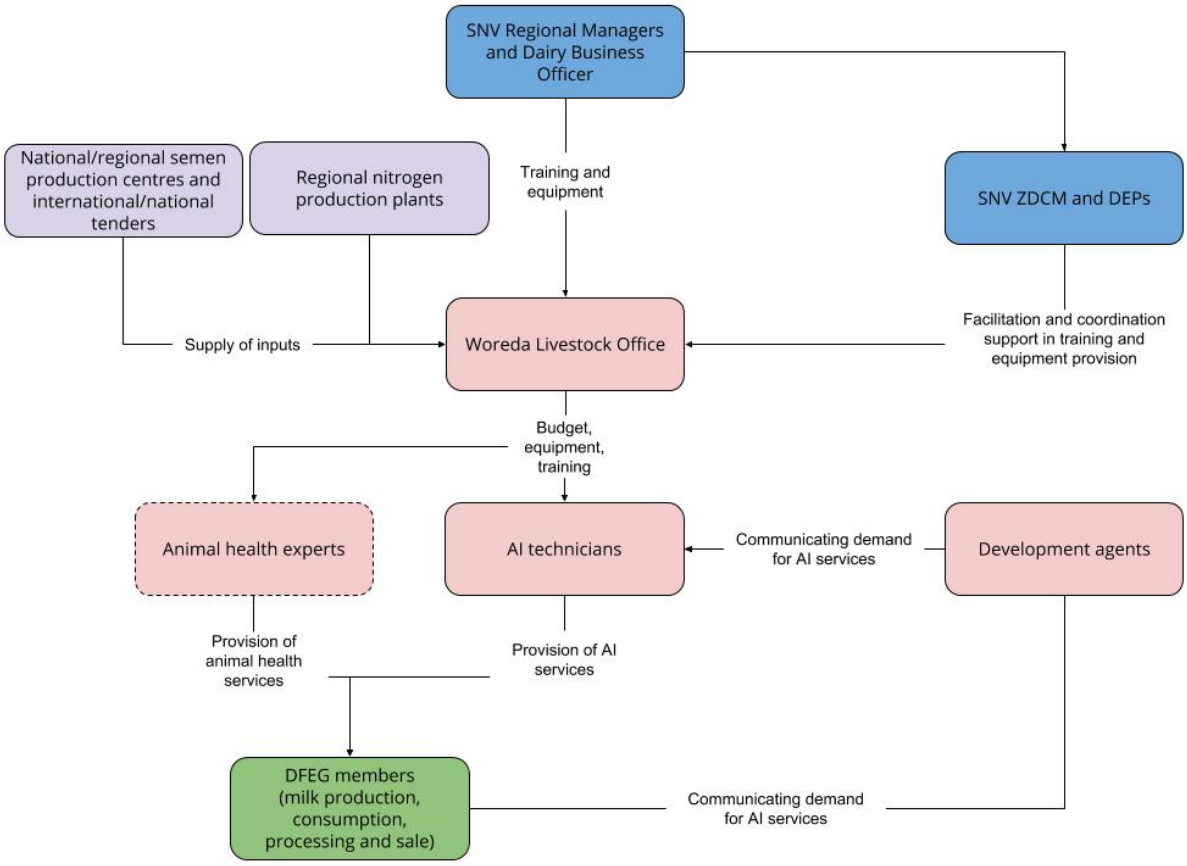

Figure 25 Actor map of the institutional strengthening component (woreda services)

Implementation: planned vs actual

Table 38 Institutional support to woreda livestock offices - achievement of output targets

Output description	Indicator	Achievement end of project	End of project revised and (original) targets
Dairy sector stakeholders that address critical constraints for dairy sector development supported	Number of regional and federal level dairy sector institutions supported	6 / 100%	6 (9)

AI service access and inefficiency is one of the main constraints identified. For this, EDGET project provided training support to 183 AI inseminators at woreda and kebele level and supply of liquid nitrogen containers in Amhara and SNNPR in 2015. AI equipment was only delivered in Oromia in 2016 as a result of delays caused by foreign currency shortage and other logistical problems faced by the supplier.

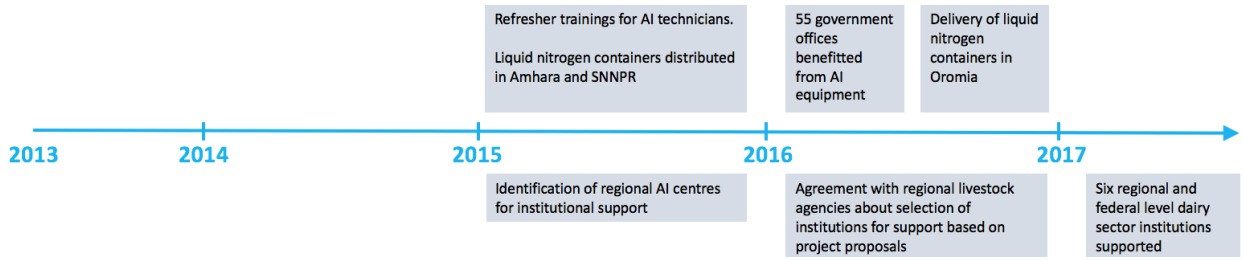

Figure 26 Timeline of implementation for SO3

In sum, more than 55 government offices (mostly woreda livestock offices) benefitted from AI equipment, even though delivery of procured goods and services by contracted suppliers was sometimes late. A total of 183 AI technicians received training support. Six regional and federal level dairy sector institutions were supported (100% of revised target). The challenge in engaging more institutions were mainly due to the limited budget allocation and the engagement/capacity of regional partners.

Assessment by subcomponent

Table 39 Qualitative findings on the institutional strengthening component (woreda services)

Sub-component	Strengths	Weaknesses
Artificial inseminations	Transportation problem for AI technicians addressed Equipment (liquid nitrogen flasks) is helping to ensure quality of the semen Improved delivery of AI services to farmers (faster service) Increase in the number of AI technicians in the	There are still gaps between demand and supply Some DEPs reported varying levels of skill and knowledge among AI technicians. Despite the material support provided there are still issues of supply (e.g. availability of liquid nitrogen and quality semen) Concerns about the semen quality remain despite

Sub-component	Strengths	Weaknesses
	woreda (Aleta Wondo, Lemu Bilbilo), though not attributed to the project. Trainings on fertility management are being provided by AI technicians Overall this is leading to an increase in the number of improved breed cows in the woredas	gains in service delivery efficiency. In some cases farmers reported getting local breeds instead of cross-breeds. However, others have reported that the efficiency of AI (in terms of positive pregnancy diagnosis) has not changed substantially and that AI technicians still take a long time to reach the farmers. The supply of semen to the WLO can also be an issue (e.g. Lemu Bilbilo had no supply between June and Oct 2017) Some farmers report having to repeat insemination and also cited costs in excess of the official government fee paying ETB 100 instead of ETB 5) Farmers get demotivated quickly when AI services are not successful In Wuchale, the issue of fuel costs was also raised. AI technicians reported only having enough fuel budget to cover 50-60 km per day even though the requirement is much higher. Insufficient numbers of AI technicians (Wuchale).
Animal health	Woreda offices are playing their role in providing drugs, treatment and immunisation services	Unavailability and high price of medicines for livestock is reported to be an issue by DFEG members and other actors in a number of woredas (e.g. Machakel and Dangila). Disease outbreaks were identified as an issue in Dangila, leading to death and reduced milk production. Mastitis was flagged as a major issue Lemu Bilbilo Lack of explicit focus on animal health seen as a key gap in EDGET project by a number of different actors at the regional, woreda and kebele levels. Delays in animal health experts reaching farmers

Assessment of relevance

The support provided by the EDGET project to the WLO addressed clear needs of the WLO in relation to the provision of AI services. Equipment provided notably included the provision of nitrogen flasks and motorcycles, critical for AI technicians to maintain the quality of semen, increase their response time and expand their coverage area.

The support on AI provided is seen to be insufficient with respect to the demand because:

- Budget constraints on the WLO side for logistics/transportation/fuel
- Irregular and insufficient supply of quality semen and liquid nitrogen

Animal health is an important issue raised in Machakel, Lemu Bilbilo and Dangila that was only partially addressed through the project. More specifically, preventative health care was provided through improved feeding practices, improved housing, hygienic milk production, etc., which many farmers' reported had led to improved animal health. However, poor response times of vets, lack of and high

cost of medicines meant that when animals do fall ill, there is a high likelihood that they do not receive treatment in a timely manner.

Assessment of effectiveness

The support to AI technicians increased their coverage and there is a perceived improvement in the delivery of AI services.

The success of the AI support has been further bolstered in areas where there was an overlap with AGP (e.g. Aleta Wondo), which supported the recruitment of additional AI technicians.

Despite this, issues still remain for reasons outlined above.

Overall, the capacity training and equipment support was seen to have played a constructive role in enabling the ongoing provision of AI services in the woreda.

However, the key constraints of limited budget for transport and the lack of inputs such as nitrogen and semen were seen as ongoing challenges that limit the scale and quality of AI service provision.

Assessment of sustainability

The technical trainings and equipment provided are likely to make a sustainable difference (good quality, etc.)

- The motivation of AI technicians is questionable

Key issues for consideration in a second phase

The institutional support to woredas on Artificial Insemination might have been better considered as an integral element of Strategic Objective 1, since it concerns key inputs and services related to the development of the dairy value chain.

- While the technical and material support provided to Woredas is likely to be sustainable, the activities carried out do not amount to a coherent and effective programme to enhance AI service delivery.
- In the future, a more systematic approach to strengthening AI services would be advisable, either as a standalone programme that works in synergy with projects like EDGET, or as a fully developed component, similar to the work with AgIDs and on strengthening forage seed systems.

Ideas put forward by respondents:

- Introduce bull breeding service instead of only AI
- Semen quality test kits should be supplied
- Liquid nitrogen centre (Asela nitrogen centre/Lemu Bilbilo) should be renovated
- Use of methods such as synchronisation
- Driving licenses for AI technician (Machakel, as per the DA)
- Allocation of (more) budget by the government for transportation and fuel
- Increased focus on animal health

Improve the supply of quality semen

- A wide range of actors - woreda officers, DAs and dairy farmers - reported issues related to the quantity and quality of semen available. Addressing such bottlenecks in the supply chain need to be addressed in the future.

Improve the supply of liquid nitrogen

Engagement with regional/national forage seed suppliers

In 2014, discussions commenced with possible regional institutions and assessment of institutions started. South Agricultural Research Institute (SARI) has been supported in using their forage land to produce highly demanded basic forage seed.

Assessment of institutions finalised in 2015 and agreement was reached with regional livestock agencies on the institutions to be supported and how to overcome challenges. Institutions (i.e. livestock agencies in the regions) had to submit proposals to SNV for approval of capacity support. In 2016, engagement with government regional forage seed multiplication centres started to address the forage seed and planting materials shortage. Despite repeated efforts and discussions with regional officials, only SARI came up with a good enough proposal on forage seed multiplication which was approved. Support focused on forage seed multiplication to address forage seed shortage. This led to a total of 66.5 quintals of forage seed in the first round of multiplication.

Assessment of relevance

The supply of improved/quality forage seed constitutes a major constraint in the dairy value chain. As such, working with credible and reliable-supply institutions to develop seed and planting materials is a highly relevant activity

Assessment of effectiveness

While the work with SARI has been positive, it is clear that the quantity of forage seed produced falls significantly short of the requirements.

As such the overall effectiveness of this component reveals some significant gaps. The mechanism of requesting proposals from institutions seeking to collaborate with the EDGET project may have proved to challenging in light of the limited capacity within the sector. As such alternative approaches may be required to address this gap.

Assessment of sustainability

It is unclear if farmers' demand or forage seed is well understood. In light of this a clear assessment of the quantity of seed required and a clear plan to meet the supply should be undertaken. If private sector suppliers and/or farmers producing seed meet these needs, a sustainable supply of these inputs can be developed to meet the demand articulated.

Key issues for consideration in a second phase

A focused, in-depth analysis of the forage seed system carried out in close coordination with key stakeholders in the system could help to underpin a clear strategy for addressing the demand for forage seed.

The role of the private sector in seed multiplication - e.g. through outgrower schemes involving AgIDs or regional feed suppliers could be further explored

4.5 Strategic Objective 4: To develop a knowledge base on dairy related issues

Implementation: planned vs actual

EDGET project developed and disseminated extension related and good practice materials in dairy production, processing, marketing and development. The project also organised knowledge sharing events.

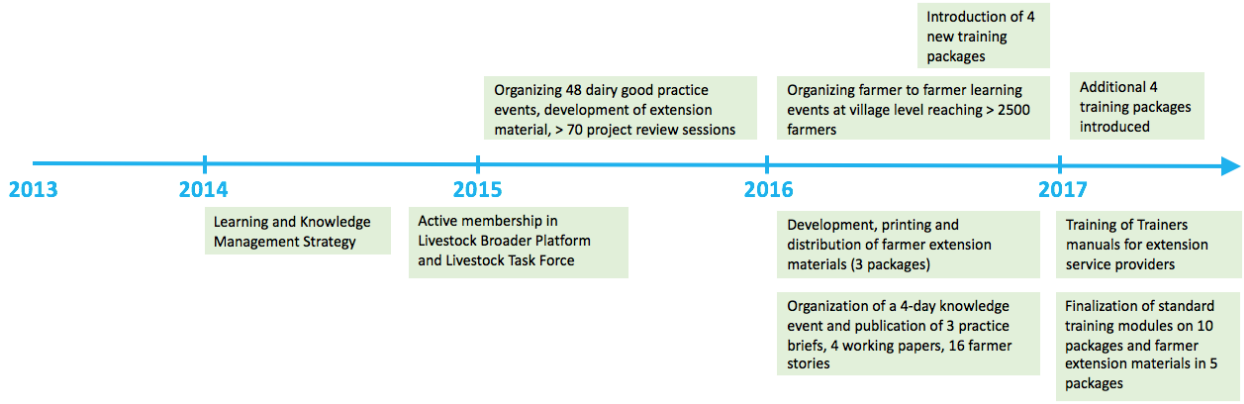

Figure 27 Timeline for implementation of SO4

The project developed its Learning and Knowledge Management Strategy in 2014. Project representatives participated in EKN Learning Knowledge Event sharing their experiences. EDGET has also become an active member of the Livestock Broader Platform and Livestock Task Force.

In 2015, the project organised 48 (64% of 2015 target) dairy good practice events (46 at woreda and 2 at zonal level) for a total of 1080 farmers in forage development and calf / cow management. 17 technical discussions were also facilitated among livestock experts and extension personnel from government at zonal and woreda level. 3 farmer extension materials were developed (one short of target).

In the same year, the project carried out 73 review sessions at both central and regional levels. M&E staff and the EDGET programme manager attended all Agri-pro Focus and EKN learning events and in one of them presenting challenges and lessons in working with the public and agricultural extension system in Ethiopia. Regional managers attended various technical working groups and multi-

stakeholder meetings contributing to cross-organisational learning, collaboration and knowledge sharing (2015 Annual Report).

In 2016, the project organised experience sharing visits for 2,631 farmers (228% of 2016 target) but due to the situation at field level, events planned could not be organised as expected (0 of 61 targeted). 240,000 farmer extension material was printed and distributed. The extension materials prepared contained three packages - Forage Development, Calf and Cow Management, and Milk Handling and Hygiene, with images and text in local languages (Amharic and Afan Oromo). 14 knowledge materials were also produced (155% of 2016 target).

Table 40 Achievement of project outputs for creating a knowledge base on dairy related issues

Output description	Indicator	Achievement end of project	End of project revised and (original) targets
Knowledge base of extension service delivery system strengthen	Number of Dairy Development Training packages/modules developed	10 / 167%	6 (10)
	Number of Farmer Extension Materials packages developed (number of packages)	8 / 1000%	8 (8)
	Number of Farmer extension materials printed and distributed (number of copies)	240,000 / 92%	260,000 (520,000)
Knowledge base of "best practices" in dairy production, processing and marketing developed and disseminated	Number of dairy good practice sharing events organized	93 / 42%	224 (224)
	Number of dairy HHs participated in experience sharing visits	5,116 / 197%	2600 (2600)
	Number of knowledge materials developed & disseminated	20 / 71%	28 (0)

In the same year, EDGET with the help of an international consultant organised the 2016 knowledge event. 50 EDGET and government staff participated over the course of the four-day event. Project good practices and three practice briefs were developed during the event. Further, 4 working papers and 16 farmer stories were written and later published. Similarly to the previous year, EDGET staff participated in sector meetings and learning events at different levels and participated in the Netherlands Trade mission to Ethiopia. In 2017, 10 dairy development training modules (125% of 2017 target), 5 famer extension materials (125% of 2017 target) and 6 knowledge materials (31% of 2017 target), including 5 practice briefs and 1 synthesis reflection paper, were finalised.

Data from the household survey and qualitative interviews regarding where beneficiary farmers received training and knowledge from is reported in the upper sections in adoption of practices.

Overall assessment

The EDGET project has made a substantial contribution to knowledge development concerning inclusive dairy value chains in Ethiopia.

4.6 Strategic Objective 5: To improve nutritional status of children through dairy consumption

Overview of the component

Dairy development and nutrition have a number of important linkages. At the level of the smallholder household, dairy development has the potential to contribute to increased consumption of milk and processed dairy products within the household, with implicit nutritional benefits. At the same time, it poses the risk of reducing household consumption of dairy products as more milk is sold (particularly if prices are high) and less retained for household consumption. From a market system perspective, the increased production of milk enables an increased availability of dairy products for consumer markets.

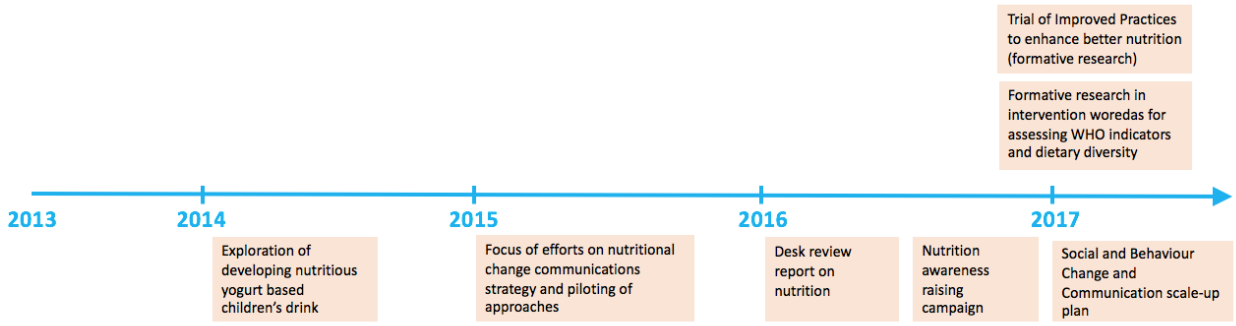

Figure 28 Timeline for implementation of SO5

Implementation: planned vs actual

Initially, in 2014 EDGET project had explored the idea of developing a nutritious yogurt based children's drink. However, further research was required to address food safety aspects and there were difficulties finding a suitable industrial processor partner. The nutrition strategy was revised in 2015, pillars of the strategy include:

- Awareness raising concerning quality nutrition and the importance of milk products to diversify diets;
- Milk fortification as a solution to micronutrient deficiencies in children under 2 and pregnant and lactating women.

Based on insights gained in 2015 (cf. donor report p.6), it was decided for the forthcoming years that the EDGET project will focus all its efforts on the implementation of the nutritional change communications strategy and piloting of approaches that are directed at behavioural change at the household level.

Table 41 Achievement of project outputs for nutrition

Output description	Indicator	Achievement end of project	End of project revised and (original) targets
Awareness raising events/campaigns on value of dairy products for child nutrition organized	Number of nutrition awareness raising events/campaigns organized	19 / 12%	153 (153)
	Number of people addressed in nutrition awareness raising events/campaigns	6,178 / ?	?
Affordable & Accessible dairy products targeting children developed	Number of affordable & accessible dairy products targeting children developed and adopted	Activity was cancelled	0 (1)

Awareness raising campaigns were initiated in 2016 on a small scale and repeated again in 2017 (e.g. World milk day was organised in 2014 and 2015 with the Livestock Resource Development and Promotion Agency and an NGO). Assessment of nutrition status in project areas was undertaken in 2016. The scale up of the nutrition interventions is highlighted as a priority for the second phase of the EDGET project.

Due to the small scale of the intervention and competing evaluation priorities, it was agreed that the evaluation would not gather primary data to assess the effectiveness of the nutrition awareness campaigns. However, data on the patterns of household consumption of dairy products was included in the household survey. The primary analysis in this section is based on a review of documentation regarding the nutrition pilot. Observations are presented below.

Findings from the household survey related to dairy consumption

In terms of consumption of dairy products, the only statistically significant difference found was related to the consumption of milk at the household level. More specifically, households in intervention woredas were found to have a higher daily consumption of milk (0.51 litres) than those in comparison woredas (0.3 litres) during the fasting season.

Piloting the nutrition initiative

In 2016, a desk review report on nutrition was published with the support of SAK Business and Personal Development PLC.

In May 2017, EDGET commissioned a formative research study in intervention woredas on 8 WHO indicators for assessing infant and young child feeding practices (IYCF), Minimum Dietary Diversity for Women (W-MDD), barriers to practice appropriate maternal, infant and young children nutrition (MIYCN) and missed opportunities or recommendations to design an effective nutrition Social and Behavioral Change Communication (SBCC) intervention. The research provided useful insights into a future nutrition awareness raising campaign: it showed that only 39.4% of children in the sample met required dietary diversity, that W-MDDS was below critical limit with only 4.3% meeting the minimum of five food groups out of 10 food groups for consumption. 67.9% heard or received messages or

information on IYCF during the 1000 days of life, with 58% mentioning health education in health facilities by health extension workers (HEW). While about half of the respondents were engaged in community organisations or social programs, IYCF related messages were not spread through such gatherings. The preferred source of information to learn about IYCF are the HEWs. Lack of knowledge and awareness about IYCF was cited for HEW and mothers as well as their supporting environment (community, family, etc.).[41]

Trial of Improved Practices

In July 2017, EDGET and the subcontracted firm EUREKA Health Services concluded a Trial of Improved Practices (TIPs) to enhance better nutrition during the first 1000 days in three pilot Woredas of Amhara, Oromia and SNNP Regions. The TIPs allows program planners to pre-test the actual practices that a program will promote by testing the messages on practices through close counselling and guidance (four visits to mothers in total) for an intervention group, and by following up on which practices were adopted. The group does not receive any intervention or support.[42] This pilot tested the compatibility of SBCC message-materials-channels strategy, i.e. six major MIYC feeding recommendations identified at the formative research stage. The following qualitative insights for programming and messaging were generated through the study:

- Key barriers to more optimal breastfeeding include mothers' lack of information, demonstrations and access to advice from elders and peers;
- If the porridge fed to children is thick, mothers were afraid it would choke the baby;
- Parents were willing to do anything to help their children eat and grow healthy if the advice is complemented with demonstration;
- Most mothers who were successful in adding milk to their children's diets during the trial period reported that they were pleased because the milk softens the porridge and their children eat well and it gave them a new way to prepare food;
- Milk was the food of choice because many mothers recognized that since milk was readily available, it was not expensive.

The study also collected quantitative data based on a subjective measure of adoption of practices in comparison to a group (See Figure 29 below). [43]

[41] Formative Research to Determine the Status and Barriers of Optimal Nutrition during the First 1000 days of Life: The Case of SNV-EDGET Dairy Project Areas. May 2017

[42] TIPs is considered a formative and often qualitative technique with small sample sizes. Statistical analysis beyond description of absolute cases was not part of the study. This means that little can be concluded about messaging effectiveness.

[43] SNV EDGET: Trial of Improved Practices Report, July 2017

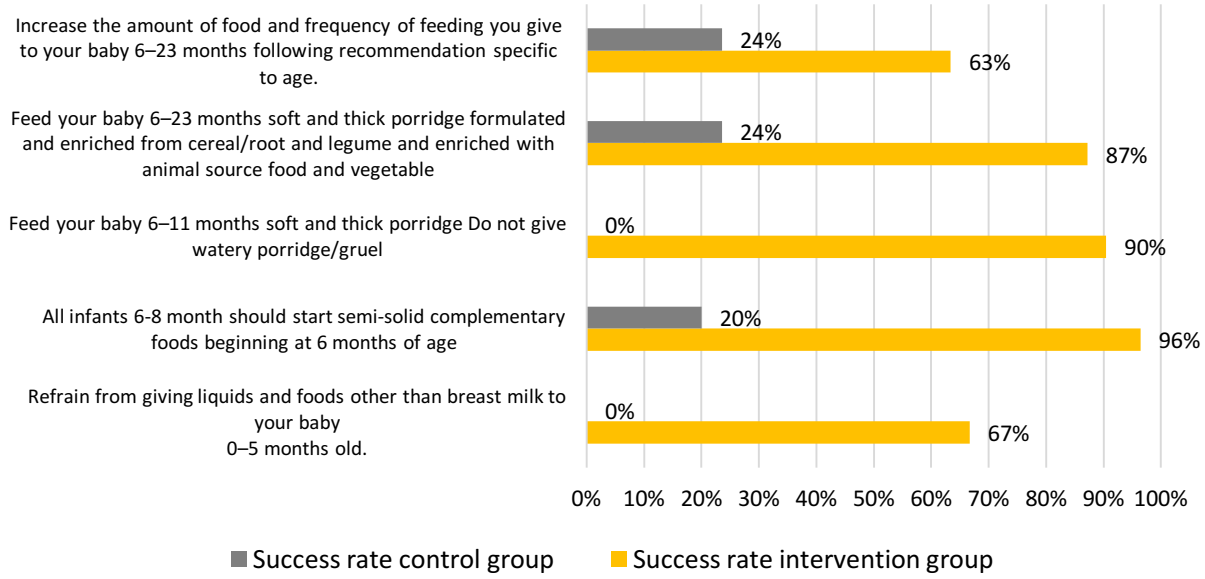

Figure 29 Overview of data from the TIP comparing uptake of recommended practices by mothers as reported during follow-up visits. Please see the limitations of possible conclusions from the quantitative part of the study[44]

The TIPs study design and possible conclusions based on quantitative data are prone to a range of criticism:

- Objective measures of effectiveness of the messages on the nutrition status of target groups were not collected (the study relied only recall data about practices), which is why little can be said about the impact of adoption of practices on children's nutrition. Subjective perceptions and recall data are prone to a range of biases.
- The sample size of the control group was 60 and for the intervention group was 180. However, sub-samples for different messages were much smaller ranging from 9 to 51 in comparison and 27 to 153 in the intervention group depending on which recommended practice was looked at. Conclusions based on small sub-samples should be drawn with caution and carefully backed up with additional and more rigorous evaluations in future.
- From the study report it is not clear which quantitative conclusions were drawn from the study and why a control group was employed. In order to test message effectiveness and adapt it for the programme context, one would expect to compare at least two messages with each other. Those messages should target the same recommended practice (in order to ensure comparability) but may be conveyed in a different way or with different intensity, for example comparing the effectiveness of three rounds of counselling per mother compared to just one, or comparing different ways of framing the messages.

[44] Diagram based on numbers provided in the Trial of Improved Practices Report

- The present study looked at six messages that mainly target different groups of children, e.g. infants 6-8 months or baby 0-5 months. The possibility of comparing messages is, therefore, limited. Further, the control group does not get any support or intervention. It is therefore not surprising that no or only smaller adoption rates can be seen for the control group. It seems advisable to assess effectiveness of future nutrition related interventions in a more rigorous manner (e.g. RCT style assessments).

Social Behaviour Change Communication Strategy and Scale up Plan

In June 2017, EDGET project developed the SBCC Strategy and Scale up Plan for the promotion of appropriate nutrition during the first 1000 days of life. Goals of the plan include:[45]

- Enhance the nutrition behaviors focusing on improving dietary diversity of mothers and infants in dairy producing HHs.
- Improve the production and consumption of nutritious and micronutrient-dense diet for children under two and pregnant and lactating women in the project areas.
- Strengthen capacity to of Agriculture and Health extension workers on appropriate nutrition during 1000 days of life and implementing nutrition SBCC interventions

To achieve these goals, the plan sets out the following SBCC strategy:

1. Advocacy to increase resources and political/social commitment for change goals
2. Tailor made trainings on Nutrition Sensitive Agriculture (NSA) for nutrition task force in the project area
3. Contextualized awareness creation of Community leaders and partners “Learning by doing”
4. Community mobilization for wider participation, collective action, and ownership
5. Behavior change communication for changes in knowledge, attitudes, and practices of specific audiences (including counselling, peer education, demonstrations)
6. Nutrition sensitive agriculture extension
7. Best experience sharing with positive deviance family

The proposed cross-cutting strategic mix will lead to:

- Creation of demand for, and utilization of appropriate nutrition during the first 1000 days of life and to promote the adoption of positive, healthy, protective behaviors.
- Improvement in the quality of service provision at the level of quality nutrition service delivery, including capacity strengthening in Interpersonal communication skills, counselling skills and community mobilization.

[45] SNV EDGET: Social and Behavior Change Communication (SBCC) Strategy for the promotion of appropriate nutrition during the first 1000 days of life. June 2017

Overall assessment of the SBCC Strategy and Scale-up Plan

The scale-up plan builds on the learning and insights generated from the formative study and the TIPs report. It appears to make good use of synergies with existing project interventions and outcomes, i.e. that more milk from dairy production is available for consumption by mothers and children. Most of the objectives and indicators referenced in the plan are time-bound to December 2017 (cf. Behavioral M&E process objectives and indicators in the Scale-up Plan), which appears to be too short. Further, given that the proportion of SNV-EDGET supported households with under two children is 20%, it will be difficult to reach the target of 65,000 households with a women-child (<2 years) pairs with MIYCN messages that have also received support on dairy production, processing and marketing - building on the potential synergies of the project's dairy and nutrition component. This target may, therefore, need to be scaled back. Furthermore, we would have liked to see an external and more rigorous evaluation of outcomes and campaign effectiveness before large scale roll-out of activities.

Assessment of relevance

Maternal, neonatal, child, and adolescent health and nutrition are one of the major priority areas in Ethiopia's Health Sector Transformation Plan (2016-2020). 2016 data from the Ethiopian Demographic and Health Survey showed that 38% of children under 5 are considered short for their age or stunted. EDGET project research documents further suggest the widespread problem of children not having the required dietary diversity and that W-MDDS was below critical limits. All things considered, nutritional behavior and change communication interventions seem to be very relevant in the Ethiopian context. Given the dairy focus of the project and the high nutritious value of dairy products, follow-on projects in collaboration with the Ethiopian extension system seem to be well positioned to deliver such interventions.

Assessment of effectiveness

In case the nutrition awareness campaign is rolled out in future we recommend to test effectiveness in a more rigorous manner. The TIPs study remains inconclusive in that regard due to design limitations.

Assessment of sustainability

As per the current scale up plan, the nutrition strategy will be implemented by Ethiopian Agriculture and Health Extension workers with close support by SNV EDGET national, regional, zonal and woreda staffs as well as the Eureka Health consulting team. The collaboration with existing government structures has the potential for sustainability of capacity building efforts.

4.7 Cross-cutting Strategies

Cross cutting issues include the promotion of women and youth entrepreneurship and climate change. This section focuses specifically on the women and youth entrepreneurship component since the climate change component is addressed in relation to SO1 and the adoption of climate smart practices.

Women and youth entrepreneurship

In order to strengthen the position of women and youth in dairy value chains, the EDGET project has sought to promote women and youth entrepreneurship in the dairy value chain. The focus has been on promoting local business initiatives that involve unemployed women and young people in input supply, seed multiplication and dairy processing activities.

Implementation: planned vs actual

Table 42 Achievement of project outputs for women and youth entrepreneurship

Output description	**Indicator**	**Achievement end of project**	**End of project revised and (original) targets**
Women & Youth dairy regional and enterprises established	Number of women/youth dairy enterprises and groups established	43 / 84%	51 (51)
Women & Youth participation in and leadership of farmer organizations and enterprises promoted	Number of women/youth dairy farmers who received leadership capacity development support	The original plan was cancelled and the project focus was shifted to engaging youth & women in dairy production & marketing enterprises support.	

Interviews with key project staff revealed that the EDGET project did not have a clear gender strategy at the outset, resulting in delayed progress on this front. However, In 2015, farmer households were asked to send women to farmer training sessions and 13 DPUs had at least one female board member plus one women out of two technicians hired for milk processing. The requirement for DPUs put in place in 2015 were strictly followed in 2016. A study was conducted to assess gender integration in the project and this led to the development of a new gender and youth strategy for EDGET, which was put forward in 2016.

In 2017, the project gave further instructions to involve/women HH members in the trainings sessions (either to invite women HH members or both husband and wife). This has been successfully implemented in SNNPR and Amhara region. Women have also received attention during advisory and coaching sessions.

Also for the AgIDs, women applications were given priority. But due to limited number of applications from women, only 6 out of 51 AgIDs were actually women-led in 2015. The women and youth strategy remained to be finalised. This is why for 2016, only three women groups and 6 youth groups were established and / or supported for forage seed multiplication and marketing. This was short of the targeted 36 women / youth dairy groups. By end of 2016, an assessment on how to engage women and youth for the project was completed, showing for instance that women struggle to acquire improved breeds (EDGET Programme Gender and Youth Mainstreaming Strategy report in SNNP regional state, 2016). A pilot for gender and youth ran in 2017. By the project end, 43 women and youth enterprises had been established (86% of the target) and also received equipment and training support.

Findings from the household survey

Findings related to the gendered division of roles in dairy activities have been presented in previous sections of the report but are summarised here for convenience:

- Women are more involved in labour-intensive dairy activities associated with looking after the cows, milking them and processing dairy products. They are less involved in market-related activities such as buying inputs and marketing milk products.
- Female headed households were less likely to be members of DFEGs than male headed households (42% vs 48%)
- While far fewer women were reported to have participated in the dairy related trainings than men, an equal proportion of both male and female headed households received trainings, indicating that female headed households were not disproportionately excluded.
- Statistically significant differences in the receipt of project inputs between male and female-headed households were only found for calf feed, with a higher proportion of FHH reporting receipt of calf feed than MHH.
- In terms of the adoption of practices, several key practices were reviewed. These pertained to the feeding system, preparation of improved feeds, varying feeding based on the stage of lactation, monitoring cows' milk production, producing forage, accessing artificial insemination services, performing regular growth measurement, using supplementary feed, use of the MTS for milking and transportation. The analysis revealed that adoption rates by male and female headed households were not statistically significant, except in the case of accessing vaccination (somewhat higher for MHH than FHH).
- The figures for milk production are 1323 litres/year for Female Headed Households and 959 litres/year for Male Headed Households. However, the difference was not found to be statistically significant as a result of the large variance and the small sample size.
- Net income figures for FHH and MHH are 6486 Birr/year and 6304 Birr/year respectively. As with milk production the difference was not found to be statistically significant.
- In the majority of cases, the revenue from the sale of milk and dairy products is controlled by men and women jointly (56%), followed by women only (34%) and men only (10%).

Overall the results above paint a mixed but generally positive picture. While there remain some gaps in women's membership of the DFEGs, female headed households appear to have benefitted equally from trainings and the receipt of inputs. On the whole, FHH were not found to be less likely than MHH to adopt key practices promoted by the project and this is reflected in similar levels of milk production and net income for both MHHs and FHHs. Perhaps most encouragingly, in the majority of cases, households reported that there was joint decision-making/control over income earned from the sale of milk and dairy products at the household level.

However, when asked about how time spent on dairy activities had changed over the last four years, 42% of female headed households and 49% of male headed households reported an increase. Looking into the extent of this increase, a higher proportion of women headed households reported that time increase was extreme compared to male headed households (28% vs. 15%). MHH were more likely to say that the increase was moderate (50% vs. 37%), while MHH and FHH were equally likely to say that

the time increase was ‘slight’ (35% vs. 35%). The average time spent on dairy activities is 4.1h for female headed households and 4.0h for male headed households (difference is not statistically significant, p>0.1).

Findings from the qualitative assessment

Table 43 Qualitative findings on women's empowerment

Sub-component	Strengths	Weaknesses
Establishing women and youth groups / enterprises	DA: women groups of 30 members established. They received training, churner and refrigerator from SNV in Aleta Wondo DEP+DFEG Members in all woredas: DEP and DFEG members voiced that change for women participation in dairy has improved but is very visible (Dangila+Wuchale, Lemu) as they are mainly involved at home, in feeding, milking, and transportation. Change is due to training, posters, increased government attention to the topic, and also to SNV prioritising this. New employment opportunities for women have arisen at DPUs (Lemu Bilbilo). Dairy product income mainly managed by women (because of SNV training - Lemu Bilbilo). According to the DA in Lemu-Bilbio, a group of seven young women buy skimmed milk from the DPU each day and then processes it into cheese. These girls have buyers and get better income (the change was not attributed to the project). Repeatedly it was voiced that dairy sectors has started to become increasingly owned by youth, especially in cooperatives, but also at household level across several woredas. This is driven by the project and family experiences. In Dangila, women were reported to be involved in the production of urea molasses mineral block, which they are selling locally to dairy farmers. An increase in women's participation in dairy activities was also reported. DFEG members also reported an increased role of youth in dairy related activities at the household level. Efforts to encourage women's participation in training activities were also noted positively. In Machakel, respondents reported an increased representation of women in the Milk Collection Committees and in the dairy cooperatives more generally. Youth involvement in forage and molasses production enterprises was also reported to have increased In Wuchale, an overall trend of increased participation of women and youth in dairy activities - notably trainings and cooperatives- was reported to have increased as a result of both project activities and the current drive by the government.	DPU Machakel: not too many women participating. MOLF Lemu: Awareness creation but no changes visible with regard to women / youth participation Difficult to include youth as they are landless (DEP Lemu Bilbilo) When DEP call for training, sometimes family members who are not carrying out dairy-related work come for training. For instance women carry out more of the home related dairy work but only males appear during the trainings (Aleta Wondo) Various respondents across all woredas reported that the involvement of women and youth in the dairy value chain remained limited. In most woredas, respondents noted that the majority of beneficiaries were male and that insufficient attention had been given to creating opportunities for women and youth engagement in dairy related activities.

Assessment of Relevance

Strengthening the position of women and youth in the dairy value chain through the promotion of women and youth-led enterprises and initiatives, holds the potential to address some of the key issues faced by both groups. However, this evaluation did not conduct a specific assessment of these women-led groups, with the result that limited conclusions can be drawn regarding these efforts.

While an enterprise-led approach holds significant potential for empowering women in public spaces, evidence from the endline household survey and from the qualitative survey suggest that household level gender dynamics and norms are a key area that require further attention. Most findings highlighted that women carry out the major share of dairy related activities (particularly looking after the cows, milking them and producing milk products) at the household level, adding significantly to their existing domestic work. At the same time, women were found to participate less in trainings than men and to have less of a role in decision-making related to economic matters such as the purchase of inputs and the marketing of milk products.

Assessment of Effectiveness

An in-depth assessment of the effectiveness of the women and youth enterprise development was not carried out as part of this evaluation. Analysis is complicated by the absence of a clear gender strategy during the initial stages of the intervention and the delays in implementation of the strategy.

Assessment of sustainability

An in-depth assessment of the sustainability of the women and youth engagement in enterprise development was not carried out as part of this evaluation.

Key issues for consideration in a subsequent phase

Any future dairy-related intervention needs to integrate the gender component much more centrally in the design of activities falling under Strategic Objectives 1 and 2.

Attention should go beyond engaging women in value chain activities to addressing gender dynamics at the household level, particularly given women's central role in dairy-related activities at the household level and well-established evidence regarding the 'double burden'.

The inherent trade-offs between productive and reproductive work of women in these households should be investigated in households where women play a more prominent role. This clearly also has implications for the nutritional level of children and the amount of milk that is consumed by household members including children.

Finding ways to address women's burden of labour related to dairy is challenging. While engagement of men, including male youth, offers one possible avenue, this also risks undermining women's control over income. The possibilities of a household level dairy farm that employs more people (and thereby results in a reduced labour burden for each individual and generates income for employees) may not be viable for the great majority of individual households. However, the establishment of professional services related to dairying – for example milking, milk collection, feeding, etc. - could provide a means

to reduce this burden. Such services could be linked to the Cooperative DPUs or could seek to engage traditional/informal traders. In some countries models of dairying based on contract farming (where dairy cows are kept in a central location and professionally managed) are also being tested. The crux is that so long as the labour entailed in dairying cannot be reduced, outsourcing of specific activities (e.g. to professional service providers) may be the only viable option.

Climate change

As a cross-cutting issue we report climate change under section 'Climate smart practices' above.

5. Inclusive, sustainable dairy value chain development in Ethiopia

Value Chains consist of a series of transactions and actors necessary to bring a product or set of products from the input stage to the final market. Every part and interaction in that chain involves adding value, and collaboration among actors and their stakeholders. The key goal is to find ways in which these sustainable value chains can have **significant impacts on the food system** (i.e. availability of milk and milk products) through **enhancing economic stability by creating value** (higher incomes, more diversified livelihoods, on and off -farm income streams, better nutrition, women and youth economic empowerment), **social sustainability by facilitating more equitable distribution of added value** among stakeholders (farmers, woreda livestock officers, DPUs, DFEGs, processors, AgIPs, AI technicians, EDGET, women, youth) and **driving environmental sustainability** by reducing ecological footprints throughout the value chain.

Whilst the earlier part of this evaluation focused on the components of the subsystem under each of the strategic objectives, this section looks at the interconnections and interdependencies necessary between the different components of the system to enable the system to function as a whole and be sustainable.

Household level outcomes may be sustainable either (1) because the project provided material or technical support that continues to be used and produce benefits in the absence of the project, or (2) because the project contributed to the development of functioning and sustainable subsystems that continue to deliver critical services and inputs to farmers beyond the life of the project. A critical aspect of this second aspect of sustainability also relates to the economic viability of dairying at the household level. While the results in terms of net income at the household level are encouraging, it is difficult to determine the extent to which this is bolstered by the provision of input such as forage seed that has effectively created monetary savings for farmers. It is important to note that calculations of net income carried out using the household survey data do not factor in the opportunity cost of reallocating agricultural land to forage cultivation from food crops.

There are four main aspects identified in this section where improvements will benefit the system working as a whole and can guide future interventions. These are:

- The key actors driving better milk production working in interconnected ways;
- A better understanding of how milk markets are working in Ethiopia, especially in the woredas in question;
- Ensuring that there are clear and contextualised plans for engagement in these milk markets; and
- Investing in an M&E system that drives evidence based decision making and generates insights that are nimble and helpful in guiding implementation.

5.1 Key Actors Driving Better Milk Production from Producers

The extension and input related activities examined during this evaluation found that activities were well-received and led to tangible benefits for actors such as government extension officers, feed suppliers, AgIDs and the dairy farmers themselves. While findings from the household survey indicate that the EDGET project has created considerable success in the adoption of improved practices, particularly with respect to the adoption of forage cultivation practices, the sustainability and replicability of the extension service delivery model(s) is still unclear.

In looking at various actors, the performance of DFEGs was mixed, DAs were found to be quite overstretched and dairy was often not a high priority within the overall woreda extension office (understaffed, under-budgeted and often competing with more dominant crop-production activities) and there appeared a reliance on the EDGET project DEPs.

SNV has had significant presence, with a **DEP** posted in each woreda. Whilst these DEPs have played extremely valuable and important roles, complementing DAs and even compensating for their shortcomings, their presence or persistence as part of the model raises questions. Is the model dependent on having such a large, dedicated and highly skilled cadre of officers in the woreda? To what extent have the skills, resources and capacities required been transferred to the DAs and WLOs and what lighter touch support modalities could fill the gap?

In the context of extension support, the **DFEGs** emerge as vulnerable elements in the system, linked to variable leadership, limited capacity, lack of role clarity within the groups and limited incentives to continue functioning beyond the life of the project. However, the DFEGs have proven integral for extending the reach of dairy extension services to a larger pool of dairy farmers than would otherwise be possible and their attributes include proximal enduring relationships with dairy farmers. Further analysis is warranted to understand exactly what drives the success of DFEGs in different contexts, the nature of incentives that can be introduced (for example, through public recognition of DFEG leaders with high group performance), how the effectiveness of these can be assessed and how less well performing DFEGs can be identified and strengthened in timely and appropriate manners (for example, by rotating the leadership or addressing conflicts or unproductive group dynamics).

Efforts to strengthening input systems through **AgIDs** proved to be very successful in enabling AgIDs to establish viable business models and to pursue growth. The linkages established with feed suppliers were seen to be mutually beneficial for all parties, and very well supported by the linkages established between AgIDs and farmers. While some challenges were found related to pricing, quality, quantity and variety of feed, the results from the household survey - for example pertaining to farmers willingness to continue purchasing calf feed without project support - are very encouraging and potentially illustrate elements of valuable potential sustainability. The challenges for these actors is how to enable their growth, increase profitability, have access to reliable finance, diversify products and services, and increase their reach to underpin sustainable delivery of inputs and relevant services.

The uptake of forage production by farmers has proven to be successful, with a significant number of farmers growing additional forage crops. Farmer-led seed production offers an avenue for increasing the supply of forage and potentially creating an additional livelihood activity that is profitable. Their

challenges relate to shortages in the supply of forage seed, little market information on the forage market and unclear demand for forage seed as a product in itself. These aspects continue to undermine the sustainability of the system as a whole. Going forward, a strong emphasis will need to be placed on expanding the supply of seed potentially through a diversity of larger actors and access to reliable finance and maybe working in a more formal arrangement with farmers supplying high quality forage seed (contract farming) and demonstrating the viability of a market for forage seed at scale.

Throughout the EDGET project, SNV maintained very strong and constructive relations with the **Ethiopian national and regional governments**. Indeed, the overall modality of project delivery was to work through the government line departments - in this case through the Ministry of Livestock and Fisheries at and the regional Bureaus of Livestock and Fisheries. This led to very positive atmosphere of collaboration, with government representatives at the national and regional levels clearly feeling that the project had contributed to enhancing their capacity and addressing specific knowledge, skill and material gaps. At the same time, the government representatives also recognise that it is the role of the government to drive the work in the dairy sector and to scale up the interventions. They believe that the support from EDGET has been aligned with growing importance to livestock and dairy in the Ethiopian Agricultural Growth Plan and has expanded their ability to do this - and that the EDGET project is a good approach. The key constraints identified at the government level are related to prioritisation of livestock and dairy activities within the broader AGP, human resources (quantity and capacity), budget allocation for dairy activities and the absence of a well-developed sectoral regulatory and policy framework for dairy development.

The core services provided by the government includes overall planning, coordination and oversight of dairy related activities and providing **AI** and **animal health services**, with the majority of EDGET project support going into technical and material support for the provision of AI services. Evidence indicates that this support has been very relevant (filling in key gaps) and at least moderately effective (increased service delivery capacity). It is also likely to be sustainable. However, key gaps in the quantity and quality of input supply (for both nitrogen and semen) constitute bottlenecks that need to be addressed for viable dairy development activities to be carried out at scale. More broadly, overall tracking of herd size, genetic composition, etc., are important factors that need to be tackled for effective, modern management of dairy development.

Beyond this, the government has a role to play in developing the infrastructure (e.g. roads and electricity) that underpins and de-risk effective dairy markets, for ensuring that natural resources (e.g. water and land) are allocated in a manner that supports the overall development of the dairy sector and that appropriate regulatory mechanisms are in place to ensure that quality standards in service provision are maintained. This requires cross-ministerial/bureau coordination and alignment on a clear policy for dairy value chain development in the country.

5.2 Integration and Interdependence of components

When considering the overall sustainability of the dairy value chain, it is necessary to look holistically at (a) the sustainability of the individual subsystems (extension, forage seed, concentrate feed, AI, etc.), (b) the ways in which these subsystems integrate, interrelate, reinforce or sustain the dairy value chain

in a dynamic way and (c) the extent to which there is an enabling environment for the development of the dairy value chain including functioning output markets and supporting policies. The following points illustrate these interdependencies:

- Without cross-breed cows (and so an efficient and effective system for breed improvement), milk production cannot reach the critical threshold required to create a viable and vibrant dairy market.
- Without the availability of quality, affordable forage, cow and calf health milk production is at risk.
- Without sufficient demand for quality affordable forage, private providers will have little incentive to produce forage or forage seed.
- Without access to remunerative milk markets, the demand for crossbreed cows and for forage will be limited.
- Without a predominance of markets/buyers that effectively discriminate and pay for the quality of milk supplied, farmers incentives to keep crossbreed cows and invest in them will be limited, thereby further limiting the supply of quality milk.

Figure 30 below, presents the key challenges reported by farmers in the endline survey, in order of decreasing frequency. The results show that the pattern of challenges reported is very similar in most cases in both treatment and comparison woredas, with issues related to the availability and cost of forage and concentrate feed ranking in the top 3 challenges. Statistically significant differences were only found for the high cost of forage feed (more frequently cited in intervention woredas), unavailability of AI services (more frequently cited in comparison woredas), lack of information on dairy cow management (more frequently cited in comparison woredas), a low success rate of AI services (more frequently cited in intervention woredas), a lack of access to veterinary services (more frequently cited in intervention woredas) and a shortage of labour (more frequently cited in intervention woredas). While the responses reflect dairy farmers' perceptions and these perceptions are likely to have been influenced by the intervention, the results reveal that the challenges faced relate to different sub-systems of the dairy value chain. Challenges in any given area risk limiting the farmers' ability to improve their dairy related practices, increase milk production and earn more income from dairy activities. This points to the importance of addressing the interdependencies in terms of how they affect dairy farmers' options and choices.

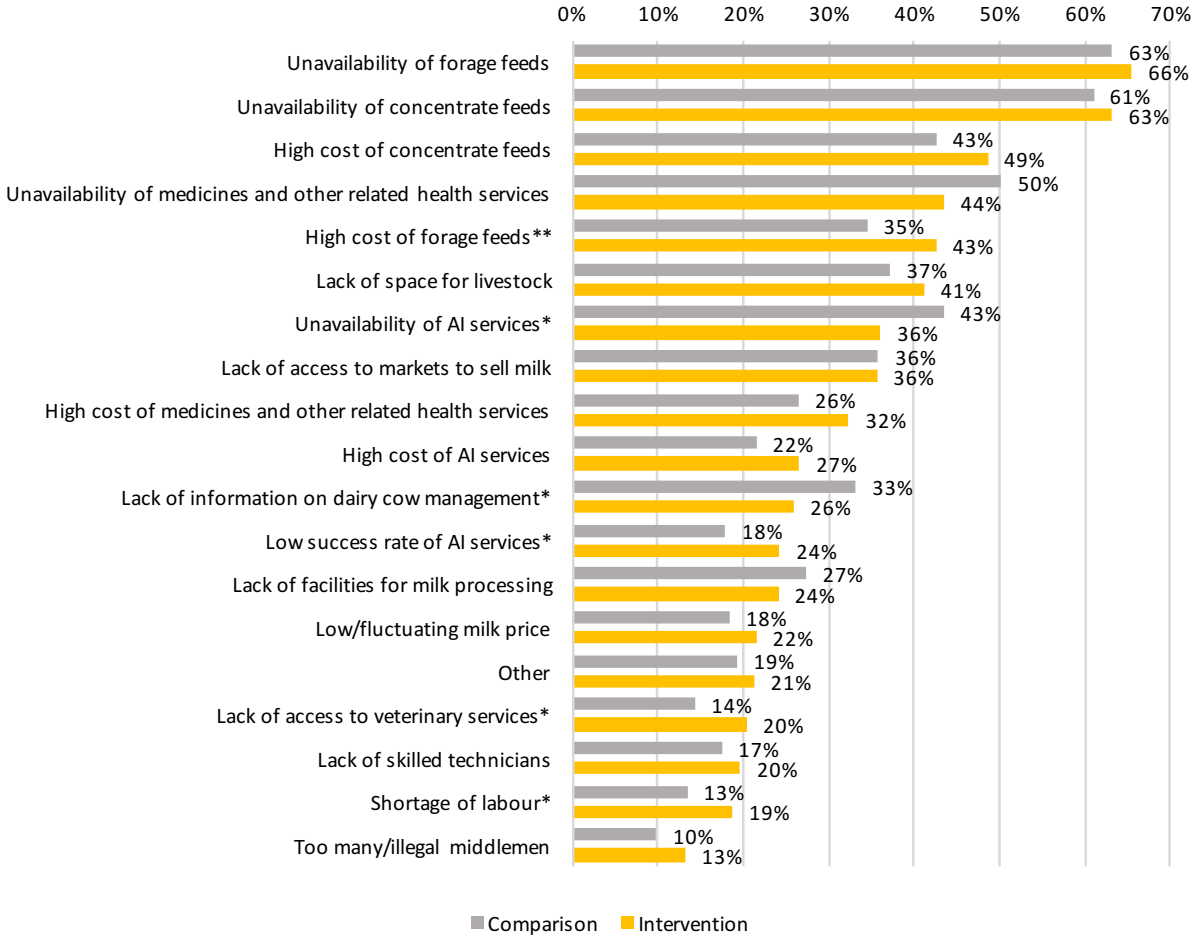

Figure 30 Proportion of respondents by comparison and intervention group that mentioned dairy production related challenges (p<0.1, **p<0.05)*

It is clear that the EDGET project did consider such interdependencies. The complementary mix of interventions and activities targeting different subsystems of the dairy value chain reflects this. However, the challenge for the EDGET project is to translate the complementarity of interventions into functional or operational integration amongst the key actors in the value chain ***across different sub-systems***. In particular, this means ensuring that the links between input suppliers, extension workers, AgIDs, dairy farmers, and cooperatives with DPUs are properly established and functioning synergistically. Any bottlenecks that may arise in one subsystem (e.g. due to a shortage of inputs, weak leadership, lack of electricity or equipment for dairy processing, etc.) will cascade into the others, limiting the extent to which the whole can function as intended. Thus, for example, delays in the supply of equipment to DPUs limited the extent to which the dairy cooperatives could play their envisaged role.

The complexity of the dairy value chain and the multiple interdependencies between its subcomponents makes it difficult to represent the system as a whole, particularly in the form of a more linear Theory of Change or results framework. By focusing on the actors in the system and their roles

(as presented in the actor maps in section 4 of the report), it becomes possible to arrive at a more accurate picture of the interdependencies that are at work in making the value chain work. However, combining all the actor maps together again leads to a high level of complexity that is difficult to represent.

In order to approach the overall value chain as an integrated map, a model of the key variables that make up the system can be constructed that spans multiple subsystems, reflects the different actors and show the direction of the feedback loops that characterise the relationships between the different variables. This not only reveals the interdependencies and relationships within the system but also provides an indication of the key parameters that need to be assessed, measured and tracked in order to design, monitor and evaluate interventions within the system in an effective manner.

5.3 A Clearer Understanding of Milk Markets and their dynamics

Efforts to promote the processing and marketing of dairy products, specifically by supporting the establishment and strengthening of cooperatives with DPUs and Milk Collection Centres, have established the early groundwork for a subsequent phase, building on the lessons learned.

While this evaluation was not able to show the anticipated gains in terms of volume of milk processed/marketed and income earned as might have been hoped for, the timeframe of the evaluation with respect to implementation (many DPUs saw significant delays in receipt of dairy processing equipment) is an important consideration in making overall judgements regarding this component.

Findings from the qualitative component of the evaluation reveal that DPUs and milk collection centres have the potential to function reasonably well, provided there are strong output market linkages in place, competent and accountable management committees. This almost certainly requires external support - above and beyond what most woreda cooperative agencies are capable of providing - and will most likely continue to require such support into the future. Appropriate mechanisms for delivering such business and organisational development support will need to be devised. Much of this will be necessary with a keen eye on the enabling environment and the maturity of output markets in different contexts that determine their absorptive capacities for both milk and processed products.

Considering the status of milk markets more broadly, evidence from this evaluation points to very weak formal output markets for milk. This presents a rather confusing picture, as one of the major assumptions underpinning the project is that stable demand for milk at sufficient scale will drive medium sized businesses for milk aggregation and processing.

On the one hand, regional milk processors reported limited (albeit growing) consumer demand for packaged milk products. On the other they reported limitations regarding a sustainable supply of quality milk. Concurrently, DPU cooperatives frequently complained about the lack of markets for their milk. The majority of farmers were found to be selling their milk to informal traders and individuals, who were reported to provide higher prices than cooperatives or private sector buyers. While informal traders are widely criticised for driving down quality standards for milk quality, they typically pay more, and pay faster than other buyers. Their contribution to increasing the household income of smallholder

dairy farmers is often under-acknowledged. Inherently, this provides strong incentives that drive farmer behaviour.

Given the contextual diversity in milk markets, future work on strengthening the dairy value chain may benefit from a more nuanced segmentation of target woredas based on the maturity of milk markets within them and models of interventions that are tailored to the contextual strengths and weaknesses within those woredas. This may include, adopting context specific strategies for nascent milk markets, emerging milk markets and more developed commercial/formal milk markets.

5.4 Principles for DPU and Milk Collection Centres

Targeting and selection of woredas and kebeles for establishment of DPUs requires careful consideration to ensure that DPUs are established in locations where they have sufficient potential to develop. This means that issues such as road connectivity, electricity supply as well as access to viable markets and a sufficient actual volume of milk production in the catchment area should be carefully assessed. Failure to adequately consider all these factors limits the ability of cooperatives with DPUs to succeed and risks contributing to negative perceptions about their relevance/utility amongst dairy farmers.

Linkages with buyers: Cooperatives with DPUs can only serve their purpose if they have stable relationships with buyers who can (a) absorb the volume of milk that farmers need to supply and (b) offer a competitive price. The capacity of the cooperatives to establish these linkages themselves can be quite limited. A thorough market assessment and clear commitments from potential buyers may be a prerequisite to successful development of the cooperatives with DPUs n respective contexts.

Organisational capacity: The organisational development of DPUs is likely to be a long-term challenge. Appropriate mechanisms for providing business, technical and management support to the cooperatives is essential. However, the requirements may be beyond what the Woreda Cooperative Agencies are capable of providing. As such, alternative support organisations may need to be established that can play the required role across multiple woredas, creating alignment in the approach and facilitating standards and best practices across these cooperatives. This is a role that could even be played by larger private players who decide to link up with the DPU/cooperatives and potential public/private partnerships models also.

Sequencing of DPU development activities: The sequencing of DPU development activities should be carefully managed. DPUs need to have simultaneous access to appropriate equipment (e.g. for refrigeration) and larger scale buyers in order to offer a viable milk market for dairy farmers. Failures on either front can undermine the overall functioning of the DPU.

5.5 Planning and Strategy

Any future intervention would benefit from having clearer strategies or a set of models that effectively stratify or categorise intervention sites based on a rigorous context analysis. Having a clear model of intervention tailored to the context in different woredas may have value in helping both to understand

actor capabilities, which actors are present, how they work together as a system and enhance actor interactions as well establish a clearer understanding of the maturity of the markets in those contexts.

Such plans and strategies should adopt a phased or tiered approach with different intervention approaches for woredas that have different characteristics in terms of milk production, forage production and market development potential. Other key issues to consider include infrastructure availability, and access to capital. An example categorisation is provided in the table below:

Table 44 Characteristics and approaches for different woreda categories

Category	Characteristics	Approach
High commercial potential	Woredas with high milk production, forage production and market development. These woredas will be located close to well-developed milk markets with established milk buyers and processors. They will have a high level of integration between input systems and output markets. The demand for milk will serve as strong incentive for dairy farmers to engage in and invest in dairy activities.	Inclusive commercial business models such as contract dairy farming; requires integration with larger scale private/cooperative enterprises
Emerging inclusive	Woredas with high milk production potential, forage production potential and **an intermediate level of** market development. These woredas may be on the periphery of more dynamic and established milk markets and will have a number of value chain actors operating at various scales and levels of performance.	Emphasis on fostering linkages with key actors within the established milk sheds
Nascent informal	Woredas with high milk production potential, forage production potential and **a nascent level of** market development. These woredas may lie outside established milksheds yet have access to small and medium sized towns with growing milk markets. They are likely to be served by weak infrastructure and have less developed value chains.	Emphasis on developing milk production potential, household level consumption and informal milk markets

The key insight here is that a systematic approach to differentiating what types of interventions, impact pathways and indeed results are appropriate for different segments. Such an analysis would help to ensure that interventions are more closely aligned with the actual opportunities and that the emphasis of resource allocation can be placed on addressing the most critical bottlenecks in a sustainable manner. The alternative to this, which to some extent reflects the EDGET project approach to date, is to have a single dairy value chain approach with some degree of adaptation based on the context. While this has been valuable in terms of generating insights and learning, as documented throughout this report, scaling sustainably will require a more systematic, stratified strategic approach.

5.6 Metrics and a versatile and effective learning system

A new strategy for engagement in the livestock sector should be underpinned by a performance measurement and learning system that is closely aligned to the nature of the system and its dynamics. While the tracking of activities and periodic data collection on key quantitative outcomes provide useful evidence of project progress, they do not necessarily provide sufficient insight into the way that the dairy value chain is functioning as a system or where the key bottlenecks, risks and opportunities are situated. Moreover, they tend to focus on relatively more linear pathways from activities to outputs and outcomes rather than providing insights into the interdependencies between different components of a system and the quality of those interdependencies.

A more systemic approach to measurement and learning is advocated, tied to a stratified strategy or tailored set of models for intervention. Such a system should provide insights into how the dairy value chain as a whole – across different segments – is actually functioning; both in terms of the individual actors within the system and in terms of the extent to which there is effective integration across different actors in the system. A set of harmonised indicators relevant across the strata would provide practical insights into the relative performance of each segment and guide decision-making. It would provide a picture across the Ethiopian dairy value chain that helps provide a better understanding of the incentives and drivers for a more formal, inclusive and successful value chain.

Underpinning this is the need for high quality data collected through accurate and rigorous context analysis and well-designed credible and meaningful baselines and periodic evaluations. It is imperative that such studies are carried out in a thorough and systematic manner that prioritises accuracy and quality. This demands that sufficient time be allocated to the design and roll-out of the evaluations and also that the evaluability of the strategy is considered during its design. This would enhance the credibility and utility of results and gear studies to generate robust insights on the functioning of the system and the impacts that are being achieved.

Moving from a linear results measurement model to one that encompasses the feedback loops and interdependencies of a system requires clearer representation of the expected pathways to impact of the interdependent system. This can be achieved through:

1. Stratified models of intervention with contextualised TOCs and actor maps, assumptions and externalities designed to fit specific contexts
2. A harmonized strategy of measurement to compare models for the key attributes leading to functional systems in different contexts and across the national system
3. A set of metrics and a measurement system that provide timely evidence on how subcomponents of the system are working, individually and in combination, to make course corrections and adjustments that can be delivered promptly
4. Studies that provide clear direction on market potential and opportunities for milk and milk product sales