IMPACT EVALUATION

Agriculture Dairy and Economic Development Project in Makueni and Kajiado Counties

NEW ZEALAND
FOREIGN AFFAIRS & TRADE
Manatū Aorere

ChildFund New Zealand

ChildFund Kenya

emali
Dedicated Children's Agency

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Acronyms

AI	Artificial Insemination
CECM	County Executive Committee Member
CIDP	County Integrated Development Plans
CO	Chief Officer
CSI	Coping Strategy Index
ETE	End Term Evaluation
FCS	Food Consumption Score
FGD	Focus Group Discussions
HDDS	Household Dietary Diversity Score
KALRO	Kenya Agricultural and Livestock Research Organization
KDB	Kenya Dairy Board
KEBs	Kenya Bureau of Standards
KEFRI	Kenya Forest Research Institute
KII	Key Informants Interviews
OECD-DAC	Organization of Economic Cooperation and Development-Development Assistance Committee

1.0 EXECUTIVE SUMMARY

EVALUATION PURPOSE AND EVALUATION QUESTIONS

This report presents the end term evaluation report of the ADED project implemented in Makueni and Kajiado Counties. The purpose of the evaluation was to gauge the gains made by the ADED project in promoting dairy and Moringa value chains and draw lessons that would inform subsequent interventions in these two value chains. The specific objectives of the end term evaluation were;

i. Assess the level of margin of change in household income over baseline among participating households in Moringa and dairy value chains in Emali,
ii. To determine current knowledge, skills and practices on hygienic handling practices and processing of milk, & milk products and Moringa at household level,
iii. To assess the extent to which the community is involved in Moringa and dairy value chains (production and marketing),
iv. Assess sources, availability and utilization of milk and milk products and Moringa products,
v. To assess limiting and facilitating factors in access, utilization, value addition and marketing of milk & milk products and Moringa products in Emali,
vi. To assess child wellbeing indicators that were directly or indirectly achieved through involvement of households in Moringa and dairy value chain through consumption and income generated through sale of livestock, Moringa, milk and milk products,
vii. To establish how appropriate, the project was to influencing behavior change in the community towards Moringa and dairy value chains, and
viii. To determine whether the project was significant or worthwhile investing.

These results will find use within an array of audience including the respective county governments, the national government and other development partners with interest in the two value chains.

PROJECT BACKGROUND

The Agriculture, Dairy and Ecoonomic Development (ADED) program funded by the New Zealand's Ministry of Foreign Affairs and Trade (MFAT), was implemented by ChildFund New Zealand and ChildFund Kenya between June 2017 and May 2021 with the aim of improving food security and incomes in Makueni and Kajiado counties. The ADED project aimed at improving agriculture, diversifying livelihoods and creating reliable and beneficial market pathways for 1,250 farming households. The project aimed at getting *i)* 100 Farmers trained and resourced to introduce Moringa crops, *ii)* 238 Households supported with adaptation techniques and inputs for improved livestock and diversified livelihoods, and *iii)* 638 Household members trained and resourced to generate income through innovative agri-business. The project was implementation started in June 2017 and will be coming to close in May 2021.

EVALUATION QUESTIONS, DESIGN, METHODS AND LIMITATIONS

Evaluation data and information were obtained from a 279 farmers randomly sampled from the project area using a structured questionnaire deployed using Open Data Kit (ODK/ONA). In addition, Key Informant Interviews (KIIs), and Focus Groups Discussions (FGDs) all selected to represent the two value chains in the project area were conducted to obtain qualitative information. Other primary information was obtained from the projects baseline, annual and semi-annual reports.

The structured end line survey and the baseline data were translated into STATA data format for analysis. The qualitative analysis focused on analyzing KIIs and FGDs through thematic profiling, identification, and quantification into counts/frequencies where themes were repeated. In order to gauge the change for outcome indicators and whether the change was significant, a reflexive approach was employed to compare the baseline (Before ADED) and end line (After ADED) for changes in production systems of crops and livestock, milk productivity (milk production per cow per day), moringa productivity (leaves, flowers and seeds per acre), incomes drawn from moringa (moringa products) and dairy (milk and milk products), and changes in number of months for which households faced food deficit.

FINDINGS AND CONCLUSIONS

PROJECT RELEVANCE

- The ADED project was relevant to the needs of the households in the project area and consistent with the existing development frameworks. Among others, the community needs in the project area included need for capacity building on livestock and crops farming, need for market linkage for crops and livestock produce, need for aggregation to benefit from economies of scale and value addition of agricultural produce. The ADED project activities focused on capacity building of farmers, both livestock and crops, aggregation of farm produce through establishment of cooperatives, establishment of market linkages and support in terms of inputs such as seedlings towards increased moringa production.
- The project was also in line with the existing development frameworks from the national and county governments. The focus on food security, income and livelihoods sits well within the County Integrated Development Plans (CIDP) 2018-2022 for both Kajiado and Makueni Counties and is in tandem with the Vision 2030 focus on agricultural productivity and development of marketing linkages

PROJECT EFFECTIVENESS

MORINGA VALUE CHAIN

- **Adoption of moringa farming**-The interventions on moringa value chain led to increase in the proportion and number of households growing moringa. The proportion of households aware of moringa showed a significant positive increase, doubling from 31% to 61% while the households actually growing moringa or those who adopted moringa had a significant increase from 6% to 41% over the ADED project implementation. These changes in awareness and in adoption were driven by the trainings on moringa husbandry practices and creation of the market linkages.

- **Moringa productivity** (leaves, flowers and seeds). Despite the increase in the proportion of households engaged in moringa production, there was no corresponding increase in area, production and productivity. Indeed, as expected, there was a decline in production and productivity since the new entrant farmers were yet to start harvesting while the yield from the old moringa plants were on a decline.
- On marketing, the proportion of farmers engagement in moringa marketing increased. Before the ADED project, only 1% of the population engaged in marketing of either seeds, flowers, leaves or animal feeds from moringa plants. After the interventions of the project, the proportion of households participating in sale of seeds and leaves significantly increased to 23% and 13% respectively.
- The supply potential for moringa products (flowers, seeds and leaves) was estimated assuming an area of 68 acres and productivity per acre as at baseline (higher than at the end line). That is seed-53Kgs/acre, flowers 38Kgs/acre and leaves 92 Kgs/acre as the best case scenarios. This meant that the potential of production of the seed, flowers and leaves would be 3,634 Kgs, 2,589Kgs for flowers and 6,284Kgs for leaves.
- **Knowledge and skills in moringa production:** Evidence showed a positive correlation between crop husbandry training, intercropping and moringa production. 67% (187) of the farmers reported to have been trained on crops production husbandry. 99% (103F and 84M) acknowledged training on crops husbandry and diversification of crops (intercropping moringa with other crops). Of those trained, 87% (161 farmers)-had diversified their livelihoods-that is, they had more than one source of income. Most of the farmers acknowledged being trained on drought resistant crops (38%), ploughing (37%) and how to use chemicals (pesticides)-32%.
- **Climate Smart Agriculture training:** Of the total sample, 66% of the farmers reported being trained in at least one of the CSA techniques/skills. Evidence from the field reveals that most of the farmers were trained on drought resistant crops (79%), use of animal manure (81%) in their farms and ploughing techniques (80%). A tabulation of the CSA training versus intercropping reveals that 99.46% (185 farmers-101F and 84M) reported to have been trained on CSA and practice intercropping Moringa and other crops. A correlation analysis revealed that even though intercropping was positively and significantly influenced by CSA, only the practices of animal manure, ploughing and use of organic chemicals positively and significantly correlate with intercropping.
- **Challenges of moringa production and value addition:** Lack of moringa information and inadequate skills and knowledge are the main challenges in production and value addition in moringa. Of the total interviewed farmers, 32% indicated that lack of information was the most important challenge in moringa production.

DAIRY VALUE CHAIN

- **Dairy production systems and structure of ownership:** Over the project period, livestock production systems shifted significantly with the proportion of households practicing zero grazing increasing from 4% to 12% while free range systems from 52% to 75%. Free ranging is the most common livestock production system practiced by 75% of the livestock keepers. Similarly, the average number of dairy cattle (pure and crosses (Sahiwal)) increased from 2 to 10 over the project period. Using Tropical Livestock

Units (TLUs), a conversion indicates that livestock units increased from 17 per household to 24 units per household over the project period. A huge proportion of this increase originated from expansion in the number of dairy cattle and dairy goats.

- **Pasture and fodder production:** over the project period, there was a general decline in the proportion of households growing fodder and pastures except for napier grass and maize. The proportion of household growing Napier grass increased from 7% to 19%, while that growing or using maize as fodder increased from 14% to 26%, partly due to the support offered by ADED. Similarly, the expansion of acreage under the different types of pastures and fodder increased variably. The area of land under napier grass production increased from 0.6 to 19 acres with Maasai love grass increasing from 30 acres to 50 acres over the project period, while Kikuyu grass expanded from 46.8 acres to 102.5 acres.
- **Livestock production husbandry**: Of the total farmers surveyed, 58% indicated that they were at least trained in one of the practices. The package covered a number of skills including training on milk handling and storage, routine livestock practices and milk preservation to reduce post-harvest loses in milk.
- **Lactation, Milk production and productivity:** Over the lactation period, more than 55% of the milk is produced during the wet season while the rest during the dry season. The production varies due to availability of feed and water which is low during the dry season. Cows remain in lactation for about 11 months with production of milk increasing early into the lactation, peaking in the middle of the lactation and declining gradually. Over the project period, comparing baseline and end line, milk product per cow increased from 4.8 litres per cow to 5.4 litres per cow.
- A closer examination reveals that the TLUs and milk production per cow per day (milk productivity) are positively and significantly correlated with the area of land allocated to livestock but not necessarily the area under pasture and fodder. However, an increase in dairy herd is positively and significantly correlated with the acreage under Napier, Maasai love grass and Kikuyu grass. Further milk productivity was found to correlate positively and significantly with several livestock husbandry practices including training in dairy cow breed identification, routine practices, silage making, health management and disease prevention. Milk hygiene and milk preservation training enhanced the quality of milk while record keeping was presumed to impact milk productivity through enhanced investment and management information.
- Further, in terms of the change of behavior (increased frequency of practices) in dairy production, milk productivity correlated positively and significantly with increased frequency of practicing storage of crop residue, paddocking and use of aluminum milk cans to store or transport milk were found to correlate positively and significantly with milk productivity. The increase in the frequency of these practices indicates a behavioural change in milk production.
- Whereas there is seemingly an increase in number of livestock owned, the pasture and fodder production has declined over the project period. This implies that there is an increase in livestock against shrinking pasture area, a practice that is likely to exploit pasture and fodder in near future with negative environmental outcomes

- **Milk value addition: t**here exists little value addition if any at the household level. Evidence shows that the proportion of households who undertook value addition increased from 11% to 25% with the milk that is locally value added increasing from 18litres to 29 litres per household. The only form of value addition is fermentation of milk into mala (sour milk) and this was evident only for 14% of the interviewed households. 9% of the households produce ghee from the milk while 4% boil milk and this is mainly the one for household consumption. At the MCCs, value addition includes testing for quality of milk and chilling. One of the chilling plants is equipped with equipment to value add milk into yoghurt and mala but this is not being done because the facility lacks Kenya Bureau of Standards (KEBs) license and a manufacturing license to fully engage in processing and marketing of value added dairy products.
- **Challenges of dairy production**: At the production level, pests and diseases, poor rainfall and high cost of veterinary drugs are among the most important costs that affect dairy production. At the value addition, sustenance of the quality of milk, high cost of processing equipment still poses challenges.

PROJECT OUTCOMES

- **Gender and decision making:** There are notable shifts in gender roles especially with participation on decision making regarding use of income generated from crops and livestock. The project improved joint decision making over household income derived from crops and livestock. Whereas the participation of men in decision making on income from dairy increased over the project period, the participation of women in deciding how the proceeds will be used and even in making the final decision dwindled.
- **Income from moringa, milk and milk products**: The overall household income declined marginally by 1.8%, from KShs 132,434.6 to KShs 130,129.1 over the project period. The decline was driven by shortfalls in income from other streams other than the dairy and moringa value chains. The project led to increase in household income from the sale of milk and milk products. Revenue from milk increased by 70% or from KShs 39,067 per month to KShs 55,252 over the project period. The sales were made over the wet and dry season. There average revenue from sale of milk was found to be higher during the wet season compared to the dry season due to the high milk production during the wet season. Compared between the baseline and end line of the project, there were significant increases in average revenue from milk in both seasons. Consistent with the increased revenue from milk, the overall annual income from milk, milk products increased by 2.4%. Income from moringa and moringa products was promising with incomes generated from moringa averaging KShs 2,500 per household and with a higher proportion of households participating compared to the baseline. However, the total household income declined marginally.
- **Household Food Security:** Evidence reveals an increase in the proportion of households consuming 3 meals a day as opposed to the time before the project. Whereas 58% of households reported consuming 3 meals a day in the baseline, the proportion increased to 89% after the project implementation. Meanwhile, those households consuming one meal and two meals a day declined compared to the baseline statistics.

- Households experience food deficits from July and the deficits worsen as year goes by peaking in September and then gradually decline through December. Even though the months of food deficit remains the same, between July and November, further analysis shows a significant decline in the proportion of households who reported to experience food deficit declined over the project implementation period. For instance, the proportion of households who experienced food deficits in August before the project were 54%, 66% in September, and 58% in October but the end line survey after the implementation of the project indicates a declined to 17%, 18% and 14% over the same months respectively. Majority of the farm households experience food deficit in August and September.

SUSTAINABILITY

The continuity of the ADED project activities is hinged on the cooperative movement created within the dairy and moringa production, the infrastructure development along the two value chains, skills and knowledge adopted by the community and the pasture and fodder development that is likely to sustain livestock production.

CONCLUSION AND RECOMMENDATIONS

Even though behavioral change is evident especially with enterprise change, adoption of various husbandry practices particularly in dairy production, the final outcome of increased household incomes is yet to be realized. Nonetheless, the project has made strides in the stages of improving production and productivity of dairy and moringa production. Food security improved with the decline of households who experienced food deficit over the years while the number of meals per day increased.

From the foregoing, it is recommending that the next phase of the project or a new project should continue training on husbandry practices on production especially on fodder and pasture production, continued support to enhance value addition, introduce nee value added products from moringa such as use of moringa in the soap industry, food flavoring and support to strengthen and diversify market linkages across both value chains.

2.0 INTRODUCTION

2.1 The Dairy Sub-Sector in Kenya

Kenya's dairy industry accounts for 4% of the national Gross Domestic Product (GDP), 14% of the agricultural GDP and 44% of the livestock GDP and provides livelihoods for an estimated 1.8 million smallholder farmers and directly employs an estimated 1.2 million Kenyans in directly and indirectly. Over 80% of the milk is produced by small-holder farmers who own between 2-3 dairy cows. The sub-sector is characterized by three production systems including zero grazing, semi-zero grazing system and free or open grazing systems. The dairy herd, according to the 2009 livestock census by the Kenya National Bureau of Statistics (KNBS) is estimated to reach 3.55 million and consists of exotic and cross breeds. Milk productivity is estimated to be low ranging between 5-9 litres per cow per day for small holder farmers and 17-19 litres per cow per day for largescale farmers[1]. Annually, the dairy sub-sector produces an estimated 5.2 billion litres from cattle, goats, sheep and camels.

The sector is regulated and coordinated by the Kenya Dairy Board (KDB) and several legal frameworks govern the operations among others include: the Dairy Industry Act Cap 336, the Public Health Act Cap 242, Food Drugs and Chemical Substance Act-Cap 254 and the Standards Act Cap 396 under the Kenya Bureau of Standards. The Kenya Dairy Board has registered 29 dairies and 67 mini-dairies which have a processing capacity of 3.75 million litres per day but less than 50% of this capacity is not utilized. Over 70 percent of the milk is sold unchilled through the informal market channels (KDB 2015[2]). Kenya's milk consumption is estimated to reach 110 litres per person per year and is expected to grow driven by the need to meet the 55%[3] deficit, increasing urbanization and population. In both rural and urban settings, dairy and dairy products have elastic income elasticities (Musyoka et al 2015) presenting an opportunity for increased production in milk as well as increased value addition.

Initially a preserve of the high altitude wet climate areas, the dairy production is increasingly spreading or being adopted in the dry areas. Makueni and Kajiado Counties represent some of the arid and semi-arid counties where dairy production is catching up. Both of these counties have their strategic plans oriented towards enhanced dairy production. The Makueni CIPD 2018-2022 programs to increase household incomes through increased milk production by supporting access to artificial insemination, promoting zero grazing, and investments in disease and pest control. In Kajiado County, the CIDP focuses on hay production to meet the increasing pasture and fodder deficit.

At the national and county levels the dairy enterprise faces considerable challenges among them climate changes, land sub-division, competing enterprises such as real estate in prime

[1] ACET. 2015. Promoting sustainable rural development and transformation in Africa – Kenya Country Report. Accra: African Center for Economic Transformation.

[2] KDB. 2015. Kenya Dairy Board Annual Report and Financial Statements for the year ended 30 June 2014. Kenya Dairy Board (KDB). Available at: http://kdb.co.ke/press/publications/reports/21-kdb-2014- annual-report/file.

[3] Auma, Joseph & Omondi, Immaculate & Baltenweck, Isabelle. (2019). KCDMS DAIRY VALUE CHAIN ASSESSMENT REPORT 2018. 10.13140/RG.2.2.13092.94080.

agricultural land, high cost of milk production, low participation of youth in the dairy value chain, increasing competition from other beverages, poor animal husbandry practices, and low budgetary allocations to agriculture. As such, opportunities for increased dairy production lies in promoting farmers' access to quality artificial insemination (AI) and other breeding services/inputs, promoting feed planning practices to reduce seasonality of feed availability and increasing dairy producers' access to technical dairy husbandry technical knowledge.

2.2 Moringa growing in Kenya

Moringa (*Moringa oleifera*) farming is still nascent in Kenya and statistics, if any, are hard to come by. The plant is grown mainly in the arid and semi-arid areas in the country. The plant is drought resistant and is increasingly being introduced in dry areas as an alternative to other crops enterprises.

Moringa roots, leaves, seeds, flowers, seed pods, and stems are harvested for various uses among them medicinal, beverage, vegetables or salad. There are several documented health benefits of moringa. The plant is touted for its pain relieving medicinal properties besides its nutritional properties-iron and proteins[4]. The products are also touted to have antiretroviral effects, immune boosting properties for HIV positive individuals, increasing breast milk in nursing mothers, the leaves are eaten as salad or as vegetables in soups and sources, the leaves can also be dried and used as a tasty seasoning and moringa seeds can be dried and crushed to extract oil[5].

Despite these benefits, anecdotal evidence shows moringa as a source of income for the poor households under the increasing failure of the conventional crops especially in dry areas. Several organization and government parastatals have made attempts to woe farmers into planting and growing moringa particularly in the arid and semi-arid counties and in parts of Western Kenya. Although growing of moringa has not become commercialized, there exists numerous buyers of moringa products- especially the seeds. Some of these buyers include Kilifi Moringa Company (in Kilifi), Earthoil Company (Athi River) and a hoard of other individuals (brokers) and small companies. It is estimated that farmers can earn as much as over KES 100,000 (circa. USD 1,000) per acre per year[6]. The crop grows to about 12 meters in height and does well in areas with 800mm rainfall. Opportunities in moringa production lies in increased awareness creation, support to inputs and technical knowhow, value addition and enhancing market linkages.

2.3. The ADED Project and Theory of Change

The Arid and Semi-Arid counties of Kenya are characterized by low agricultural productivity and increasing climate change shocks. Despite the relatively medium level production potential, many of these counties, Makueni and Kajiado included, face increasing occurrences of food insecurity and dwindling household incomes. Even though poverty rate may have

[4] https://www.agrilinks.org/post/kenyan-farmer-turns-new-leaf-moringa-plant
[5] https://internationaltreefoundation.org/moringa-farming-kenya/
[6] https://www.farmbizafrica.com/market/1936-oil-maker-looking-for-farmers-to-supply-them-with-moringa-seeds

remained fairly constant over time, the depth of poverty may have increased with many poor households plunging deeper into the poverty trap.

Efforts to enhance agricultural productivity have yielded little in these counties and concerted efforts are needed if households are to be lifted off the poverty trap and spiraling negative effects of climate change. In a bid to improve food security and incomes in Makueni and Kajiado counties, ChildFund New Zealand and ChildFund Kenya with funding from the New Zealand's Ministry of Foreign Affairs and Trade (MFAT) funded a dairy and economic development project (ADED) with the aim to deliver improved agriculture, diversifies livelihoods and reliable and beneficial market pathways for 1,250 farming households. These are included within the 2,500 direct beneficiaries (5,000 indirect). The project aimed at getting *i)* 100 Farmers trained and resourced to introduce Moringa crops, *ii)* 238 Households supported with adaptation techniques and inputs for improved livestock and diversified livelihoods, and *iii)* 638 Household members trained and resourced to generate income through innovative agri-business. The project was implementation started in June 2017 and will be coming to close in May 2021.

The long term goal of the ADED project is to enhance food security, economic empowerment and diversify the livelihoods of the population in the project focus area. This goal is in tandem with the needs of the population who rather practice agro-pastoral (Makueni) and pastoral activities (Kajiado County) and are prone to food insecurity and erosion of livelihoods emanating from market and climate shocks. From the agro-pastoral areas, the project seeks to maximize livestock and crop returns while in the livestock dominant area, it seeks to maximize livestock returns. Moreover, in order to maximize the crops and livestock returns, it will be imperative to strengthen the resilience of the community against climate change shocks. Communities can improve the resilience to climate shocks by adopting climate sensitive technologies and diversification of agro related livelihoods. Improved pasture development, adoption of drought resistant crops, value addition to milk and Moringa crop produce, and market linkage development are among the approaches that the ADED project seeks to implement to maximize crops and livestock returns and thereby enhance the household incomes. To meet the goal, the project targets 100 farmers for introduction to Moringa farming in order to diversify crops related livelihoods and 238 households to be supported with adaptation techniques and inputs for improved livestock production. Further, 638 households will be trained and supported to generate income through agri-business innovations.

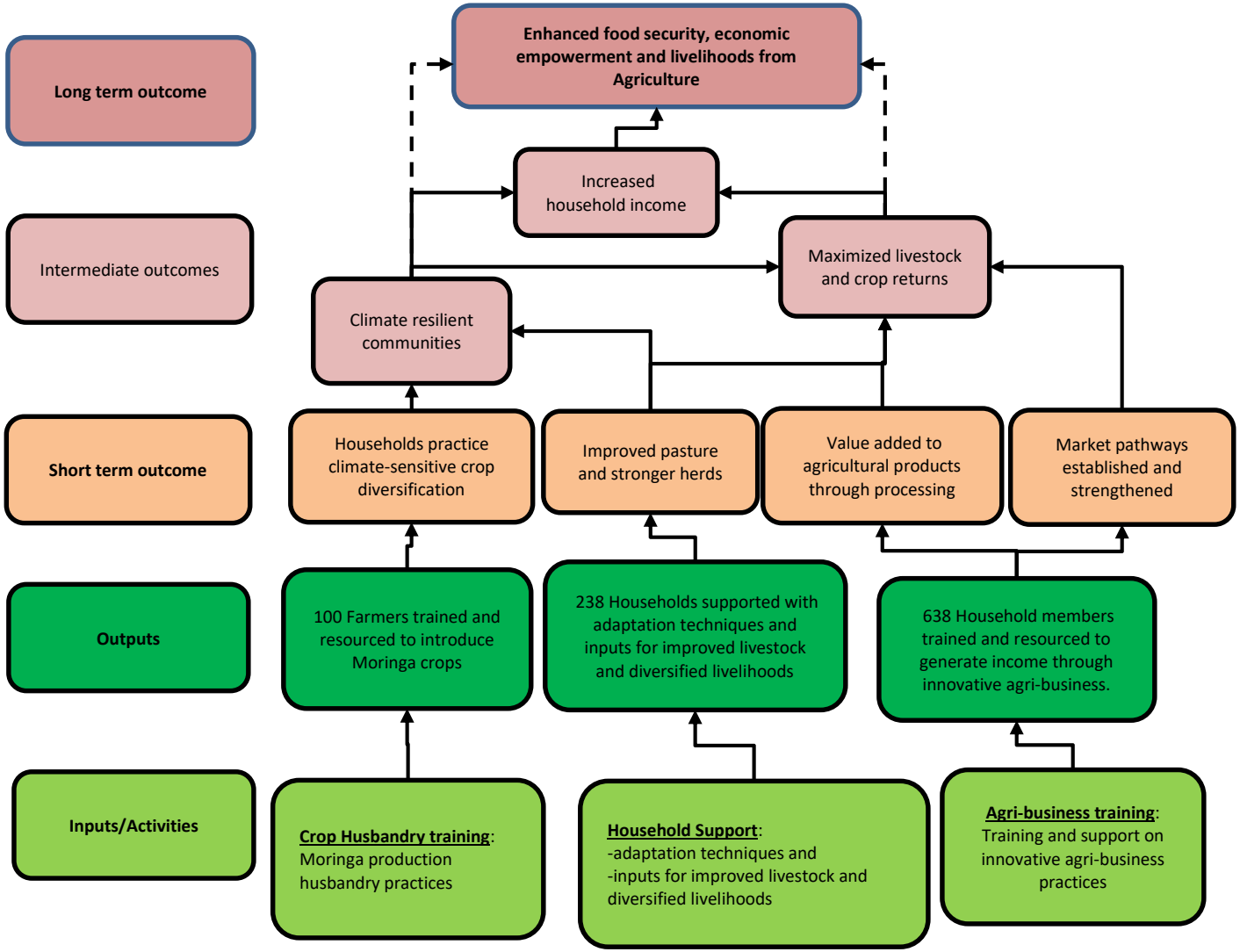

Figure 1: ADED Theory of Change- consultant's depiction

2.4 The ADED Project indicators

The ADED project's achievement were measured using some outcome indicators which are of interest to the implementing organizations. These outcome indicators are measured in the medium-term and cover the two value chains-dairy and Moringa production value chains-covering production, value addition and marketing and associated environment that facilitates value chains. All the project indicators are listed in ANNEX1: Indicator Fact Sheet.

The outcome indicators are categorized into long, medium and short term indicators. The long term indicators, measured after full implementation of the project relate to:

- Food and nutrition security at household level and diversification of livelihoods. Several indicators of food security including the number of months in which households experience food deficits, household dietary diversity score (HDDS), Food Consumption Score (FCS) and Coping Strategy Index (CSI) are all used as indictors of household food security and nutrition.
- Livelihood diversification-The evaluation devises a simple livelihood diversity (no. of economic activities) to compare changes realized over the project implementation period.

The Medium term indicators (measured after 4 years) include increased crop and livestock productivity and households' incomes.

- Livestock productivity is measured as the milk produced per day per cow while Moringa is the output (leaves/seeds/oil per acre).
- Household income is measured as monthly returns from sale of output from livestock (milk in this case) and crops (Moringa products).

The short term outcomes include:

- Adoption of climate sensitive crop diversification measured as the proportion of farmers trained that report increased knowledge of crop diversification and apply that knowledge in crop production;
- Improved practice in livestock productivity and diversified livelihoods- measured as the proportion of farmers trained that report increased knowledge of improved livestock productivity and apply that knowledge; and
- Value added to agricultural products through processing-measured as the proportion of people trained that report increased knowledge of agri-business and apply that knowledge, and volume of Moringa and milk processed.

In addition to these outcome indicators, output indicators include;

- Farmers trained and resourced to introduce Moringa crops-entailed training on Moringa crop husbandry, business planning and establishment of a communal Moringa demonstration plot with access to a water point for demonstration purposes.
- Households supported with adaptation techniques and inputs for improved livestock and diversified livelihoods- Included training livestock farmers on stock management, establishment of a 5-acre irrigation demonstration plot for pastures, training livestock

farmers on pasture development and management, training of animal health assistants, establishment of Vet Clubs in primary schools, business plan training and distribution of goats and chicken and artificial insemination services.

- Household members trained and resourced to generate income through innovative agri-business- this entailed establishment of 5 (five) milk collection centers (MCCs) and Moringa processing workshop, establishment of cooperatives for Moringa and Dairy in addition to training of the cooperative members of respective value chains on processing.

2.5. Purpose and objectives of the study

2.5.1 Purpose

The purpose of the ETE was to determine how well the ADED project was designed and monitored against the objectives, benchmarks, and processes established in the project design document and to evaluate the project's achievements (progress comparing with the baseline), challenges, and draw lessons learnt from the best practices to inform future similar programming.

2.5.2 Specific objectives

Specifically, the ETE sought to;

i. Assess the level of margin of change in household income over baseline among participating households in Moringa and dairy value chains in Emali,
ii. To determine current knowledge, skills and practices on hygienic handling practices and processing of milk, & milk products and Moringa at household level,
iii. To assess the extent to which the community is involved in Moringa and dairy value chains (production and marketing)
iv. Assess sources, availability and utilization of milk and milk products and Moringa products
v. To assess limiting and facilitating factors in access, utilization, value addition and marketing of milk & milk products and Moringa products in Emali
vi. To assess child wellbeing indicators that were directly or indirectly achieved through involvement of households in Moringa and dairy value chain through consumption and income generated through sale of livestock, Moringa, milk and milk products.
vii. To establish how appropriate, the project was to influencing behavior change in the community towards Moringa and dairy value chains.
viii. To determine whether the project was significant or worthwhile investing.

2.5.3 Other End Line Questions

In addition to addressing the project result framework, the evaluation collected information on;

- The current diverse livelihoods of Maasai and Kamba farming communities in Emali compared to status during baseline.

- The changes in the level of food insecurity in the farming communities in Emali compared to 3 years ago.
- The mitigating measures against climate change and economic shocks that have been obtained in the farming communities of Emali.
- The transformation in women's roles as per the project design.
- Reduction of impact on environment through reduced cattle herd sizes in regard to changes in farming practices;
- Any improvement in dairy farming value chain due to improvement in pastures

2.6. Scope of Work to be undertaken

This evaluation targeted the farming households in Emali, Kajiado East and Kibwezi West Sub-Counties with the aim of assessing the performance of the ADED project and to capture the project achievements, challenges, and draw lessons learnt from the best practices that would be used to inform similar projects in the future.

3.0 EVALUATION METHODOLOGY

3.1 Approach and Analysis

The ETE was guided by the Organization of Economic Cooperation and Development-Development Assistance Committee (OECD-DAC) criteria. The OECD-DAC comprises of five standards including Relevance, effectiveness, efficiency, impact, and sustainability.

3.2 Sample Size, Sampling and Data Collection

The evaluation used baseline and end line data. The baseline data was collected in March 2018 covering a random sample of 238 farmers in the project area. There was no control group covered during the baseline. The end line survey captured data from 279 randomly sampled farmers covering both value chains. In addition to the indicators captured in the baseline, the end line survey captured food security indicators - Food Consumption Score (FCS), Household Dietary Diversity (HDDS) and Coping Strategy Index (CSI) which were captured in the end line survey in March 2021.Both samples were obtained from a population universe consisting of the households in the 8 zones in Makueni and Kajiado Counties within which the ADED program was implemented. Specifically, the population of households within Makueni County (Mulala Division) - Mulala, Tutini, Kwa-Kakulu, Emali-Makueni, and Mwanyani and within Kajiado County (Kenyewa Division)-Emali-Kajiado, Game and Nkusso. Households within these zones reside in villages for which the ADED project was implemented.

The sample covered both Makueni County (68%) and Kajiado County (32%). Sampling was done to allow for representation of these zones of implementation as shown in(Table 1).Of the interviewed, 51% were female and 49% male.

Table 1: Sample Distribution

Zone	Makueni County		Kajiado county		Total	
	Sample	%	Sample	%	Sample	%
Mulala	44	23.3	2	2.2	46	16.5
Tutini	40	21.2	0	0.0	40	14.3
Kwa Kakulu	32	16.9	0	0.0	32	11.5
Emali-Makueni	11	5.8	0	0.0	11	3.9
Mwanyani	49	25.9	0	0.0	49	17.6
Emali-Kajiado	12	6.4	18	20.0	30	10.8
Game	0	0.0	31	34.4	31	11.1
Nkusso	1	0.5	39	43.3	40	14.3
Total	189	100	90	100	279	100

Qualitative data was collected from KIIs and FGDs. A total of 21 KIIs of categorized from different zones and specialties but with knowledge on the project were targeted for discussions.

A total of 8 FGDs were covered representing the 8 zones and representing the two value chains-livestock and Moringa which were covered by the ADED project. Additional data and information was collected through review of annual and semi-annual reports, baseline report and other documents including respective county integrated plans, Ending drought Emergency Framework, Kenya Vision 2030 and, Kenya Food Security Steering Group short and

long rains assessments, Famine Early Warning Systems Net Work Food Security updates (FEWSNET) National Drought Management Authority (NDMA) Early Warning Bulletins, FAO reports, Red Cross Desert Locust Assessment Report 2020.

3.3 Data Analysis

A mix of quantitative and qualitative analysis methods were used depending on the specific objective. Qualitative data from KIIs and FGDs were analyzed through thematic approach and where possible, identification and quantification into counts/frequencies where themes were repeated. Key ideas and views emerging were summarized along the main themes/clusters used to add value to the quantitative data. All analysis and presentation of findings were tailored to the objectives of the study.

Quantitative approaches for data analysis included descriptive statistics generated through frequencies, means, share components and medians and regressions and correlation analysis. Where applicable a reflexive approach was employed to evaluate the changes between baseline and end line. The reflexive approach[7] considers the baseline as the counterfactual in impact evaluation here a counterfactual data is not available. The significance of the indicator change between the baseline and end line will be tested through a means-test. For the quantitative indicators a FACT SHEET with estimated values of the indicators was developed (see Appendices). The indicators were measured through frequencies, means, and proportions/percentages among others depending on the type of indicator in the log matrix. Moreover, quantitative analysis also focused on giving the evaluation some rigor and statistical validity where necessary.

3.4 Limitations

There were several limitations that created challenges in data collection and thus would pose an analytical challenge;

1) The time of ETE coincided with the long rains season and although the falling rains did not pose bunch a challenge, it was a source of inefficiency and mobility.
2) Although a baseline existed, it was difficult to follow households in the baseline and this meant a household panel data with a universal identity was not possible. This made it a challenge to trace beneficiaries of the program.
3) The roads infrastructure in the area is poor and this meant that more time was to be spend in tracing the beneficiaries.

[7] Khandker SR, Koolwal GB, Samad HA 2010. Handbook on Impact Evaluation: Quantitative Methods and practices. Washington, DC: The World Bank

4.0 RESULTS

This section presents the results of the ADED project evaluation. The results are derived from quantitative and qualitative analysis, a mixed methods approach. The quantitative analysis was conducted from the household survey of 279 farmers in the project area and incorporates analysis from the baseline data. The qualitative analysis is presented in from of frequencies, means/averages, standard errors of means, correlations and confidence intervals. Where available data allows for comparison of difference in changes, a test of statistics using a t-test is presented.

4.1 Program Participants Demographic characteristics

The ADED project was implemented in two Counties, Makueni and Kajiado covering 8 implementation zones (Mulala, Tutini, Kwa-Kakulu, Emali-Makueni, Emali-Kajiado, Mwanyani, Game, and Nkusso. The population structure that defines the age characteristics in the project area is shown in Figure 2. Majority (60%) of the population lie between 6 and 35 years of age while only 23% of the population account for 36 to 60 years. Almost 45% of the total population is between 0 and 17 years. This buttressed population points to the need to create employment for the upcoming generation. In the project area, the average age of a farmer or household head is 46 years. However, the age of the farmers varies over sex with women farmers averaging 48 years compared to male farmers who have average age of 45 years.

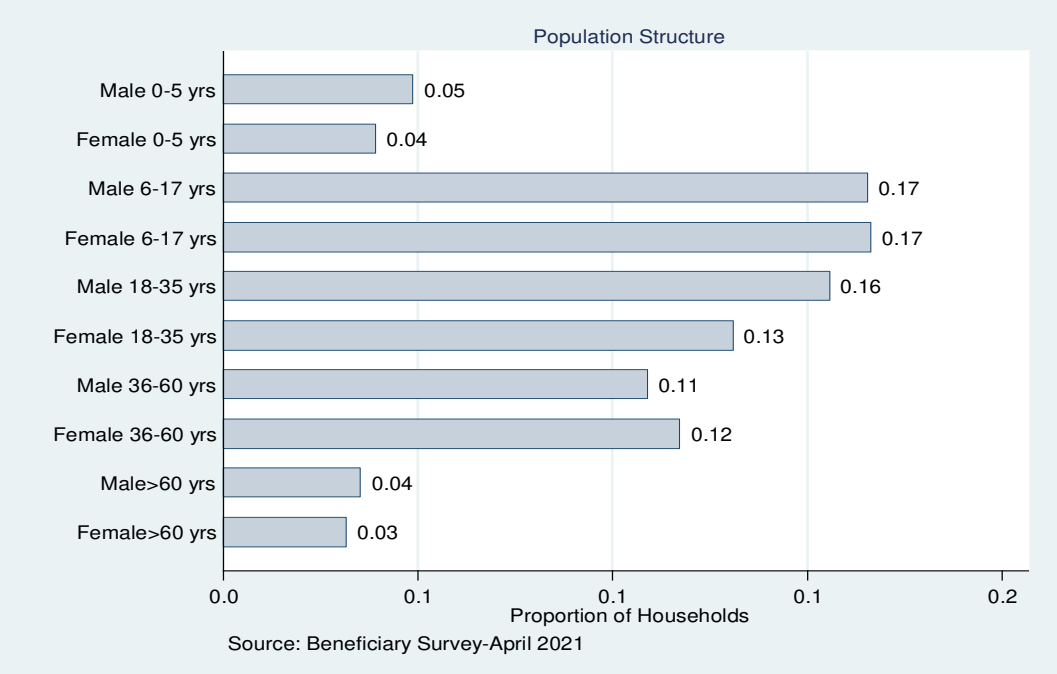

Figure 2: Population structure in the ADED project area

In the project area, 28% of the household heads have reached or completed secondary school level education while 21% have completed primary school level. Notably, around 14% have no formal education (Figure 3).

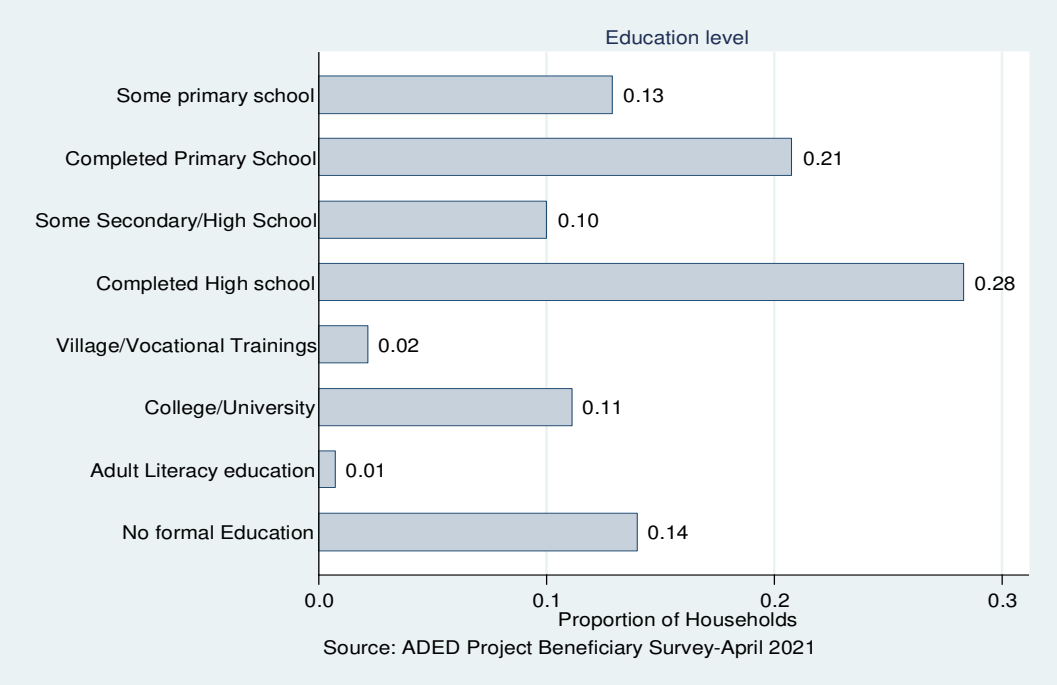

Figure 3: Education Level across the project area

There are three important crops enterprises in the project area-crops, livestock (pastoral) and a mixture (agro-pastoral). Comparing the baseline and end line, there has been a significant shift towards the crops enterprise with the proportion practicing pure crops farming increasing from 7% to 42% over the project period. Similarly, there is a shift away from agro-pastoral (mixed farming) with the proportion increasing from 59% to 25%. The proportion of households depending on livestock enterprise declined marginally over the period (Table 2).

The farm sizes in the project area vary by county due to the predominant livelihoods. While Makueni County is predominantly agro-pastoral, Kajiado Country is predominantly livestock keeping. As such, the farm sizes in Makueni County averaged 10 acres per households/farmer with 6 acres allocated to livestock and 4 acres to crop production. In Kajiado County, the land sizes are relatively larger with average land size being 79 acres. There is little crop farming approximately an acre allocated for crop farming with 67 acres on average allocated to livestock keeping.

Table 2: Farm Sizes-Area (acres) of land under crops and livestock

	Before			After			Mean diff. significance
variable	sum	mean	N	sum	mean	N	
Crops Enterprise	16	7%	240	116	42%	279	***
Livestock Enterprise	82	34%	240	92	33%	279	
Agro-pastoral (Livestock and crops)	142	59%	240	71	25%	279	***
Household farm size (acres)	11,566	48.2	240	8,944	32.4	276	***
Area under livestock (acres)	9,883	41.5	238	7,229	37.1	195	
Area under fodder and pastures (acres)	3,002	46.2	65	1,660	25.9	64	*
Total Livestock units (TLUs)	4,086	17.6	232	3,869	24.2	160	***

4.2 Validity, Relevance and Consistency of ADED Program

The section explores the extent to which the objectives of ADED were consistent with beneficiaries' requirements, county and regional needs, global priorities and policies. Three objectives as per the terms of reference were looked into this.

4.2.1 Relevance to the Needs

The evaluation found the ADED project to be relevant considering the needs of households in the area. Through KIIs and FGDs, the evaluation deduced that community needs included among others need for- capacity building in crops and livestock production husbandry practices, support on value addition especially in milk, inadequate access to Artificial Insemination (AI) information and services, information on production, weak cooperatives and poor market linkages. The ADED project intervened through training of farmers in production of Moringa and dairy livestock, provided seedlings for Moringa and bulls for dairy livestock improvement, and machines for Moringa and milk value addition. Further, it linked the farmers to market including Brookside company for milk and Kilifi Moringa Company for Moringa powdered leaves and seeds. The outcomes of these intervention were realized in reduced milk spoiling, increased moringa sales and consequently increased household incomes and diversified livelihoods.

4.2.2 Validity, Consistency with other policies and programs

Kenya's Vision 2030 reiterates that agricultural; development will drive economic growth through 2030 and build strategies that will see improvement on agricultural productivity. With devolution, the County Integrated Development Plans (CIDPs) spell development in a five-year span for every county but in line with the Kenya Vision 2030. In Kajiado County CIDP, the county recognizes the challenges of low productivity in livestock caused by inadequate feeds, diseases and pest occurrences, low adoption of technologies, low quality breeds and high cost of inputs especially feeds. Moreover, the county also recognizes the weak and dormant cooperatives due to mismanagement and poor uptake of the cooperative movement as an impediment towards livestock development. On the side of crops, low productivity and inadequate market and market infrastructure are key prohibitory of any crops development in the county.

In Makueni County the CIDP 2018-2022 seeks to enhance crop productivity through adoption of appropriate technologies, promoting value addition and agricultural commercialization and enhancement of industrialization (agro processing, cottage industries), promoting climate smart agriculture, and promotion of dairy development and value addition through AI and disease control.

The ADED project sought to enhance food security and diversification of livelihoods for households in Makueni and Kajiado County. It sought to undertake this through improvement of livestock breeds, climate smart agriculture promotion, value addition in dairy and Moringa and support to marketing. The broad objectives of the ADED project is to improve food security and livelihoods of the participating households remained valid and is still valid past

the project conclusion. These objectives are still valid since food security and livelihoods of the farming communities and livestock keeping communities are main source of income for families and still room exists for improving from the foundations laid by the project. Moreover, all of these interventions are in line with the respective County CIDPs and in line with the broad objective of the Kenya's Vision 2030. Moreover, the ADED program corroboration with other partners besides the County governments attests to the consistency especially with Kenya Dairy Board (KDB), Kilifi Moringa Company, Kenya Forest Research Institute (KEFRI), Kenya Agricultural and Livestock Research Organization (KALRO) and Brookside Company.

4.2.3 Community involvement and inclusiveness

The ADED program involved the community in several ways. The community was involved in discussions of the project interventions for ownership purposes and groups formed to support these initiatives. The process of project implementation started with inception workshops which aimed at creating awareness of the project in the focal area. The awareness campaigns brought together the stakeholders in milk and moringa farming within the community including the county and national government administration.

During these workshops, the community and other stakeholders engaged in joint planning of the implementation of the activities over the 5 years. The planning entailed the timelines of implementation, mobilization of the community into groups and joint monitoring and follow ups with government officers, community resource persons, animal health assistants, and cooperative leaders and would entail monthly and quarterly monitoring and follow up done.
In terms of gender, the project involved both sexes in Moringa and Dairy production activities. However, evidence from literature revealed highly unequal society when it comes to sexes. In Kajiado, the Gender Inequality Index (GII)[8] was 0.60 while in Makueni County, it was estimated to 0.55 compared to the national average of 0.55- a bias against women. In Makueni County, the CIDP 2018-2022 recognizes the low level of women participation in economic activities. The female participation in economic activities is 54.7% compared to the male participation at 70.9% highlighting the need for engendering development programs to bridge the gender development gap.

As such, the ADED project was designed to impact on the gender inequality by supporting more women than men. This was meant to enhance equity in communities where there were inequities in gender. For instance, key informant discussions indicate that in dairy, much of the milk aggregation has benefited women, in particular in Kajiado. These benefits are accrued to women because culturally for Maasai community, milk is managed by the women while men are the owners of the livestock. As such, any effort to aggregate milk has disproportionally favoured women. Men have been involved in the trainings on livestock and crops husbandry practices and hence benefiting through better livestock and prices.

[8] https://data.humdata.org/dataset/kenya-human-development-index-per-county

Picture 1: Moringa products

4.3 ADED Program Effectiveness and Achievements

The effectiveness criterion explored the extent to which the ADED project achieved, or is expected to achieve, its objectives, and its results, including any differential results across groups. It entailed evaluation the production, productivity, capacity building and compared these between the baseline and end line surveys.

4.3.1 Moringa Value Chain

The ADED interventions in the moringa value chain included support towards formation of a Moringa cooperative, establishment of moringa nurseries and distribution of seedlings to farmers, capacity building of farmers on moringa and associated agronomic practices, training of farmers on processing/value addition of moringa products using acquired simple equipment, creation of market linkages especially with Kilifi Moringa Estates and development of individual business plans for farmers and strategic business plan for the cooperative in partnership with IESC/ farmer to farmer program. Specifically, farmers were trained on among others business planning, agronomic practices, value addition, marketing linkages and record keeping. The project supported the value chain with moringa oil extracting equipment for communal use and established a nursery for moringa seedling development.

4.3.1.1 Adoption and growing of Moringa

Moringa was grown in the area, albeit without commercial objectives, earlier than the ADED project. The early Moringa was promoted by a project under CARE international. The ADED project heralded the moringa commercial dispensation. Following the ADED project, Currently, moringa is grown and intercropped with other crops as aforementioned. Following the interventions by ADED, moringa is grown for its seeds, flowers and leaves. Evidence shows an enterprise shift in the project area between the time ADED was initiated and its closure. There was an increase in crops enterprise from 7 to 42%. The proportion of households aware of moringa increased significantly, doubling from 31% to 61% while the households actually growing moringa or those who adopted moringa had a significant increase from 6% to 41% over the ADED project implementation (Table 3). Of the households who adopted, 96% are in Makueni project sites.

Marketing of moringa increased driven by the efforts to connect farmers to value adding companies like Kilifi Estates Company. Before the ADED project, only 1% of the population engaged in marketing of either seeds, flowers, leaves or animal feeds from moringa plants. After the interventions of the project, the proportion of households participating in sale of seeds and leaves significantly increased to 23% and 13% respectively.

4.3.1.2 Moringa Production and Productivity

Although the acreage under moringa doubled over the project period increasing from 0.3 acres during the baseline to 0.6 acres per household by the end of the ADED project, the increase was not statistically significant. The total acreage under moringa increased from 2 acres owned by 6 households to 68 acres owned by a sample of 113 farmers. The acreage was

by the increased adoption. Of the total area under moringa, 66 acres (97%) are in the Makueni project sites with only 1.7 acres (3%) in Kajiado. This implies that the sites in Makueni adopted Moringa more than the pastoral Kajiado County and benefits of the program are likely to be so skewed.

Table 3: Enterprise Shift, moringa awareness and growing before and after ADED project

	Before ADED				After ADED				Mean test sign
Variable	Obs	Mean	[95% Conf. Interval]		Obs	Mean	[95% Conf. Interval]		
Enterprise shift									
Crops	240	7%	0.0349	0.0985	279	42%	0.3576	0.4740	***
Livestock	240	34%	0.2812	0.4021	279	33%	0.2742	0.3853	
Both	240	59%	0.5290	0.6543	279	25%	0.2031	0.3059	***
Awareness and adoption of moringa production									
Households aware of Moringa	241	31%	0.2484	0.3657	279	61%	0.5480	0.6634	***
Households growing Moringa	81	6%	0.0082	0.1153	279	41%	0.3471	0.4630	***
Market Participation									
Sold Seeds	241	0.8%	-0.0032	0.0198	279	22.6%	0.1764	0.2752	***
Sold Flowers	241	0.4%	-0.0040	0.0123	279	1.1%	-0.0014	0.0229	
Sold Leaves	241	0.8%	-0.0032	0.0198	279	12.9%	0.0895	0.1686	***
Sold Feeds	241	0.4%	-0.0040	0.0123	279	0.7%	-0.0028	0.0171	
***significance of mean difference (ttest)									

The increase in acreage resulted to an increase in absolute output of moringa products-leaves, flowers and seeds. However, due to the increase in the number of households producing moringa products, the average production per household declined from 15.3 Kgs to 8.6 Kgs/household for seeds, 7.0 Kgs to 4.1Kgs per household for flowers and leaves declined from 31.5 Kgs to 12.5 Kgs per household (Table 4).

Table 4: Area, production and productivity of Moringa

	Baseline			**End line**					**sign**
Variable	Obs	Sum	Av per HH	Obs	sum	Av per HH	[95% Conf. Interval]		
Moringa area (acres)	**6**	**2**	**0.3**	113	**68**	**0.6**	**0.4521**	**0.7541**	
Moringa seed produced (Kgs)	6	92	**15.3**	114	980	**8.6**	6.3069	10.8817	
Moringa flowers produced (Kgs)	4	28	**7.0**	31	122	**3.9**	2.4338	5.4049	
Moringa leaves produced (Kgs)	5	138	**27.6**	80	927	**11.6**	9.0579	14.1171	**
Moringa seed Productivity (KGs/acre)	4	213	**53.3**	113	3,448	**30.5**	21.3093	39.7239	
Moringa Flower productivity (Kgs/acre)	3	114	**38.0**	29	527	**18.2**	10.3644	26.0035	**
Moringa leaves productivity (Kgs/acre)	3	277	**92.2**	65	3,870	**59.5**	41.4983	77.5838	
****significance of mean difference (ttest)**									

Considering that the acreage under moringa and the absolute output of seeds, flowers and leaves increased, we estimated the production per acre to reveal if there were any efficiency gains in production. The production per acre (productivity) was measured in terms of the seeds, flowers and leaves per the acreage harvested. Evidence shows a decline in productivity

over the project period although the decline was only significant for the productivity of moringa flowers. Comparing the baseline and end line, productivity declined from 53.3Kgs/acre to 30.5 Kgs/acre for seeds, 38.0 Kgs/acre to 18.2 Kgs/acre for flowers and 92.2 Kgs/acre to 59.5 Kgs/acre for leaves. The decline was attributed to the fact that those farmers who had adopted moringa were yet to start harvesting while the yields from the older trees, planted prior to the ADED program was on a declining trend.

In terms of gender decomposition, we computed the production parameters comparing the sex of the household head. Full information for production of both sexes of household heads was only available from the end line survey. Evidence presented in Table 5 reveal that even though women owned less area of land under moringa (0.3 acres) compared to 0.6 acres by male headed households, the male headed households produced less leaves and flowers on average compared to female headed households and similarly, had less production per acre of flowers and leaves. However, when subjected to a means test, we found no statistical significant difference on the area, productivity and production.

Table 5: Household head sex and Moringa area and productivity

After ADED project	Female headed hh		Male headed hh	
Variable	Obs	Mean	Obs	Mean
Moringa seed produced	6	3	99	9
Moringa flowers produced	1	5	30	4
Moringa leaves produced	6	15	65	12
Moringa area (acres)	5	0.30	99	0.6
Moringa seed Productivity (KGs/acre)	5	9	99	32
Moringa Flower productivity (Kgs/acre)	1	20	28	18
Moringa leaves productivity (Kgs/acre)	3	89	57	62

4.3.1.3 Enterprise mix (intercropping) in the project area

The two counties-Makueni and Kajiado have distinct enterprises-whereas Makueni County is agro-pastoral, Kajiado County is pastoral. The ADED project promoted production of moringa and dairy farming in the area. In the project area, an estimated 26% of the beneficiaries practice mixed farming (growing crops and keeping livestock) while 67% of the beneficiary farmers practice crop farming. Of these, majority (92%) are in Makueni County while only 8% are in Kajiado County. The opposite is true for livestock farming, that, whereas 58% of the beneficiaries practiced livestock keeping, 55% of the livestock farmers were found in Kajiado County while 45% in Makueni County.

Beneficiary households in Makueni County were largely practicing intercropping. Although the practice is old for the crops including maize, beans, cowpeas, pigeon peas among others, introduction of Moringa brought about competition for the already small pieces of land leading to further intercropping. From a set of correlations coefficients, Moringa has been significantly intercropped with maize, beans, sorghum, green grams, pigeon peas, cow peas, mangoes and pastures. Evidence from the KIIs and FGDs corroborated that among important challenges of growing Moringa was competition for land with other crops and thus, intercropping was necessary to maximize on the available farm land sizes.

4.3.1.4 Supply and utilization of Moringa products

Supply potential[9] for moringa products (flowers, seeds and leaves) was estimated assuming the best case moringa productivity scenario (at baseline) and that the average area of was 0.6 acres, and that 40% of the sample (n=279) adopted moringa. At the baseline, the productivities were estimated to -53Kgs/acre for seeds, flowers 38Kgs/acre and leaves 92 Kgs/acre as the best case scenarios. This meant that the potential of production of the seed, flowers and leaves would be 3,634 Kgs, 2,589Kgs for flowers and 6,284Kgs for leaves. A closer examination of the utilization before the ADED and after the ADED project indicates that moringa was and is largely used for medicinal purposes, albeit by household proportions lower compared to the baseline. Further, evidence shows that the decline in utilization is negatively correlated with the increase in sum of quantities sold over the project period.

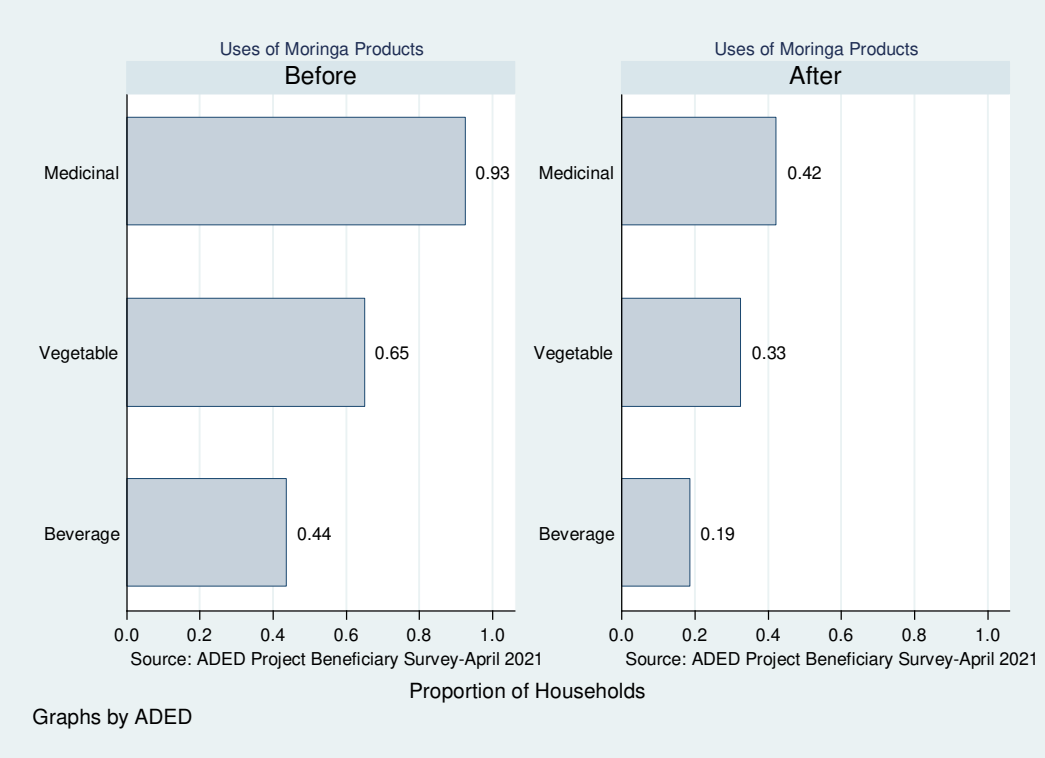

Figure 4: Uses of moringa products

4.3.1.5 Moringa Production Knowledge, Skills and Practices

To strengthen the institutions and build the capacity of the actors around the moringa value chain, the ADED project undertook trainings on business planning, agronomic practices, value addition, marketing linkages and record keeping. In line with the project, a number of crop husbandry practices were trained over the project implementation period. 67% (187) of the farmers reported to have been trained on crops production husbandry. 99% (103F and 84M) acknowledged training on crops husbandry and diversification of crops (intercropping

[9] Productivity (production per acre) *Av. Acreage (0.6) * Proportion adopting moringa (0.4) * sample size (279)

moringa with other crops). Of those trained, 87% (161 farmers)-had diversified their livelihoods-that is, they had more than one source of income. Majority of the farmers acknowledged being trained on drought resistant crops (38%), ploughing (37%) and how to use chemicals (pesticides)-32% (Figure 5). Compared to the baseline (Before) it appears that there was a decline in the intensity of capacity building since the proportions of households trained on various crop husbandry practices were smaller than those from the baseline. Despite the low proportions trained, the training exhibited a positive and significant correlation with production of moringa seeds and leaves.

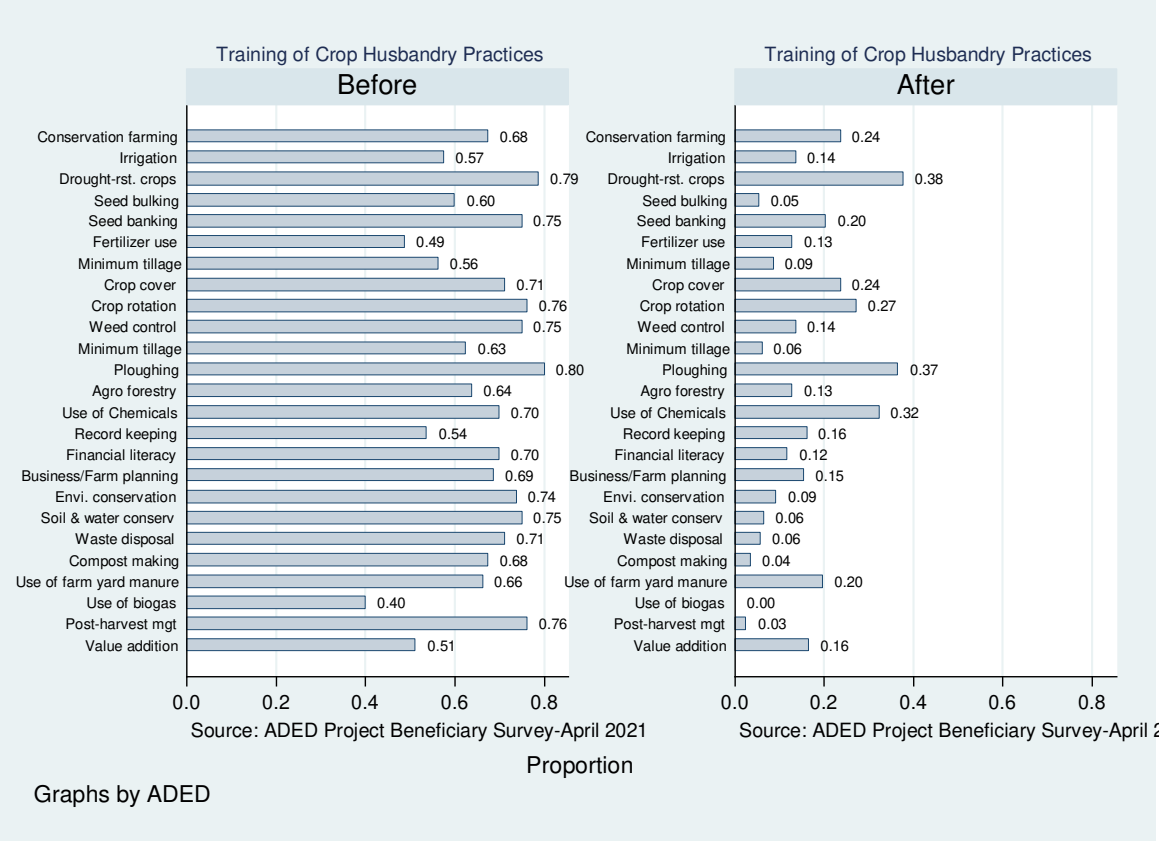

Figure 5: Proportion of households trained on crop husbandry practices

Among the ministries and agencies involved in capacity building and training include the Ministry of Agriculture and Livestock Development (MoALD), and Ministry of Health (MoH), Kenya Forest Services (KFS), Kenya Forest Research Institute (KEFRI). Most of the farmers obtained this training through the Ministry of Agriculture staff. Usually, the employees of the Ministry both at national and county levels were facilitated by the ADED project to undertake trainings on crop husbandry. Households interviewed were asked to identify the source of training on moringa.

Whereas there are different sources, apart from the neighbours and friends and private companies, all other sources are aligned to the ChildFund through either facilitation or direct training. This implies that over 75% of the training emanated from the program (Figure 6). Whereas this training was relevant to the farmers, 54% of the farmers indicated that they were satisfied with the training while 39% were very satisfied with the kind of training offered.

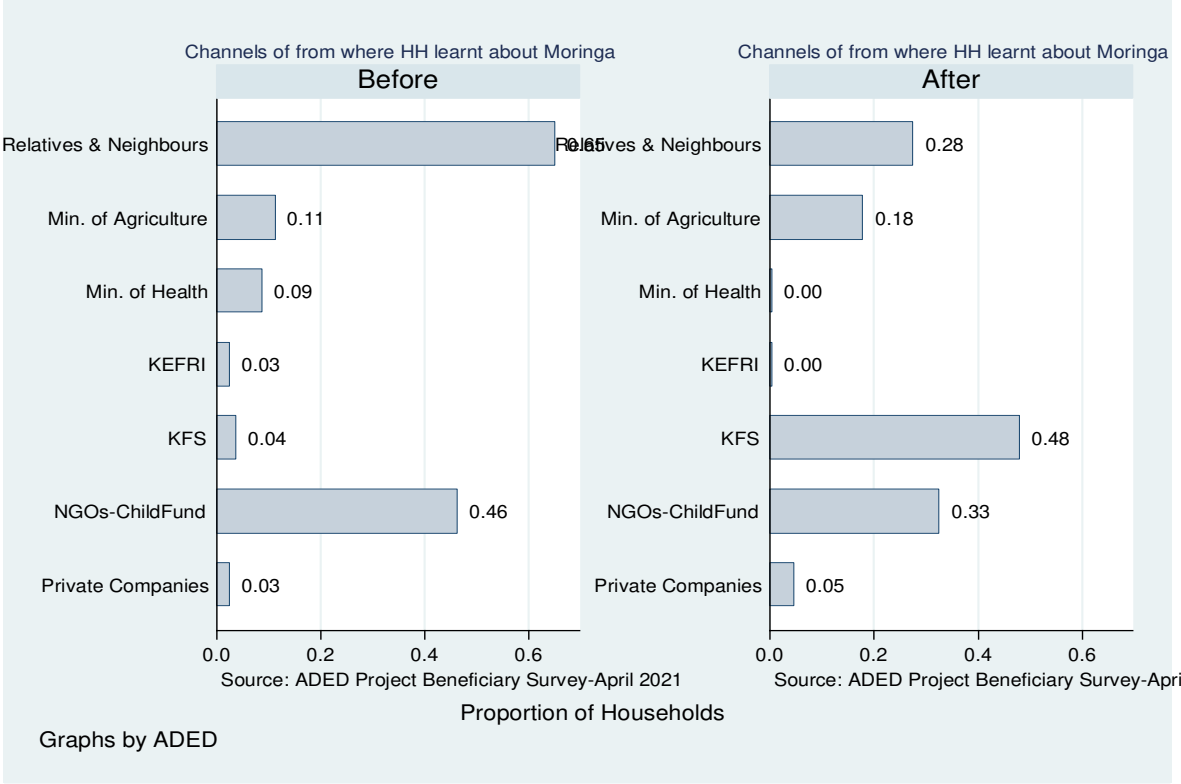

Figure 6: Sources of training for crop husbandry

A correlation between the crop husbandry practices, moringa production and intercropping reveals positive and significant relationships (Table 6: Training on crop husbandry practicesTable 6) underlining the idea that these practices were relevant in diversification of crops and livelihoods. Moreover, there is positive and significant correlation between the training and moringa production especially on leaves production. This shows that in order to increase production of moringa powder, a derivative from the leaves, more training would be important.

4.3.1.6 Moringa value chain service providers

The moringa value chain is operated by several service providers who in one way or the other support the operations of the chain. Key in the bottom of the value chain are farmers who operate as individuals, or in groups or under the moringa cooperative. The formation of the moringa cooperative, EMUKA, was supported by the ADED projects. The cooperative consists of 128 members (76 active) and is still in its formative stages. The cooperative has a board in place comprising of 9 members within which a supervisory board, executive board and sub-committees. The cooperative generates its finances from sale of moringa seeds and powder. However, despite the production and market potential existing in seed and powder, information from the KIIs and FGD aligned to EMUKA pointed out that the cooperative has been operating on low volumes and poor quality of moringa especially the leaves translated to powder. Through the ADED project, the cooperative has benefited from linkages to the county government, capacity building on skills and knowledge on moringa production, value addition and marketing, market linkage to potential buyers and on cooperative management.

Table 6: Training on crop husbandry practices

Crop Husbandry practice	Obs	% trained	Std. Err.	[95% Conf. Interval]		Corr. Coeff. (* sig 95%)
Conservation farming	279	0.2366	0.0255	0.1864	0.2867	0.3968*
Irrigation	279	0.1362	0.0206	0.0957	0.1767	0.2830*
Growing drought-resistant crops	279	0.3763	0.0291	0.3191	0.4335	0.5381*
Seed bulking	279	0.0538	0.0135	0.0271	0.0804	0.1699*
Seed banking	279	0.2043	0.0242	0.1567	0.2519	0.3612*
Fertilizer use	279	0.1290	0.0201	0.0895	0.1686	0.2744*
Minimum soil disturbance	279	0.0860	0.0168	0.0529	0.1191	0.2187*
Crop cover	279	0.2366	0.0255	0.1864	0.2867	0.3968*
Crop rotation	279	0.2724	0.0267	0.2198	0.3250	0.4191*
Weed control	279	0.1362	0.0206	0.0957	0.1767	0.2830*
Minimum tillage	279	0.0609	0.0143	0.0327	0.0892	0.1816*
Ploughing	279	0.3656	0.0289	0.3087	0.4225	0.5411*
Agro forestry	279	0.1290	0.0201	0.0895	0.1686	0.2744*
Spraying of Chemicals-pesticides and herbicides	279	0.3226	0.0280	0.2674	0.3778	0.4919*
Record keeping	279	0.1613	0.0221	0.1179	0.2047	0.3126*
Financial literacy – savings, investments, borrowing/credit	279	0.1183	0.0194	0.0802	0.1564	0.2611*
Business /farm planning	279	0.1541	0.0217	0.1115	0.1968	0.3043*
Environmental conservation	279	0.0932	0.0174	0.0589	0.1275	0.2285*
Soil and water conservation	279	0.0645	0.0147	0.0355	0.0935	0.1872*
Waste disposal	279	0.0573	0.0139	0.0299	0.0848	0.1758*
Compost making	279	0.0358	0.0111	0.0139	0.0578	0.1374*
Utilization of farm yard manure in crop production	279	0.1971	0.0239	0.1502	0.2441	0.3532*
Use of biogas technology	279	0.0000	0.0000	0.0000	0.0000	.
Post-harvest management	279	0.0251	0.0094	0.0066	0.0436	0.1144
Value addition	279	0.1649	0.0223	0.1211	0.2087	0.3167*

On the policy and governance, the moringa value chain has players including the County government of Kajiado and Makueni, departments of agriculture, livestock, and cooperatives, Agricultural sector development programme (ASDSP). On the capacity building stakeholder who have supported the value chain development include Eco-green, Women groups and International Executive Service Corp (IESC) who operate farmer-to-farmer programme. ASDP team supported capacity building sessions/technical support, joint monitoring of projects, financially with cost-sharing during some trainings, joint learning sessions, off-taking/marketing of products, development of cooperative strategies and business planning. On the marketing from, the Kilifi Moringa Estates has been working with the project providing the market demand for the moringa products produced in the area.

4.4.4.1 Value addition of Moringa

Value addition to moringa is minimal with only 21% of the interviewed farm households indicating that they value added moringa into either powder, oil or soap. Of the 21% value adding farmers, 95% crush moringa leaves into powder while 12% crush the seeds to extract oils with only 2% venturing into soap production using moringa. The process of value addition moringa into oil involves removing of seeds from the pods and crushing them to extract the oil. Leaves are harvested and dried then crushed into powder. This has been done manually in many of the cases. Evidence from the KIIs in moringa farming indicate that that the EMUKA (a moringa cooperative) generates 100 Kgs of moringa powder and 400Kgs of seeds on a monthly basis. The cooperative consists of 76 members.

The moringa powder is largely used as a beverage and for medicinal purposes with the flowers used as vegetables and leaves as animal feeds. Evidence from the field survey corroborates KIIs with 42%, 33% and 19% indicating that moringa is used for medicinal, vegetable and beverage respectively.

An expansion of marketing outlets for moringa were realized. Whereas before the ADED interventions farmers has only two outlets (farm gate and local market), the efforts by the project yielded an expansion of the market outlets linking the farmers with contracted buyers and manufacturers or processors. Evidence from KIIs indicate that EMUKA sells its products to Kilifi Moringa Factory with ChildFund providing support in terms of market linkages. Despite the increase in outlets for value added moringa, the local markets remained the main source of market taking up 50% and 58% before and after the project in addition to the new market outlet of contracted buyers who absorbed 29% of the value added moringa (Figure 7).

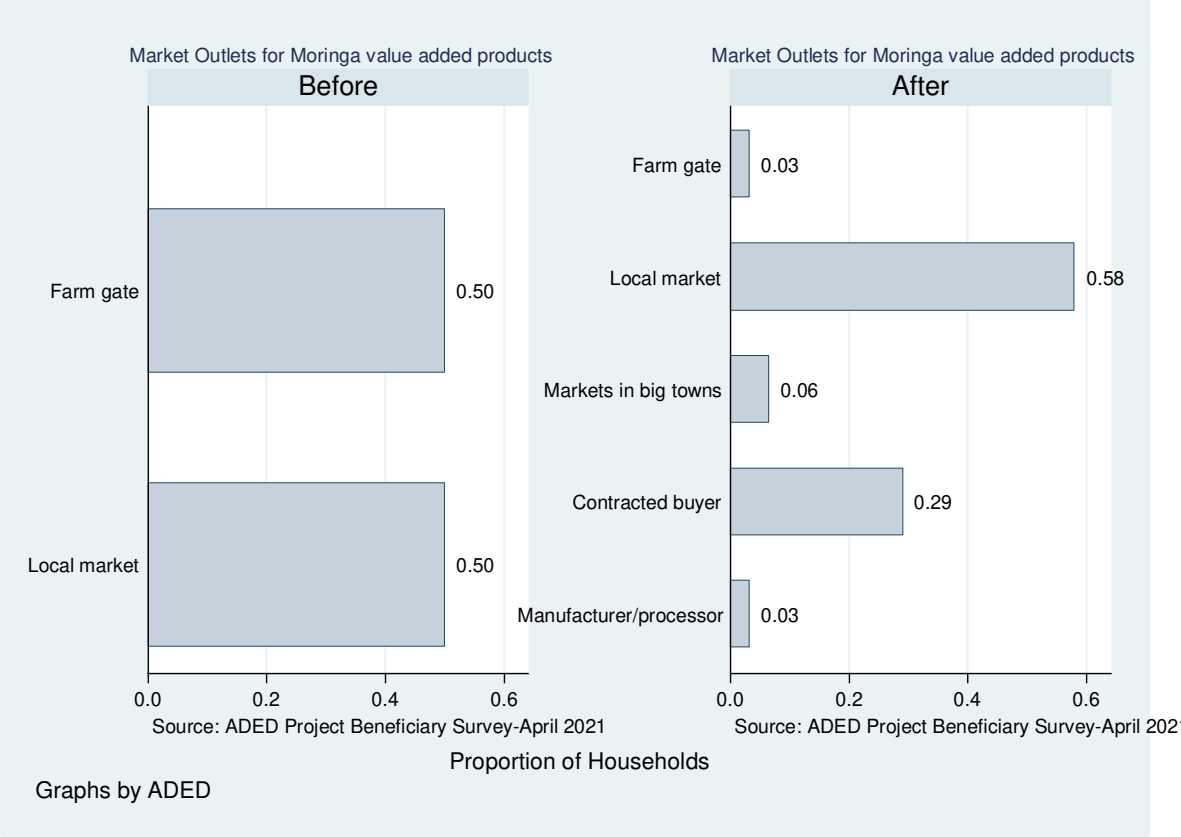

Figure 7:Market outlets for moringa products

Although moringa has found use in industrial products including soap (Geisha moringa), the linkage to markets is week for farmers in the project area.

4.3.1.7 Climate Sensitive Agriculture (CSA) and Crop Diversification

The ADED program trained farmers on Climate Smart Agriculture (CSA) in order to mitigate the effects of perennial droughts in the project area. Several techniques were evidently trained including conservation agriculture, irrigation, planting of drought resistant crops including moringa, seed bulking and banking among others. Others included breed

improvement, promotion of fodder and pasture production, use of organic farming practices and soil and water conservation. The soul and water conservation included the rehabilitation of Esukuta spring water source.

Of the total sample, 66% of the farmers reported being trained in at least one of the CSA techniques/skills. Evidence from the field reveals that most of the farmers were trained on drought resistant crops (79%), use of animal manure (81%) in their farms and ploughing techniques (80%)-Figure 8. Other techniques were also trained but were not reportedly as widespread as these three. Although the proportion of households trained was lower compared to the baseline proportions, the training on CSA was found to correlate positively with moringa seed and leaves production.

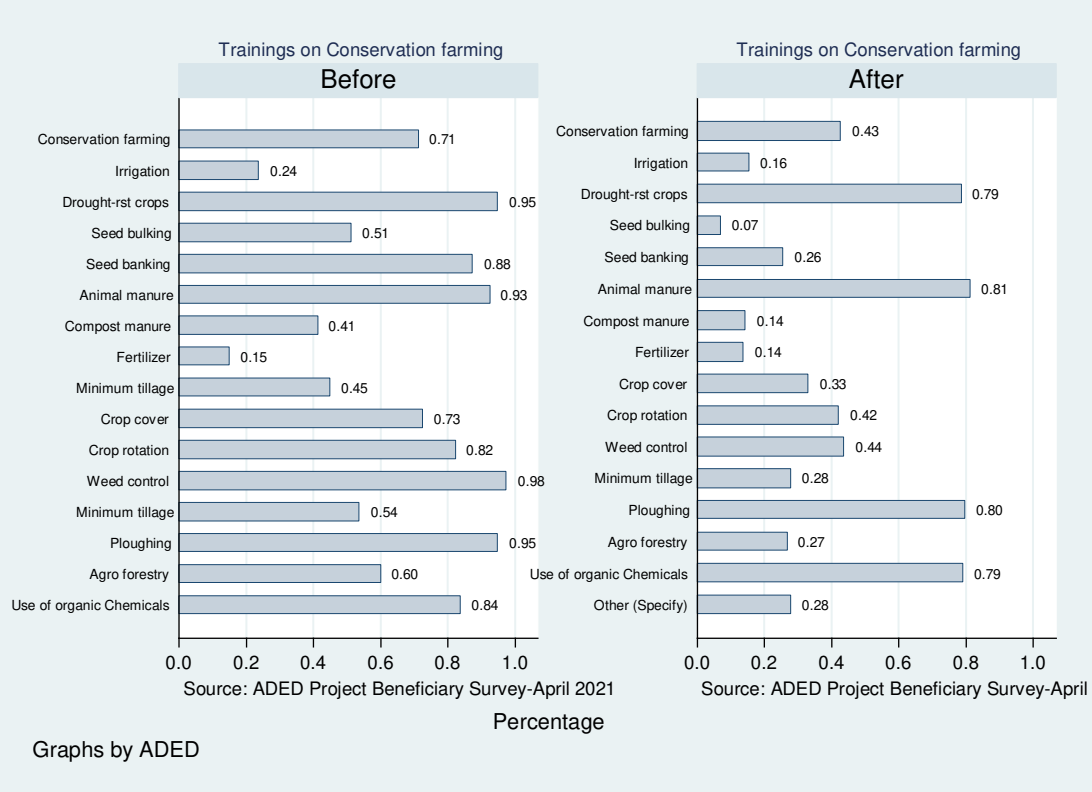

Figure 8: Proportion of households trained on Climate Smart Agriculture

The exercise looked into the frequency of practice or application of the CSA techniques and finds that these same skills were practiced widely. 44% of farmers interviewed reported planting drought resistant crops and using animal manure while 45% of the farmers reported applying the ploughing techniques. However, compared to the baseline, the frequency of practice had declined over the project period. As shown in Figure 9, the proportion of households who were regularly practicing CSA were smaller than were during the baseline. This could point to worsening environmental conservation and consequently decline in agricultural performance as seen in moringa productivity.

We evaluated whether these farmers who were trained in CSA had diversified their crops and either intercropped moringa and other crops. Since intercropping was not captured in the

baseline, the correlation of the CSA training and intercropping was only possible for the end-line. survey because intercropping was not captured as a variable in the baseline. Evidence shows that 66% of the farmers were trained at least trained on any one of the CSA skills. For these trained, we correlated with intercropping of moringa and found that all (99.46%; 185 farmers-101F and 84M) practiced intercropped moringa with other food crops. Further, a correlation analysis revealed that even though intercropping was positively and significantly influenced by CSA, only the practices of animal manure, ploughing and use of organic chemicals positively and significantly correlate with intercropping.

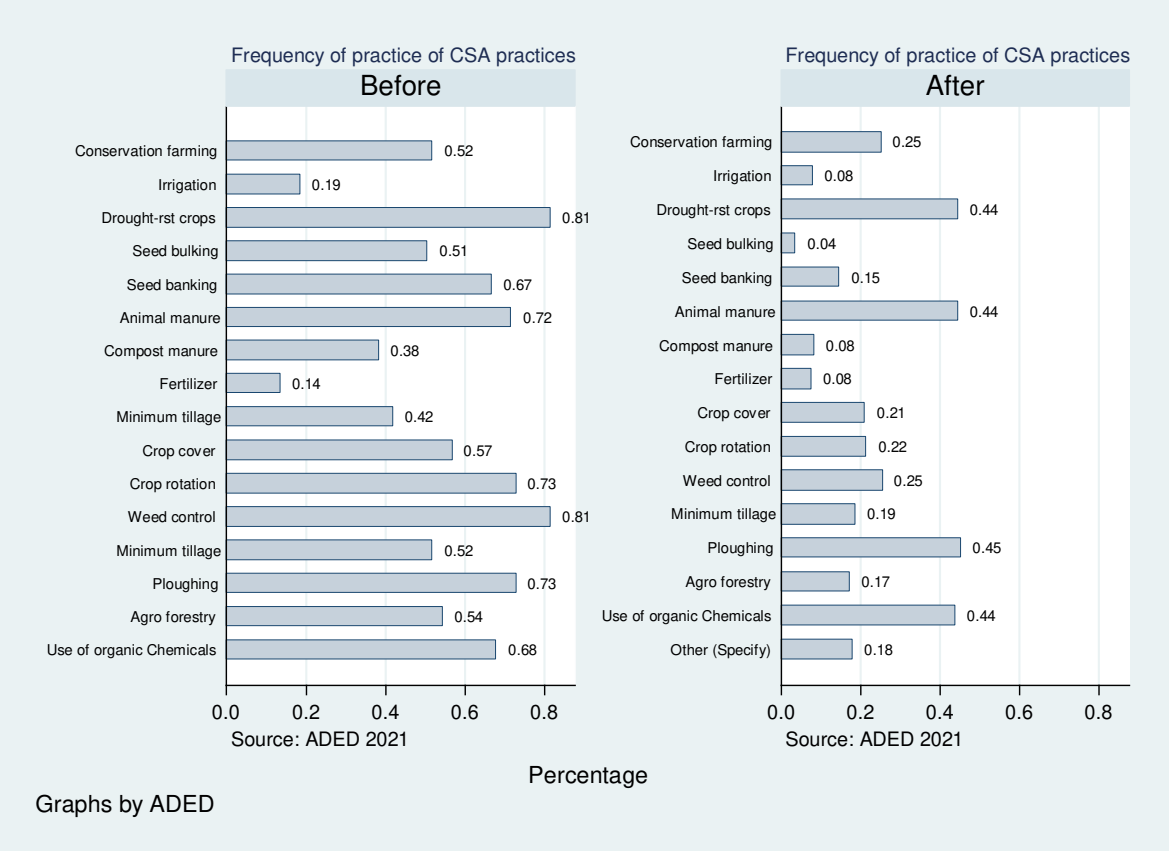

Figure 9: Proportion of households regularly practicing CSA.

4.3.1.8 Challenges of Moringa production, value addition and Marketing

Moringa farming is still nascent despite the increasing awareness due to the ADED project. At the production level, moringa is affected by lack of information on production husbandry practices. Of the total interviewed farmers, 32% indicated that lack of information was the most important challenge in moringa production. This corroborates information from KIIs and FGD who signed lack of husbandry practices knowledge as a setback to moringa production. Other challenges include poor rainfall and pests and diseases and competition for space from food crops.

Declining land sizes and subdivision into uneconomical sizes of land is also posing a challenge in adopting moringa. Moringa competes with other crop enterprises for the diminishing land

thus can only be cultivated as an intercrop with common crops like beans, maize, sorghum and others.

Value addition into powder is the most important and widely practiced. As aforementioned, moringa is value added to powder, oil and soap. Evidence from the field corroborated by the households survey and KIIs shows that moringa value addition is bedeviled by several challenges including lack of processing equipment, inadequate skills and processing knowledge and lack of market information.

4.3.2 Dairy Value Chain

The ADED project supported dairy production with a view to improve livestock livelihoods through breed improvement, milk production and increase in income from dairy and dairy products. ADED undertook capacity building of farmers especially on fodder and pasture production, training in milk handling and hygiene, storage and transport, training on vet clubs, facilitation of training for 3 animal health assistants animal health assistant training, construction and equipping of cooling plants, milk collection points and mini-milk processing unit and milk handling equipment-plastic cans and development of a marketing strategy for SAMLI dairy cooperative. Further, the ADED project facilitated purchase of milk testing apparatus and facilitated milk transportation through purchase of vans, motor cycles and tuk tuks. All these activities were targeted towards enhancing dairy production, value addition and marketing.

4.3.2.1 Dairy Production Knowledge, Skills and Practices

4.3.2.1.1 Livestock husbandry training and livestock diversification

In order to improve the productivity of livestock and especially dairy, the ADED program facilitated training on livestock husbandry practices. These included business planning, record keeping, fodder and pasture production, preservation and storage, clean milk production, testing, transport and storage, Artificial Insemination (AI), animal husbandry and animal health and vet clubs training on animal husbandry. The aim was to improved practice in livestock productivity and diversified livelihoods. The proportion of households who reported to have been trained at least in one of the livestock husbandry practices increased from 29% at the baseline to 58% by the close of the project. The package covered a number of skills including training on milk handling and storage, routine livestock practices and milk preservation to reduce post-harvest loses in milk (Table 7).

Table 7: Training on livestock husbandry practices

	Before					After				
	Obs	Mean	[95% Conf. Interval]		Corr. Coeff. (* sig 95%)	Obs	Mean	[95% Conf. Interval]		Corr. Coeff. (* sig 95%)
***Dairy cow breeds and their characteristics**	**159**	**23%**	**0.166**	**0.2599***	**0.2599***	**279**	**15%**	**0.108**	**0.193**	**0.1292***
***Routine practices (dehorning, deworming, vaccination, cleaning units etc)**	**159**	**27%**	**0.201**	**0.2944***	**0.2944***	**279**	**30%**	**0.250**	**0.359**	**0.3113***
Appropriate feeding and watering of dairy cows	159	33%	0.183	0.0901	0.0901	279	16%	0.115	0.201	0.0619
***Silage making**	**159**	**21%**	**0.144**	**0.2382***	**0.2382***	**279**	**5%**	**0.022**	**0.071**	**0.2092***
Forage/fodder production (planting and management of fodder fields)	159	22%	0.155	0.3143*	0.3143*	279	10%	0.062	0.132	0.0836
Forage/pasture conservation e.g. hay making	159	25%	0.183	0.2740*	0.2740*	279	9%	0.056	0.123	0.0966
Appropriate housing for dairy animals	159	30%	0.147	0.0809	0.0809	279	11%	0.071	0.144	0.0772
Breeding: Improving breeding performance	159	25%	0.183	0.2372*	0.2372*	279	11%	0.071	0.144	0.0843
***Health Management and disease prevention**	**159**	**30%**	**0.224**	**0.2353***	**0.2353***	**279**	**12%**	**0.083**	**0.160**	**0.2193***
***Milk hygiene (Milk Handling and storage)**	**159**	**25%**	**0.183**	**0.2472***	**0.2472***	**279**	**32%**	**0.261**	**0.370**	**0.4446***
***Milk preservation and treatment**	**159**	**21%**	**0.149**	**0.2420***	**0.2420***	**279**	**23%**	**0.176**	**0.275**	**0.2942***
Value addition – yoghurt, cheese, mala, Ghee etc	159	16%	0.105	0.2511*	0.2511*	279	12%	0.083	0.160	0.1031
***Record keeping**	**159**	**20%**	**0.138**	**0.2057***	**0.2057***	**279**	**10%**	**0.065**	**0.136**	**0.1423***
Financial literacy – savings, investments, borrowing/credit	159	31%	0.236	0.1466	0.1466	279	8%	0.044	0.106	0.0314
***Business /farm planning**	**159**	**21%**	**0.149**	**0.1071**	**0.1071**	**279**	**7%**	**0.041**	**0.102**	**0.1608***
***Environmental conservation**	**159**	**25%**	**0.178**	**0.1647***	**0.1647***	**279**	**2%**	**0.002**	**0.034**	**0.1866***
Soil and water conservation	159	23%	0.166	0.1755*	0.1755*	279	1%	0.000	0.028	-0.0406
Waste disposal	159	22%	0.155	0.103	0.103	279	1%	0.000	0.028	-0.0406
Compost making	159	21%	0.144	0.1610*	0.1610*	279	1%	-0.001	0.023	-0.0281
***Utilization of farm yard manure in crop production**	**159**	**23%**	**0.161**	**0.106**	**0.106**	**279**	**9%**	**0.059**	**0.128**	**0.2550***
***Use of biogas technology**	**159**	**11%**	**0.063**	**0.2285***	**0.2285***	**279**	**1%**	**-0.001**	**0.023**	**0.3791***

Table 8: Training Dairy livestock husbandry practices

	Before					After				
Husbandry Practices specific to Dairy livestock	Obs	% trained	[95% Conf. Interval]		Corr. Coeff. (* sig 95%)	Obs	% trained	[95% Conf. Interval]		Corr. Coeff. (* sig 95%)
Spraying against tick and other Ectoparasites	159	95%	0.915	0.984	0.1219	163	96%	0.934	0.992	0.1126
Deworming	159	95%	0.915	0.984	-0.0032	163	96%	0.934	0.992	0.1041
Dehorning	159	56%	0.482	0.638	0.1610*	163	41%	0.335	0.487	0.1492
Routine health check up	159	72%	0.646	0.788	0.2148*	163	73%	0.661	0.799	-0.0905
Routine vaccination	159	77%	0.708	0.839	0.0519	163	66%	0.583	0.730	0.0302
Silage making	159	14%	0.089	0.200	0.152	163	10%	0.052	0.144	-0.0155
Storing crop residue	159	40%	0.325	0.480	0.2062*	163	35%	0.276	0.424	0.0126
Storing/conserving hay/fodder (e.g.in barns)	**159**	**34%**	**0.265**	**0.414**	**0.2440***	**163**	**23%**	**0.162**	**0.292**	**0.1820***
Hay storage structures	**159**	**35%**	**0.277**	**0.427**	**0.2152***	**163**	**21%**	**0.146**	**0.272**	**0.2646***
Supplementation with concentrates (Dairy Meal)	159	43%	0.356	0.512	0.2278*	163	34%	0.270	0.417	-0.0082
Supplementation with minerals	159	86%	0.800	0.911	0.0674	163	46%	0.383	0.537	0.1416
Washing hands and Udder before milking	**159**	**79%**	**0.722**	**0.851**	**0.1242**	**163**	**43%**	**0.353**	**0.506**	**0.2158***
Using Aluminium/stainless steel/Mazzicans cans to store and transport milk	159	13%	0.079	0.185	0.1404	163	7%	0.033	0.114	0.1134
Using plastic cans to store and transport milk	**159**	**76%**	**0.694**	**0.828**	**0.1464**	**163**	**58%**	**0.506**	**0.659**	**0.3341***
Testing for mastitis before milking	**159**	**46%**	**0.381**	**0.537**	**0.2879***	**163**	**21%**	**0.151**	**0.278**	**0.1688***
Establishment of a fodder tree nursery	159	14%	0.084	0.193	0.0879	163	4%	0.011	0.074	-0.0595
Using bulls to serve cows	159	79%	0.722	0.851	0.0766	163	60%	0.525	0.677	0.1307
Using AI to serve cows	**159**	**9%**	**0.048**	**0.140**	**0.1974***	**163**	**7%**	**0.029**	**0.106**	**0.1680***
Keeping Breeding records	159	5%	0.016	0.085	0.1242	163	7%	0.033	0.114	-0.0499
Paddocking	159	40%	0.325	0.480	0.2297*	163	18%	0.124	0.244	0.0335
Zero Grazing	159	6%	0.020	0.093	0.2461*	163	15%	0.092	0.202	0.0243
Milk records	159	10%	0.053	0.148	0.1138	163	16%	0.103	0.216	0.0723
Lactation period less than 10 months	159	74%	0.673	0.811	0.1883*	163	33%	0.258	0.404	0.1317
Calving interval more than 12 months/cow	**159**	**74%**	**0.667**	**0.805**	**0.1608***	**163**	**20%**	**0.140**	**0.265**	**0.2205***

Most of the information about livestock husbandry practices was facilitated by ChildFund and EDCA. Of those trained, reports indicate that 48% and 42% indicated ChildFund and EDCA respectively as the main source of information and training. This wide coverage was in line with ChildFund activities which sought to enhance the skills of livestock farmers. Most of the farmers, 25% and 65% indicated that they were very satisfied and satisfied respectively pointing to that the training met and addressed the needs in the livestock sector.

For dairy, specific husbandry packages were trained on farmers who were practicing dairy farming. Purposely, this was to increase milk productivity and consequently household incomes. Among the most important practices that have a positive and significant correlation with milk productivity include storage of hay and having the requisite structures, using AI and calving interval (

Table 8)

Others such as washing hands and udder before milking, testing mastitis and using cans to transport milk enhanced the quality of milk by maintain cleanliness and contamination.

Although the proportion of households trained on dairy husbandry practices over the project period declined, the frequency of using almost all the trained practices significantly increased (Table 9: Frequency of practice on dairy practicesTable 9).

Table 9: Frequency of practice on dairy practices

	Before				After					
	Obs	Mean	[95% Conf. Interval]		Obs	Mean	[95% Conf. Interval]		Mean test	Corr. Coef. To milk productivity
Spraying against tick and other Ectoparasites	158	70%	0.624	0.769	157	74%	0.669	0.808		-0.0543
Deworming	158	54%	0.459	0.617	157	72%	0.649	0.791	***	-0.0963
Dehorning	157	41%	0.330	0.485	67	85%	0.763	0.938	***	-0.156
Routine health check up	158	59%	0.511	0.666	119	88%	0.824	0.941	***	0.1031
Routine vaccination	158	53%	0.447	0.604	107	84%	0.771	0.912	***	0.1261
Silage making	156	12%	0.070	0.174	16	94%	0.804	1.071	***	0.0128
Storing crop residue	159	30%	0.230	0.374	57	89%	0.813	0.977	***	**0.1934***
Storing/conserving hay/fodder (e.g.in barns)	159	27%	0.201	0.340	37	97%	0.918	1.028	***	0.1574
Hay storage structures	159	26%	0.189	0.327	34	94%	0.858	1.025	***	0.1738
Supplementation with concentrates (Dairy Meal)	158	23%	0.167	0.301	56	91%	0.834	0.988	***	0.0457
Supplementation with minerals	158	65%	0.577	0.727	75	95%	0.895	0.999	***	-0.1102
Washing hands and Udder before milking	159	72%	0.653	0.794	70	81%	0.721	0.908	***	0.0741
Using Aluminum/stainless steel milk cans to store and transport milk	157	22%	0.151	0.282	12	92%	0.733	1.100	***	**0.2318***
Using plastic cans to store and transport milk	158	58%	0.505	0.660	95	81%	0.730	0.891	***	0.1351
Testing for mastitis before milking	158	38%	0.303	0.456	35	86%	0.735	0.979	***	-0.0665
Establishment of a fodder tree nursery	157	17%	0.107	0.224	7	86%	0.508	1.207	***	**0.2650***
Using bulls to serve cows	158	51%	0.434	0.591	98	86%	0.787	0.928	***	**-0.1972***
Using AI to serve cows	157	6%	0.025	0.102	11	55%	0.195	0.896	***	**0.3038***
Keeping Breeding records	157	4%	0.012	0.077	12	83%	0.586	1.081	***	**0.4680***
Paddocking	158	23%	0.167	0.301	30	100%	1.000	1.000	***	-0.0469
Zero Grazing	158	19%	0.128	0.252	24	50%	0.284	0.716	***	**0.2943***
Milk records	157	8%	0.039	0.126	26	100%	1.000	1.000	***	0.0265
Lactation period less than 10 months	159	53%	0.424	0.632	54	78%	0.663	0.892	***	**0.2058***
Calving interval more than 12 months/cow	158	48%	0.338	0.624	33	88%	0.761	0.996	***	**0.2317***

4.3.2.1.2 Vet Clubs

The ADED project aimed at establishing a total of 5 Vet Clubs (3 Vet Clubs in Primary schools and 2 in Secondary schools). Vet clubs are pupil driven platforms for crop and livestock farming within the school compound. By the time of the end term evaluation, two Vet Clubs were still running successfully-Mulala and Tutini Primary School Vet Clubs.

The Mulala and Tutini Vet Clubs are offshoots from the previous ChildFund project that fleshed sweet potatoes with oranges. The project also supplied the schools with green houses which they would use to produce cabbages and kales. After ChildFund ended the implementation activities, parents in Mulala came together and supported continuation of school feeding program then started through the ChildFund Orange fleshed project. The parents supplied

maize that would be mixed with beans harvested from the farms where the orange fleshed potatoes were being grown.

The aim of the Vet Clubs is to engage pupils in co-curricular activities with orientation to farming. Established in May 2018, the Vet Clubs have been engaged in vegetable production, poultry production. The vegetables and eggs from the poultry production are fed to the Early Childhood Development Education (ECDE) pupils to boost their health and nutrition.

The ADED project supported each of the Vet Clubs (Mulala and Tutini) with 2 nanny goats and one buck. The schools provided the structures to keep the goats-building a goat shed and ensuring that there is enough feed and water for the goats. ADED has also been in charge of disease control and surveillance while the club members are in charge of spraying the goats. The impact of Vet Clubs is noticeable through increased enrollment of the ECDE pupils who are less than 5 years and nutrition is highly important for their growth.

4.3.2.2 Fodder and pasture production

Pasture and fodder development augurs well with dairy production. The arid conditions and the prolonged dry seasons in the project area necessitated support towards pasture development if at all livestock livelihoods were to be supported. Before the project started, the proportion of households engaging in pasture production was small. There was a general decline in the proportion of households growing fodder and pastures except for napier grass and maize. The proportion of household growing Napier grass increased from 7% to 19%, while that growing or using maize as fodder increased from 14% to 26% (Table 10), partly due to the support offered by ADED. ADED project supported the farmers with pasture and fodder seeds, trained them on husbandry practices and set up a pasture and fodder demonstration site at Oldonyo Lenkai in Masimba to promote pasture and fodder development. The demonstration site has been used as a learning site where farmers learn and replicate skills in their farms. It has also been used to demonstrate income generation from pasture and fodder as hay from the farm is balled and sold.

Similarly, the expansion of acreage under the different types of pastures and fodder increased variably. The area of land under napier grass production increased from 0.6 to 19 acres with Maasai love grass increasing from 30 acres to 50 acres over the project period, while Kikuyu grass expanded from 46.8 acres to 102.5 (

Table 11). These expansion was realized only for a few farmers who were growing pasture and fodder crops. The pasture and fodder produced can last between 1 and 5 months, largely supporting livestock over the dry season which lasts on average 4 months. This streamlines feed availability especially dry season and reduces livestock movement in search of pasture.

Table 10: Proportion of households growing fodder and pasture

	Before				After			
Variable	**Obs**	**Mean**	**[95% Conf. Interval]**		**Obs**	**Mean**	**[95% Conf. Interval]**	
1 Napier grass	**159**	**7%**	**0.029**	**0.109**	**163**	**19%**	**0.129**	**0.251**
2 Boma Rhodes	159	6%	0.020	0.093	163	1%	-0.006	0.018
3 Maasai love grass	159	29%	0.218	0.361	163	9%	0.047	0.137
4 Kikuyu grass	159	4%	0.008	0.068	163	1%	-0.005	0.029
5 Buffel grass	159	17%	0.111	0.229	163	0%	0.000	0.000
6 Couch grass	159	22%	0.155	0.285	163	4%	0.011	0.074

7 Maize	**159**	**14%**	**0.089**	**0.200**	**163**	**26%**	**0.195**	**0.332**
8 Desmodium	159	2%	-0.003	0.040	163	1%	-0.006	0.018
9 Sweet Potato vines	159	1%	-0.005	0.030	163	0%	0.000	0.000
10 Lucerne	159	0%	0.000	0.000	163	1%	-0.006	0.018
11 Sorghum	159	0%	0.000	0.000	163	1%	-0.006	0.018
12 Fodder trees (Leucaena, sesbania, calliandra etc)	159	1%	-0.006	0.019	163	1%	-0.006	0.018

Table 11: Area under pasture and fodder

	Before		After		
Variable	Obs	Av. Acres of pasture	Obs	Av. Acres of pasture	No of months the pasture can last
1 Napier grass	**10**	**0.6**	**31**	**18.8**	**3**
2 Boma Rhodes	4	32.5	1	0.1	4
3 Maasai love grass	**40**	**30.9**	**15**	**50.4**	**5**
4 Kikuyu grass	**4**	**46.8**	**2**	**102.5**	**3**
5 Buffel grass	24	27.3	0	.	.
6 Couch grass	30	22.6	7	1.2	3
7 Maize	20	2.6	43	2.5	3
8 Desmodium	2	30.0	1	1.0	3
9 Sweet Potato vines	0	.	0	.	.
10 Lucerne	0	.	1	0.5	1
11 Sorghum	0	.	1	1.0	2
12 Fodder trees (Leucaena, sesbania, calliandra etc)	0	.	1	0.1	1

A correlation analysis between the area under pasture shows that an increase in area under pasture is likely to result into increased number of dairy cattle, dairy calves and heifers. This implies that continued expansion of the pasture and fodder could spur increased milk production as dairy livestock population expands.

4.3.2.3 Livestock Production Systems and Productivity

An assessment of livestock production systems reveals three systems-zero grazing, semi-intensive and free ranging. Over the project period, livestock production systems have shifted significantly with the proportion of households practicing zero grazing increasing from 4% to 12% while free range systems from 52% to 75%. Free ranging is the most common livestock production system practiced by 75% of the livestock keepers (Table 12). It is often the main production system in Kajiado where land is expansive and settlements sparsely distributed. Zero grazing and semi-intensive production systems are practiced by 12% and 14% respectively and these are largely practiced in the project sites in Makueni County.

Table 12: Livestock structure and production systems

	Before				**After**				
Variable	**Obs**	**Mean**	**95% Conf. Interval**		**Obs**	**Mean**	**95% Conf. Interval**		**Mean test**
No. of livestock owned									
Dairy cattle (pure & crosses)	26	2	1.682	2.471	77	10	6.282	12.835	
Indigenous cattle	175	8	5.839	10.206	82	11	6.058	16.869	
Dairy goats (pure and crosses)	12	7	3.187	9.813	48	14	9.810	19.065	
Indigenous goats	201	16	12.663	18.670	89	20	14.481	24.642	
Donkeys	74	3	1.918	3.325	54	2	1.774	2.485	
Sheep	149	17	12.807	21.287	106	25	19.123	30.386	
Poultry	153	11	9.637	13.278	93	14	11.691	16.524	
Oxen	63	3	2.060	3.464	31	2	1.958	2.752	
Production system									

Zero grazing	159	4%	0.012	0.076	163	12%	0.067	0.166	***
Semi intensive	159	43%	0.356	0.512	163	13%	0.082	0.188	***
Free Ranging	159	52%	0.444	0.601	163	75%	0.681	0.816	***

There was evident change in dairy livestock structure over the project period with the number of dairy cows increasing from 2 per household to 7 per household. Dairy herds consist of on average 7 dairy cows per farmer and equal number of cross-breeds dairy cows, 2 dairy bulls and an average of 11 local or indigenous cattle. On average, 6 cows of the total 28 dairy cows (pure dairy, cross breeds and indigenous) are usually in lactation at any one point (Table 13). This ensures all season supply of milk although with seasonal fluctuations.

Table 13: Dairy livestock structure

	Before				After			
Variable	Obs	Mean	95% Conf. Interval		Obs	Mean	95% Conf. Interval	
Pure Dairy Cows	13	2	1.096	3.365	35	7	3.501	11.185
Pure dairy calves	7	1	0.934	1.923	29	6	3.970	7.548
Pure dairy heifers	4	2	-0.250	4.250	18	6	2.045	10.844
Pure dairy bulls	6	1	0.476	2.190	10	2	1.217	2.183
Cross breed dairy cows	11	3	1.379	4.802	47	7	3.781	10.644
Cross breed dairy calves	10	4	1.454	6.546	45	6	3.225	8.730
Cross breed dairy heifers	6	2	0.396	2.938	26	7	2.220	11.165
Cross breed dairy bulls	7	2	0.709	3.862	17	2	0.855	3.851
Local/Indigenous cattle	125	8	5.618	9.598	83	11	6.032	16.185
Dairy cows are in milk/lactation (all breeds)	73	2	2.093	2.839	101	6	4.022	7.364

Several types of livestock are kept including dairy cattle, indigenous cattle, dairy goats, sheep, donkey, indigenous goats and poultry. The average number of dairy cattle (pure and crosses (Sahiwal)) increased from 2 to 10 over the project period. Using Tropical Livestock Units (TLUs)[10], a conversion indicates that, despite the earlier noted marginal decline in household practicing livestock farming, the average TLUs per household was positive and significant with an increase from 17 per household to 24 units per household over the project period. A huge proportion of this increase originated from expansion in the number of dairy cattle and dairy goats.

A closer examination reveals that the TLUs and milk production per cow per day (milk productivity) are positively and significantly correlated with the area of land allocated to livestock but not necessarily the area under pasture and fodder. However, an increase in dairy herd is positively and significantly correlated with the acreage under Napier, Maasai love grass and Kikuyu grass. Whereas there is seemingly an increase in number of livestock owned, the pasture and fodder production has declined over the project period. This implies that there is an increase in livestock against shrinking pasture area, a practice that is likely to exploit pasture and fodder in near future with negative environmental outcomes.

The maximum years that farmers here have practiced or owned livestock is 11years. With the average age of a farmer (household head/spouse) in the region being 47 years, this implies that the current started owning livestock by early 30s.

[10] http://www.fao.org/3/t0828e/T0828E07.htm

4.3.2.4 Milk Availability (Supply)-Milk Production and productivity per cow

Milk production per household/farm is determined by the number of milking cows and quantities of roughages, concentrates and mineral supplements fed. Milk productivity (production per cow per day) will depend on the quality of feeds, breed type and production system. Exotic breeds have higher yields compared to crosses and while dairy cows under zero grazing system produce higher than those under free range or semi-intensive production systems. In the project area, milking takes place twice in a day, in the morning and in the evening. There is more production of milk in the morning than in the evening.

Over the lactation period, more than 55% of the milk is produced during the wet season while the rest during the dry season. The production varies due to availability of feed and water which is low during the dry season. Cows remain in lactation for about 11 months with production of milk increasing early into the lactation, peaking in the middle of the lactation and declining gradually.

Estimation of milk production per cow per day (milk productivity) is always elusive due to the fact that milk production is not constant over the lactation period and also varies from cow to cow even if the breed and feeding is the same. Evidence from literature shows that whereas pure breeds (exotic) peak after two or three after calving, the crosses do not peak and yields per day gradually decline over the 10 months of lactation. An estimation of supply over the dry and wet season reveals that the area can produce 2,768 litres of milk per day from a total of 575 cows in lactation translating to about 6 litres per cow per day.

A comparison of milk productivity over the project period and across the different production systems reveal a general improvement in every production system. In the zero grazing production system, milk productivity increased from 7.9 to 8.1 litres per cow per day or by 7.7% while in semi-intensive production system, productivity almost doubled from 4.6 to 9.2 litres per cow per day with a marginal increase in the free range system from 4.4 to 4.7 litres per cow per day. Productivity was lowest in the free range system compared to the semi-intensive and zero grazing system. In overall, milk productivity increased from 4.8 litres per cow per day during the baseline to 5.4 litres per cow per day, by the end of the project (Table 14). The decline was significant partly driven by the ageing dairy cows. As at the start of the project, the average years the farmers had owned the cows was 6 years meaning each dairy cow was 6 years old. Five years down the project implementation, the age of the cow was 10 years. A correlation between milk productivity and years of ownership was negative pointing to the decline in milk productivity. On average from the all season total and the number of cows in lactation, the average milk production per cow per day was estimated to 6 litres (95% CI: 4.743-6.487), giving the range of 5-6 litres of milk per cow per day.

Table 14: Milk Production and Productivity

		Before				After			
Variable		Obs	Mean	[95% Conf. Interval]		Obs	Mean	[95% Conf. Interval]	
Number Lactating		73	2	2.093	2.839	101	6	4.022	7.364
Lactation Period (months)		0	.	.	.	155	11	1.631	19.659
Average as at ETE (April 2021)	Morning	68	5	3.695	6.261	98	12	7.112	17.786
	Evening	65	5	3.778	6.422	87	7	5.047	8.471

	Total	69	10	7.084	12.139	100	17	11.805	23.095
Dry season	Morning	66	3	2.286	4.320	99	6	3.835	7.832
	Evening	62	3	2.121	3.943	85	4	2.544	4.567
	Total	66	6	4.297	8.006	100	9	6.400	11.194
Wet Season	Morning	72	6	4.514	7.000	99	13	7.291	18.416
	Evening	70	6	4.522	7.021	87	7	5.302	8.843
	Total	72	11	8.907	13.829	100	19	12.950	24.806
Total Milk across wet and dry season		72	17	12.986	21.028	100	28	19.567	35.783
Milk consumed by calves		50	3	1.957	3.283	70	3	2.368	3.703
Milk consumed at home		69	2	2.086	2.836	100	3	2.413	3.337
Milk sold		**56**	**6**	**4.510**	**8.222**	**89**	**15**	**8.984**	**21.173**
Total Milk Production		72	9	7.015	11.243	100	18	12.492	24.348
Milk production per cow		72	8	6.094	10.039	100	6	4.743	6.487
Production systems									
Zero grazing		5	7.9	3.938	11.762	4	8.1	-1.116	17.366
Semi intensive		25	4.6	3.725	5.473	13	9.2	5.943	15.775
Free Ranging		29	4.4	3.056	5.812	83	4.7	4.102	5.243
Total milk Productivity		59	4.8	3.979	5.607	100	5.4	4.644	6.074

Milk productivity was found to correlate positively and significantly with technical factors such as training in dairy cow breed identification, routine practices, silage making, health management and disease prevention. Other factors that indirectly related to milk productivity, but enhanced the quality of milk relate to training on milk hygiene, milk hygiene, milk preservation and treatment. Further, in behavioural change practices (increased frequency of practices) which correlate positively and significantly with milk productivity were increased frequency of practicing storage of crop residue, keeping breeding records, milk records, paddocking and use of aluminum milk cans to store or transport milk. Presumably, while keeping records may not directly influence milk productivity, they enhance investment knowledge and management that directly relate to milk productivity. Similarly, use of milk cans reduce milk spoilage and thus increase the volumes that are delivered for sales.

The supply of milk as such, estimated from the daily milk production per cow (5.4 litres). This average productivity lies between a confidence interval of 4.6 and 6.07 (CI 4.644: 6.074). From the sample, the sample total of lactating cows were estimated to be 575. The range of potential, was thus estimated as a product of the lower and upper bound productivity as shown by the confidence interval to be 2,670 and 3,492 litres per day. This estimation favourably compares to the daily market collections from the MCC branches, who, through KIIs and FGDs reported a range between 3,000 and 5,000 litres per day.

To get an insight about the utilization of milk, households were asked on how much milk they used to feed calves, for household consumption and amount that is sold. Evidence shows that on average, 82% of the milk is sold with 16% being consumed within the household and 12% given to calves. By the end of the project, the average volume of milk sold had more than doubled from 6 litres to 15 litres on average per households. For a sample of 279 farmers, where 100 sell milk, the total volume of milk sold from the sample was estimated 1,342 litres in a day.

4.4.4.5 Milk Value Addition

At household level, there is little milk value addition if any. Evidence shows that the proportion of households who undertook value addition increased from 11% to 25% with the milk that is locally value added increasing from 18litres to 29 litres per household. The only form of value addition is fermentation of milk into mala (sour milk) and this was evident only for 14% of the interviewed households (Figure 10). 9% of the households produce ghee from the milk while 4% boil milk and this is mainly the one for household consumption. This means that there is no value accrued due to value addition and farmers continue to depend on sale of raw milk for income.

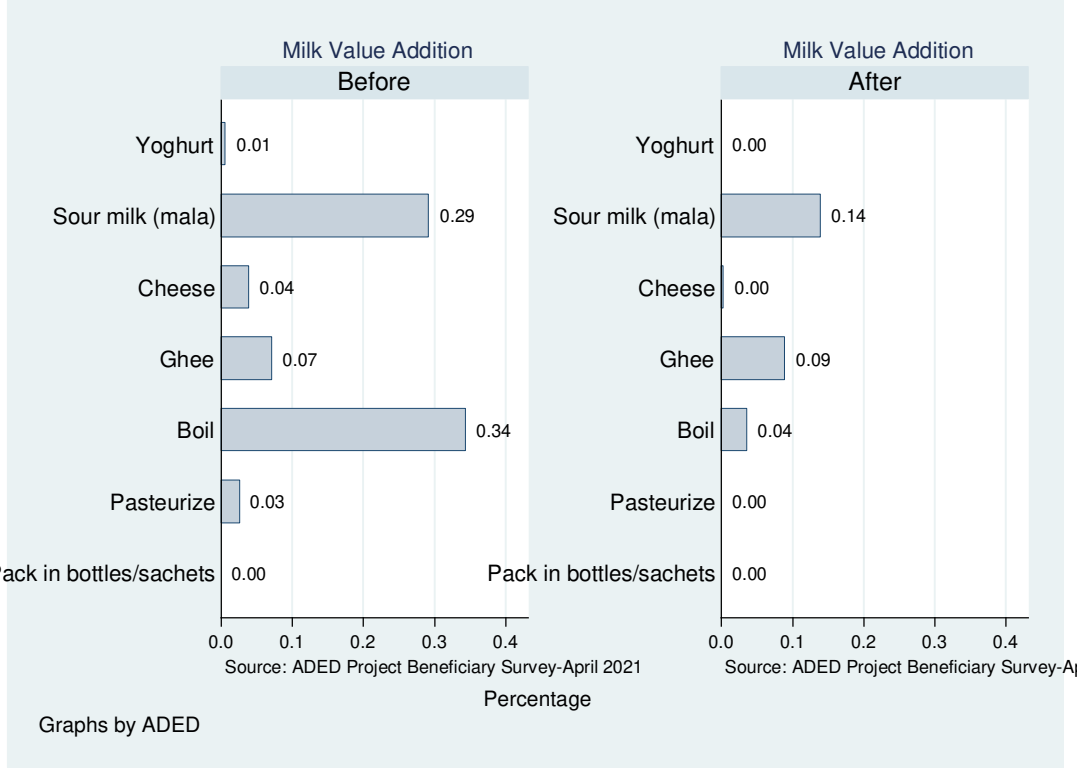

Figure 10: Milk value addition

As aforementioned, the intervention of ADED project has led to opening of a new marketing outlet, the MCCs and their collection centres. Sultan Hamud and Mashimba aggregation centres are equipped with chillers for cooling milk. In these milk is aggregated and quality checks conducted. The quality checks conducted include alcohol test, lactometer test (test for milk density) organoleptic test (appearance, colour, and temperature). In Mashimba aggregation centre, much of the value addition that is done is chilling and quality tests. There is little value addition into yoghurt and mala despite the equipment being in place. Although yoghurt and mala can be packaged in Mashimba aggregation centre, the facility lacks the KEBS certification and a manufacturing license to fully engage in value addition and marketing. As such, no value added product form the facility has hit the market.

4.3.2.6 Participation and involvement of community in Dairy Production and Marketing

Several stakeholders have supported the dairy value chain. At the production level, there has been considerable participation in dairy value chain from the community side. The community participates as individuals as well as through organized groups. Five Milk Collection Centers (MCC) were established and equipped for milk collection (Table 15) with a potential of 8,200 litres daily.

About 60% of the households participated in the dairy value chain and majority (98%) were from the sites in Kajiado. On the other hand, over 40% participated in the moringa value chain and majority 96% were from the sites in Makueni.

Table 15: Established and equipped milk collection centre

Milk Collection Centers		
Name	**Location**	**Volume of milk handled**
Masimba	Masimba	3,800
Sultan Hamud	Sultan Hamud	2,200
Oltinka	Oltinka	1,200
Illamirror	Illamirror	1,000
Mwanyani	Mwanyani	Newly constructed

To build the capacity of farmers, the ADED project has worked with the Kajiado and Makueni County departments of agriculture and livestock. These have been key in supporting production and pasture development.

At the value addition level, milk aggregation and cooling are the main activities. These are done at the aggregation centres where the milk is also tested of the quality. Kenya Dairy Board has been looped for support to ensure quality and hygiene of milk. At the marketing front, the project established linkage with Brookside Kenya Company which has been collecting milk from the aggregation centres for processing and packaging.

4.3.2.7 Challenges in Dairy Production, Value Addition and Marketing

Agricultural production across the country faces insurmountable perennial challenges that negatively affect optimum production. Coupled with market challenges, agricultural production challenged prohibit farmers from optimizing investment returns in agriculture and consequently demean incomes for the farming households. Dairy farmers are not exemptions to these challenges. Evidence from Key Informant and focus group discussions reveal challenges that affect production, value addition and marketing of the dairy value chain. A summary of dairy and moringa production challenges is given in Figure 11.

The dairy value chain is affected by numerous challenges. At the production level, pests and diseases, poor rainfall and high cost of veterinary drugs are among the most important costs that affect dairy production. The Makueni and Kajiado area in which this project was implemented is characterized by below average rainfall and at times, the rains are erratic and poorly distributed. Poor rainfall leaves the livestock farmers who largely practice free ranging and depend on rangeland pastured for livestock production. Evidence from the household survey, KIIs and FGD corroborates that scarcity of pasture is a challenge to many livestock

keepers in the area. Lack of pasture and water lead to depressed livestock production with milk production declining over the dry season.

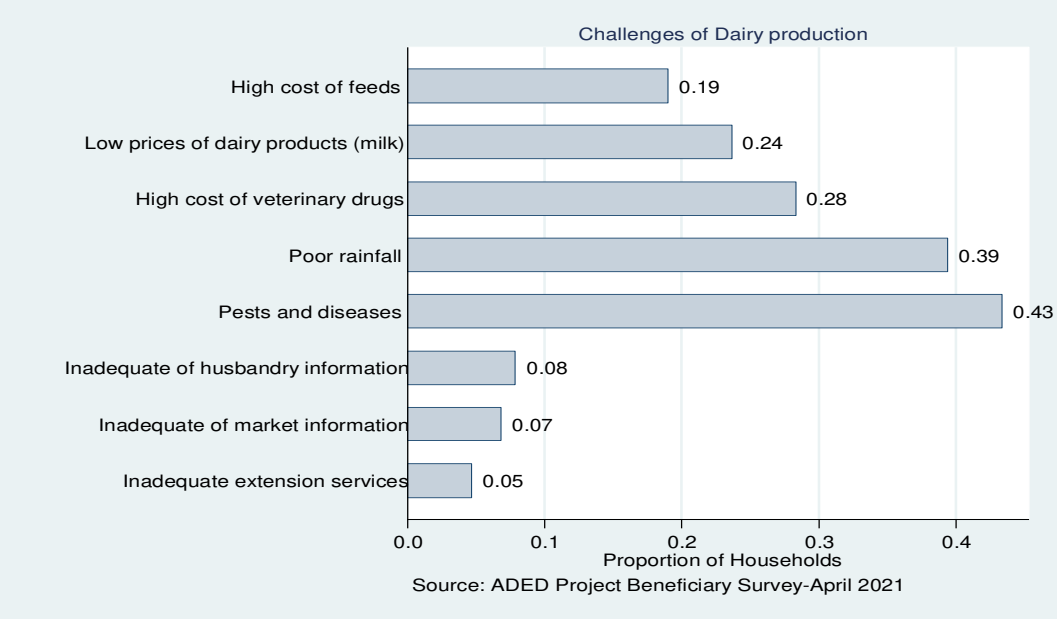

Figure 11: Challenges of Dairy Production

High cost of drugs and veterinary services is another challenge that impacts negatively on livestock production. With households characterized by low household incomes, affordability of veterinary drugs becomes a challenge to many and consequently diseases reduce livestock productivity.

The common diseases and pests in dairy farming within the area include foot and mouth disease reported by 72% of the interviewed farmers (Figure 12). Other common diseases include anthrax, and lumpy skin diseases. At the processing level, evidence reveals that dairy processing suffers from poor quality of milk delivered to aggregation centres, high cost of processing emanating from cost of electricity, and poor milk deliveries by farmers.

Poor quality milk due to poor handling and management of hygiene lead to condemning of large volumes of milk. A discussion with the management of the aggregation centres at Mashimba and SAMLI dairy in Sultan Hamud pointed to an improvement of milk quality following training hygienic handling of the milk. Although almost 98% of samples of milk meet the standards, there is still much more to do to sustain the milk quality. Often, farmers failed to meet the standards of quality due to poor hygienic conditions in which milk is produced and handled, poor means of preservation and inadequate training on milk handling.

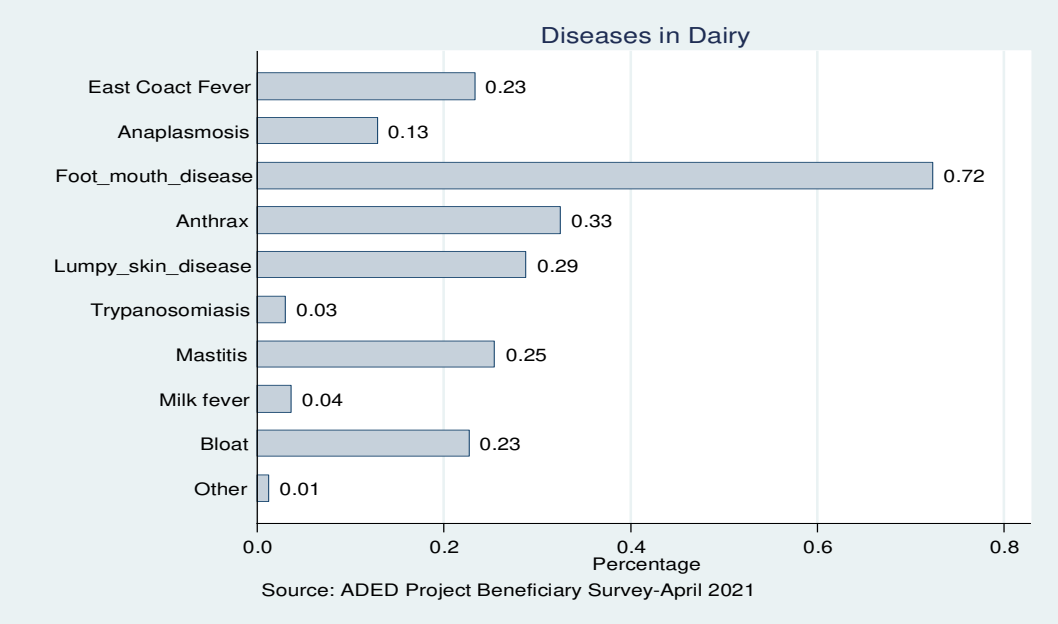

Figure 12: Diseases affecting dairy animals

High cost of processing- milk value addition, aggregation and cooling in this case, is faced with high costs of processing. Aggregation and cooling centres- Sultan Hamud (operated by SAMLI dairy cooperative) and Mashimba cooling centres pointed to high costs emanating from electricity, fuel for power generators and cost pf labour.

Uneconomical volumes of milk deliveries- despite the potential of dairy production in the area, farmers still aggregate small amounts of milk to warrant any further processing apart from cooling. The two main collection centres (SAMLI Dairies and Mashimba –collected an estimated total of 10,000 litres in a day). This is sold to Brookside Company for packaging. Higher volumes of milk would guarantee farmers economies of scale and better prices from processing and packaging at higher levels of the value chain. Currently, a litre of milk goes for KShs 38 at the aggregation centres.

4.4 Outcomes, Sustainability and Replication

The outcome section evaluated the achievement of the wider effects of the ADED project. We evaluated *the relationship between the project's mission and the specific objectives and whether these would lead to achievement of the expected outcomes*. Outcomes of the ADED project were considered within the realm of food and nutrition security- Household Dietary Diversity (HDDI), Coping Strategy Index (CPI), Food Consumption Score (CSI), Number of meals and Number of months for which households did not have enough to eat. An additional aspect was to evaluate the contribution of the dairy and moringa into the household income basket.

4.4.1 Enhanced food security and livelihoods from agriculture

Household food security was evaluated by checking the number of meals, number of months in which households face food deficits, Household Dietary Diversity (HDDS), Food Consumption Score (FCS) and coping strategy index (CPI). Only two indicators –number of meals and number of months household face food deficits could be compared between the baseline and the end line. The rest of indicators, FCS, HDDS and CPI were captured at the end of the project implementation.

4.4.1.1 Household Food Self sufficiency

To assess the household food self-sufficiency, households were asked about the number of meals they consume in a day seven (7) days prior to the survey and the number of and in which months in the last one year (12 months) they faced food deficit or did not have enough to eat. In both counties, the assessment found that a significant majority (94% in Makueni County) and 79% in Kajiado County could afford 3 meals in the previous 7 days prior to the end line survey (Figure 13). On comparison, we find that there was significant improvement in food security with the proportion of households who reported months of food defect significantly declining over every month and a significant increase in the number of meals taken in a day.

The proportion of households consuming 3 meals a day increased as opposed to the time before the project. Whereas 58% of households reported consuming 3 meals a day in the baseline, the proportion increased to 89% after the project implementation. Meanwhile, those households consuming one meal and two meals a day declined compared to the baseline statistics. In addition to the number of meals, the evaluation enquired into months for which households indicated that they faced inadequate food supplies or did not have enough to eat within the households.

Evidence shows that the months of household food deficit start in July and the deficits worsen as year goes by peaking in September and then gradually decline through December. Even though the months of food deficit remains the same, between July and November, further analysis shows a significant decline in the proportion of households who reported to experience food deficit declined over the project implementation period.

For instance, the proportion of households who experienced food deficits in August before the project were 54%, 66% in September, and 58% in October but the end line survey after the

implementation of the project indicates a declined to 17%, 18% and 14% over the same months respectively. Majority of the households experience food deficit in August and September. These findings rhyme with the seasons experienced in the project area. Long rains occur between March and May during which there is plenty to consume from the farm through June. The Short rains take place between October and December and are the driver of the gradual decline of household food deficit over the October to December. Available food supplies support households through to the long rains in March.

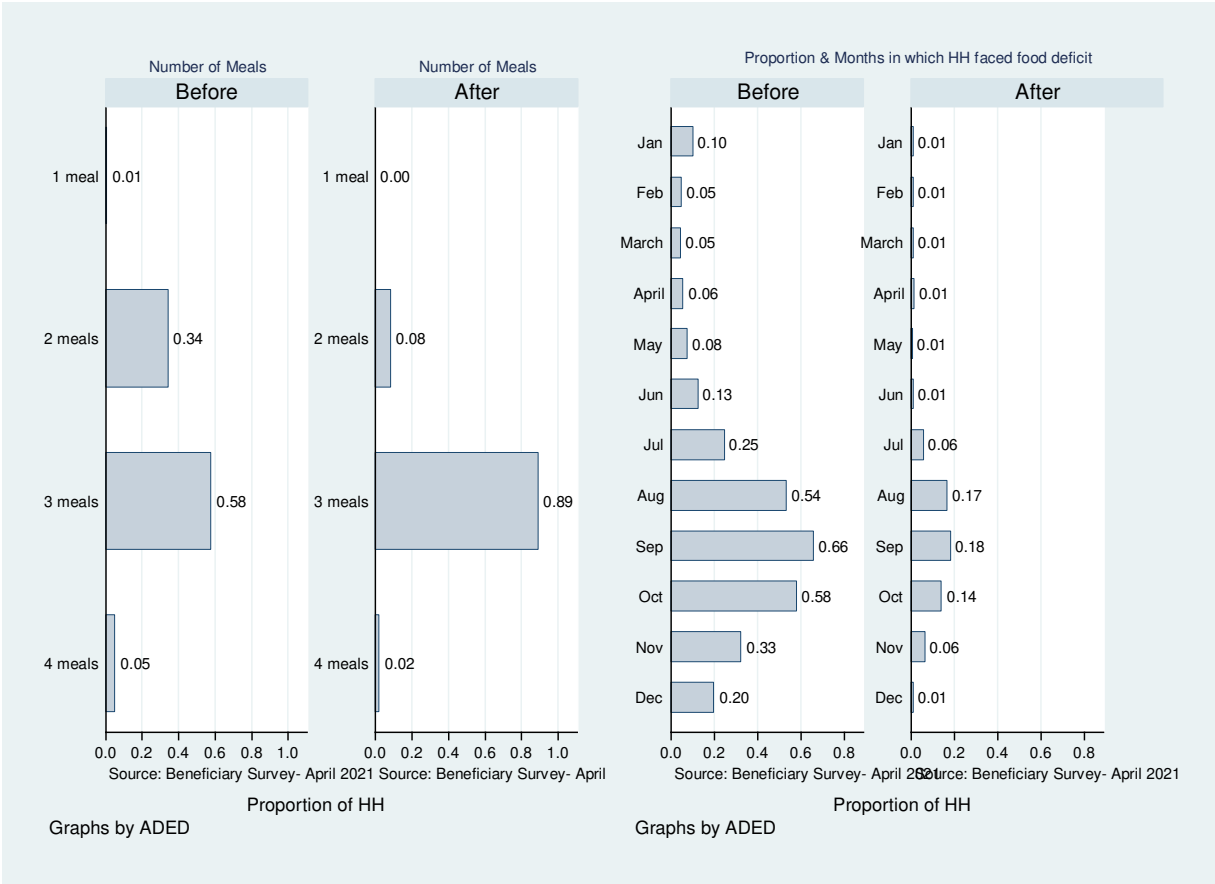

Figure 13: Household food security-Number of meals and months of food deficit

4.4.1.2 Household Coping Strategy Index (CSI)

Whenever households did not have enough to consume within the family, they employ strategies in order to streamline their consumption. Following the guidelines in Maxwell and Caldwell (2008), we estimated the CSI for the project area. The CSI is calculated as a product sum of severity weights and the number of days in a week, the household had to employ a particular strategy. The CSI severity weights are as shown in Table 16.

An evaluation of the Coping Strategies reveals that households employed strategies variably. In Makueni County, households employed about three coping strategies in number while in Kajiado, households employed more than 10 coping strategies. The higher the number of coping strategies employed, indicated the severe the food insecurity. As such, drawing from

the number, households in Kajiado County are likely to face severe food insecurity compared to the households in Makueni.

Table 16: Coping strategies' weights

Strategy	Severity weight
1) Rely on less preferred and less expensive foods?	1
2) Borrow food, or rely on help from a friend or relative?	2
3) Purchase food on credit?	2
4) Gather wild food, hunt, or harvest immature crops?	4
5) Consume seed stock held for next season?	3
6) Send household members to eat elsewhere?	2
7) Send household members to beg?	4
8) Limit portion/quantity size at mealtimes?	1
9) Restrict consumption by adults in order for small children to eat?	2
10) Feed working members at the expense of non-working members?	2
11) Reduce number of meals eaten in a day?	2
12) Skip entire days without eating?	4

As assessment of the different coping strategies reveals that two most relied coping strategies are reliance of less preferred and less expensive foods during food deficits (34% in Makueni and 56% in Kajiado) and purchase of food on credit. (19% in Makueni and 46% in Kajiado). In addition, households in Kajiado County also borrow food or rely on help from friends or relatives (Table 17).

Table 17: Coping strategies used by households in the project area

Variable	Makueni (n=189)	Kajiado (n=90)	ADED Project area (n=279)
Rely on less preferred and less expensive foods?	34%	56%	41%
Borrow food, or rely on help from a friend or relative?	7%	39%	17%
Purchase food on credit?	19%	46%	27%
Gather wild food, hunt, or harvest immature crops?	4%	8%	5%
Consume seed stock held for next season?	4%	21%	10%
Send household members to eat elsewhere?	4%	16%	8%
Send household members to beg?	3%	19%	8%
Limit portion/quantity size at mealtimes?	7%	30%	14%
Restrict consumption by adults in order for small children to eat?	8%	21%	12%
Feed working members at the expense of non-working members?	1%	20%	7%
Reduce number of meals eaten in a day?	5%	24%	11%
Skip entire days without eating?	1%	20%	7%

4.4.1.3 Household Food Consumption Score (FCS)

Food Consumption Score[11] (FCS) is estimated as a product-sum of weighted food groups and number of days the food group is consumed within previous seven days of the survey. These food groups include staples, tubers, pulses, vegetables, fruits, meats and fish, oils and fats, dairy/milk products, sugars and condiments. The weights assigned to each food category are

[11] $FCS_i = \sum_{j=1}^{7} \alpha_j F_{ij}$, where α_j is the weight for the j^{th} food group of the total 7 food groups, and F_{ij} if thej^{th} group of food consumed by i^{th} and FCS_i is the Food Consumption Score for the i^{th} household

globally agreed to standardize the estimation of Food Consumption Score (FCS). The weights are as shown in Table 18. FCS is categorized into poor, borderline and acceptable levels of consumption. The higher the FCS, the higher the probability of adequacy of nutritional uptake. So those households with poor FCS are considered to have a poor nutritional uptake with those with acceptable considered to have adequate nutritional uptake.

Table 18: Food Consumption weights

Food Item	Food Group	Weight
1. Maize, wheat, rice, sorghum, millet, pasta, bread & other Cereals	Main staples	2
2. Tubers - potatoes		
3. Beans, Peas, cow peas, groundnuts & cashew nuts	Pulses	3
4. Vegetables and leaves – Spinach, cabbage, lettuce	Vegetables	1
5. Fruits – Mangoes, ripe bananas, apples, oranges, guava, watermelon, lemons	Fruits	1
6. Beef, goat, poultry, eggs and fish	Meat and Fish	4
7. Milk and milk products/dairy products; Yoghurt	Dairy/Milk	4
8. Sugar and sugar products, honey	Sugar	0.5
9. Oils, fats and butter	Oil	0.5
10. Sauce, coffee, Vinegar, spices, tea, salt	Condiments	0

An evaluation of the FCS seven days prior to the survey revealed that across the two counties, a large majority, 89% in Makueni County and 98% in Kajiado County had an acceptable level of food consumption while 8% and 2% in Makueni and Kajiado respectively had borderline level of consumption (Table 19).

Table 19: Food Consumption Score in ADED project area

Variable	Makueni County			Kajiado County			ADED project area		
	mean (n=189)	[95% Conf. Interval]		mean (n=90)	[95% Conf. Interval]		mean (n=279)	[95% Conf. Interval]	
Poor	3%	0.0034	0.0495	0.0%	0.0000	0.0000	2%	0.0023	0.0336
Borderline	8%	0.0446	0.1247	2.2%	-0.0088	0.0533	6%	0.0355	0.0935
Acceptable	89%	0.8437	0.9341	97.8%	0.9467	1.0088	92%	0.8851	0.9500

4.4.1.4 Household Dietary Diversity (HDDS)

In addition to number of meals we evaluated the household Dietary diversity. Household dietary diversity is measured as the number of food groups consumed by a household, seven (7) days preceding the survey. It measures household access to a variety of foods. An increase in the average number of different food groups consumed provides a quantifiable measure of improved household food access. In general, any increase in household dietary diversity reflects an improvement in the household's diet. HDDS provides a snapshot of the diet quality for a household. Evidence shows that in the 7 days preceding the survey, all households in the project area and across the two counties had consumed more than 4 food groups of the 10 food groups (Table 20). This is an indication to good access to diversified diets and consequently good nutrition.

4.4.2 Impact on Gender and Child well Being

4.4.2.1 Gender Roles Transformation

The ownership of livestock has a cultural bearing especially in the Maasai community. It is said that culturally, the cattle belong to the husband/man while milk belongs to the woman/wife in the household. Since most of the livestock activities, especially dairy promoted by the ADED project were largely in the Kajiado sites, we evaluate the ownership of the livestock through the cultural and gender lenses.

Table 20: Household Dietary Diversity in ADED Project area

	Variable	Obs	Mean	[95% Conf.	Interval]
ADED project area	HDDS	279	9	8.905	9.281
	Less_4	279	0%	0.0	0.0
	More_4	279	100%	0.989	1.003
Makueni	HDDS	189	9	8.711	9.225
	Less_4	189	1%	0.0	0.0
	More_4	189	99%	0.984	1.005
Kajiado	HDDS	90	9	9.142	9.569
	Less_4	90	0%	0.0	0.0
	More_4	90	100%	1.000	1.000

Within the project area, evidence shows that the male household head owns dairy and indigenous cattle, goats, sheep while the wife owns poultry (Figure 14). A comparison of decision making by different members of households was explored to check on whether there was some any form of gender transformation in decision making. We found that there has been a change in the participation in decision making and making the final decision especially in terms of use of income from crops and livestock. Figure 15 shows that before the project, women less participated in decision making. However, over the period of project implementation, there has been a change with the proportion of men participating in decision making about dairy increasing from 16% to 25% with the proportion of women remaining relatively constant while also, participation in decision making jointly (male and female) increased.

We find a significant increase in joint participation and in joint decision making on how to spend income from crops and livestock within the household despite the dominance in making the final decision on how to use income from dairy proceeds but there was an increase in joint decision making. In terms of crops, whereas the proportion of women participating in decision making on crop income increased women increased, the participation of men declined with participation jointly increasing. A similar decline was also evident in final decisions with regard to income, where the proportion of men declined while that of women and joint decision making increased.

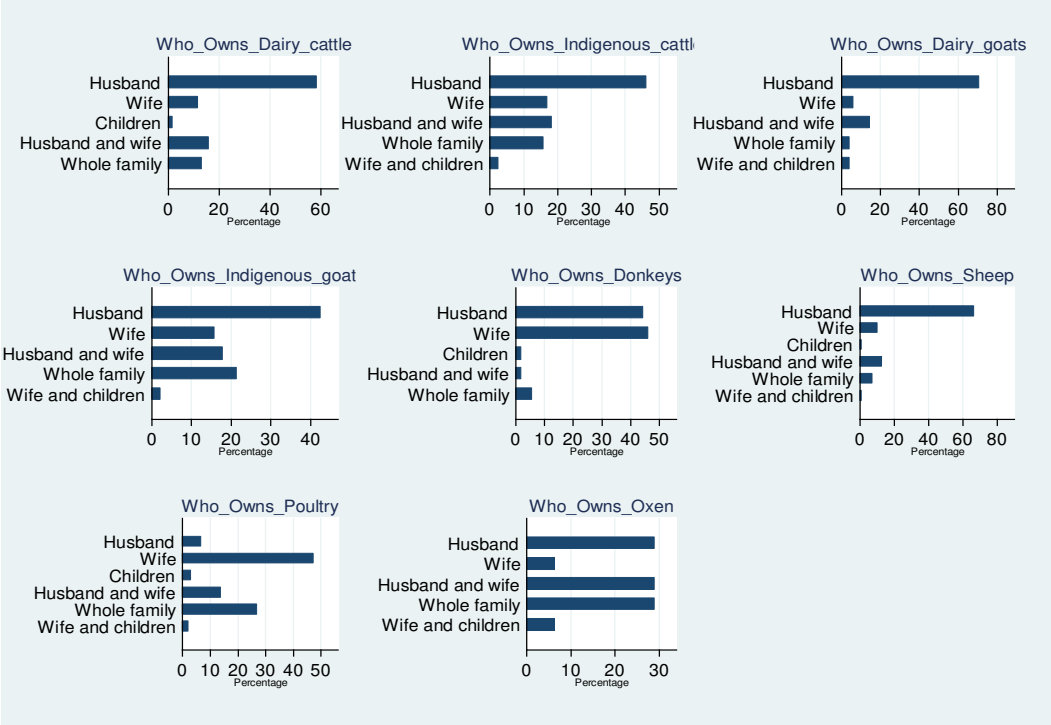

Figure 14: Livestock Ownership

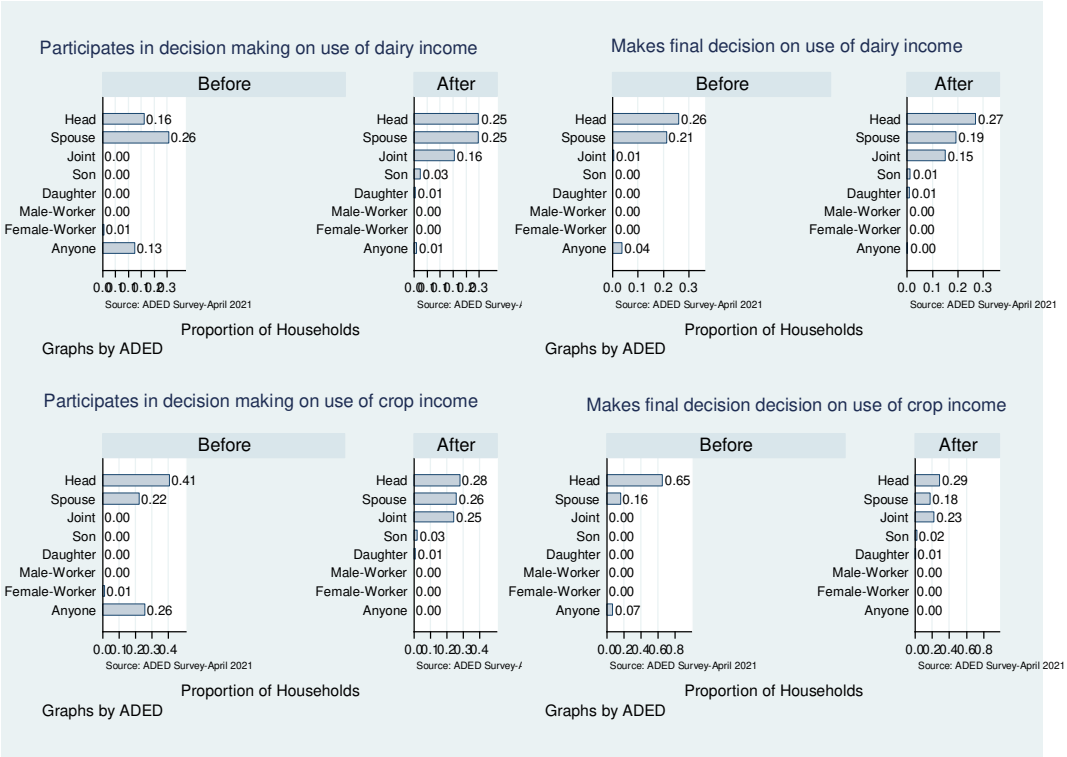

Figure 15: participation in decisions and making of final decisions on income use

4.4.2.2 Enrolment of the school going children

Of the total beneficiaries covered, 84% of the families had school going children. Evidence shows that all the school going children were regularly attending school even though KII and FGD information partly alluded to the challenge of school fees which prohibited some of the children from going to school at times. However, the burden of school fees was lessened by engagement in Moringa and dairy farming which enabled households to gain income and meet the fees burden. Evidence on use of income from moringa points to that 67% of the proceeds are used in offsetting the school fees bill.

4.4.3 Increased household Income-Dairy and Moringa

One of the targets of the ADED projects was to enhance households' incomes through promoting Moringa and dairy production. An assessment of this target and revenue from dairy and moringa reveal a positive trend towards enhancement of household incomes. The objective of this sub-section was to *Assess the level of margin of change in household income over baseline among participating households in Moringa and dairy value chains in Emali*. As such, we compare the current findings of income from sale of moringa and moringa products and milk and milk products with the baseline values to asses if there is change.

4.4.3.1 Revenue from sale of Moringa and Moringa products

In terms of Moringa, over the implementation period of the ADED project, income from sales of moringa products increased from an average of KShs 2,055 to 2,570 (25%). This income is accrued largely from the sale of seeds which account for 60% and leaves which account for 31% of the income (Table 21). Going by the adoption, this income is accrued to farmers (the 40%) who adopted Moringa and mainly are in Makueni County project sites. On average, male headed households had higher revenue compared to the female headed households.

Table 21: Revenue from sale of Moringa products (seeds, flowers, leaves, and feeds)

variable	Sum	% of total income	Mean	Female Headed HH Av. Revenue	Male Headed HH (av. Revenue)
Seeds	92,250	60%	1,647	525	1665.70
Flowers	150	0%	150	.	225
Leaves	60,325	39%	2,234	1600	2118.48
Feeds	1,500	1%	1,500	.	900
Total	154,225	100%	2,570	2,125	2,471.36

4.4.3.2 Revenue from sale of milk and dairy products

Income from dairy and other dairy products depended on the volume of milk sold, the outlet and the value addition. Different dairy and dairy products outlets attracted different prices and also absorbed different amounts of milk volumes. The sale of milk and milk products generated a substantial amount of household income. Milk is sold in several outlets including farm gate (at the household to either neighbors or local traders), institutions (schools, hospitals, colleges… among others), cooperative or cooling plan (aggregation centre) or in hotels.

The evaluation assessed the market outlets over seasons with the presumption that there might be changes in market outlets as milk vendors increase in number and often frequent milk production zones during the time of surplus of during wet season. We found little changes in the market outlets with institutions (hospitals, schools) fading out during the dry season, this, being an indication of reduced production and consequently sales during dry season.

At the start of the project, there were no deliveries of milk to the cooling plants since these were not operational or were not in existence. By the closure of the project, the investment in milk plants especially in Mashimba and support in Sultan Hamud SAMLI dairies had yielded. The cooling plants provided a new market outlet with 48% of dairy farmers delivering their milk into the cooling plants (Figure 16) and hence linking up with the Brookside Dairies.

During the dry and wet seasons before the project, an estimated 23% and 26% of farmers sold milk at farm gate. However, with the intervention of ADED that has supported aggregation centres and cooling facilities, an estimated 48% of farmers sell their milk through these facilities with 17% of farmers selling through milk bars/hotels.

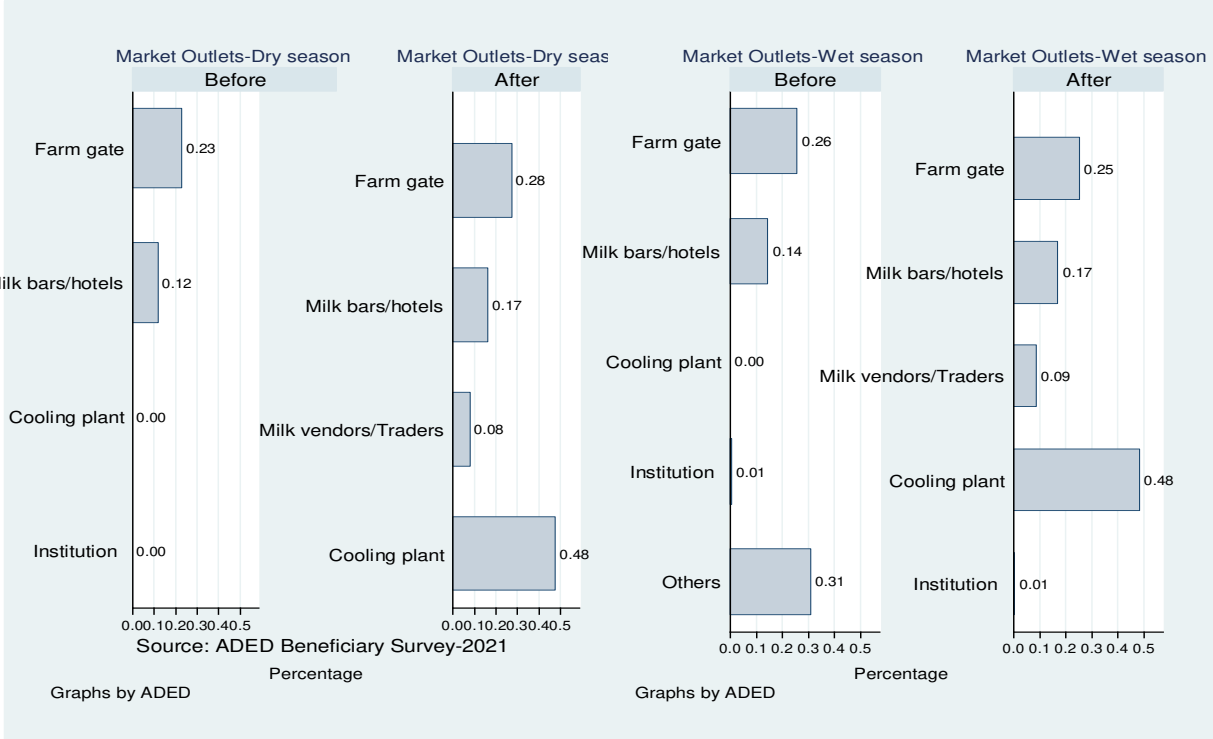

Figure 16: Shifts in market outlets for milk

Before the ADED project interventions

Prices of milk have varied over the period of the ADED project implementation and between the different outlets. Over the period of implementation of ADED and during the wet seasons, prices have declined from a range of KShs 60-70 per litre before to KShs 36-60 per litre by the close of the project. Over the dry seasons, the price fluctuation has relative to the wet season, remained low and too, the prices have also been as low as KShs 40 per litre. One would expect

that prices would decline during the wet season when there is high milk surplus. The prices offered by different outlets remain fairly constant over the seasons. Cooling plants, introduced by the ADED project offer KShs 36 per litre, but also increase to KShs 38 according to the KII informants. Seemingly, the leading milk price pace setters are the milk bars offering between KShs 45 and KShs 70 per litre depending on the season (Figure 17). In terms of quantities/volumes, cooling plants absorb the highest volumes of milk and provide the new marketing outlet to the community. Before the ADED, milk bars used to provide the highest average uptake of milk.

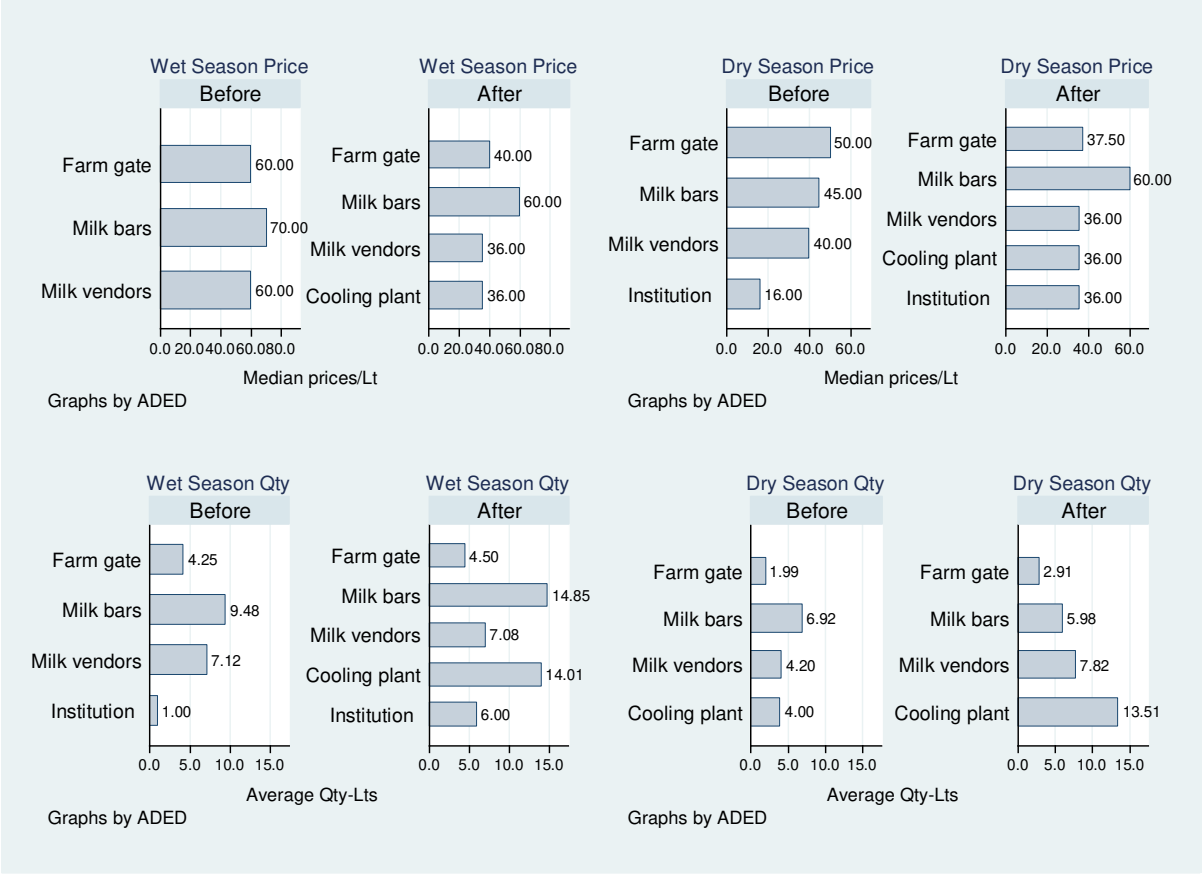

Figure 17:Seasonality and market outlet price and quantity dynamics

Evidence shows that during the dry season, an average of 10 litres per household is sold while during the wet season 13 litres are sold (Table 22). In both seasons, dry and wet season, the cooperatives or cooling plants account for the highest proportion of uptake of milk taking almost 50% of the milk offered for sale after consumption by calves and at households.

Household sale of milk generated substantial amount of income over the period of ADED project implementation. Partly, this could be attributed to the operationalization of the cooling plants in Sultan Hamud and Masimba markets where farmers are able to aggregate milk through the cooperative. The aggregated milk is sold to Brookside, an established dairy processing company. Because of the high variation in terms of milk supply into the cooperative between different households, we use the median revenues as proxy for the mean or average income from milk and other dairy products.

Table 22: Milk sales during wet and dry season by different market outlets

		Wet season		Dry season	
		Av. Litres per HH	N	Av. Litres per HH	N
Farm gate	Litres sold	5	8	3	11
	Price per litre	41	8	42	11
Milk bars/hotels	Litres sold	15	23	6	23
	Price per litre	54	23	58	23
Milk vendors/Traders	Litres sold	7	12	8	11
	Price per litre	34	12	36	11
Cooling plant/Co-operative/p	Litres sold	14	72	14	70
	Price per litre	36	72	36	70
Institution (school/ college	Litres sold	6	1		
	Price per litre	36	1		
Total	Litres sold	13	116	10	115
	Price per litre	40	116	41	115

Comparing the baseline and the end line, household revenue from sale of milk and milk products increased by 70% from KShs 39,067 per month to KShs 55,252 over the project period (Table 23). The sales were made over the wet and dry season. There average revenue from sale of milk is higher during the wet season compared to the dry season due to the high milk production during the wet season. Compared between the baseline and end line of the project, there were significant increases in average revenue from milk in both seasons.

Table 23: Revenue from milk sales and Dairy products (calves, heifers, sale of hay)

			Before			After	
Variable	Obs	sum	**Mean/month**	Obs	sum	**Mean/month**	
Total Revenue from milk and other dairy products	111	4,336,384	**39,067**	129	7,127,510	**55,252**	
Revenue from other products (includes sale of dairy livestock)	53	4,286,000	**80,868**	43	4,119,620	**95,805**	
Milk revenue	102	50,384	**494**	116	3,007,890	**25,930**	***
Milk revenue (Wet season)	97	29,115	**300**	114	1,642,695	**14,410**	***
Milk Revenue (Dry Season)	83	21,269	**256**	115	1,365,195	**11,871**	****

The increase in revenue from dairy and dairy products was largely driven by sale of dairy calves, heifers and bulls, value addition and sale of other dairy related products including dairy calves, dairy bulls and heifers as well as baled hay, silage and fodder. Key dairy products were sale of bulls, heifers and calves which contributing 35%, 9% and 54% of the total revenue from dairy products respectively.

4.4.3.3 Livelihoods-Sources of household incomes-

Although the exercise captured revenue, this was used as an indicator of commercialization of the two value chains but this could not measure to the total household income. As such, in addition to the revenue, households were asked to indicate the total revenue generated from different sources of income. These responses were used to evaluate the changes in household income over the period of ADED implementation.

The ADED project sought to diversify the income sources/livelihoods of households within the project area. Households with more than 2 sources of income significantly increased from 34% to 45% over the project implementation period. Moreover, the number of income sources

increased over the project from 6 to 8 sources although only very small proportions of households could have more than 4 sources.

Compared to the time the project started, there was a shift in both the proportion of households generating income from different sources and also an expansion of the sources of income. In terms of gender, by the end of the project, a higher proportion of women (19%) generated income from one source than were before the project (8%)-(Figure 18). This implies that over 10% of women headed households at least had obtained an income source. A considerable expansion of income sources was accrued to the male headed families.

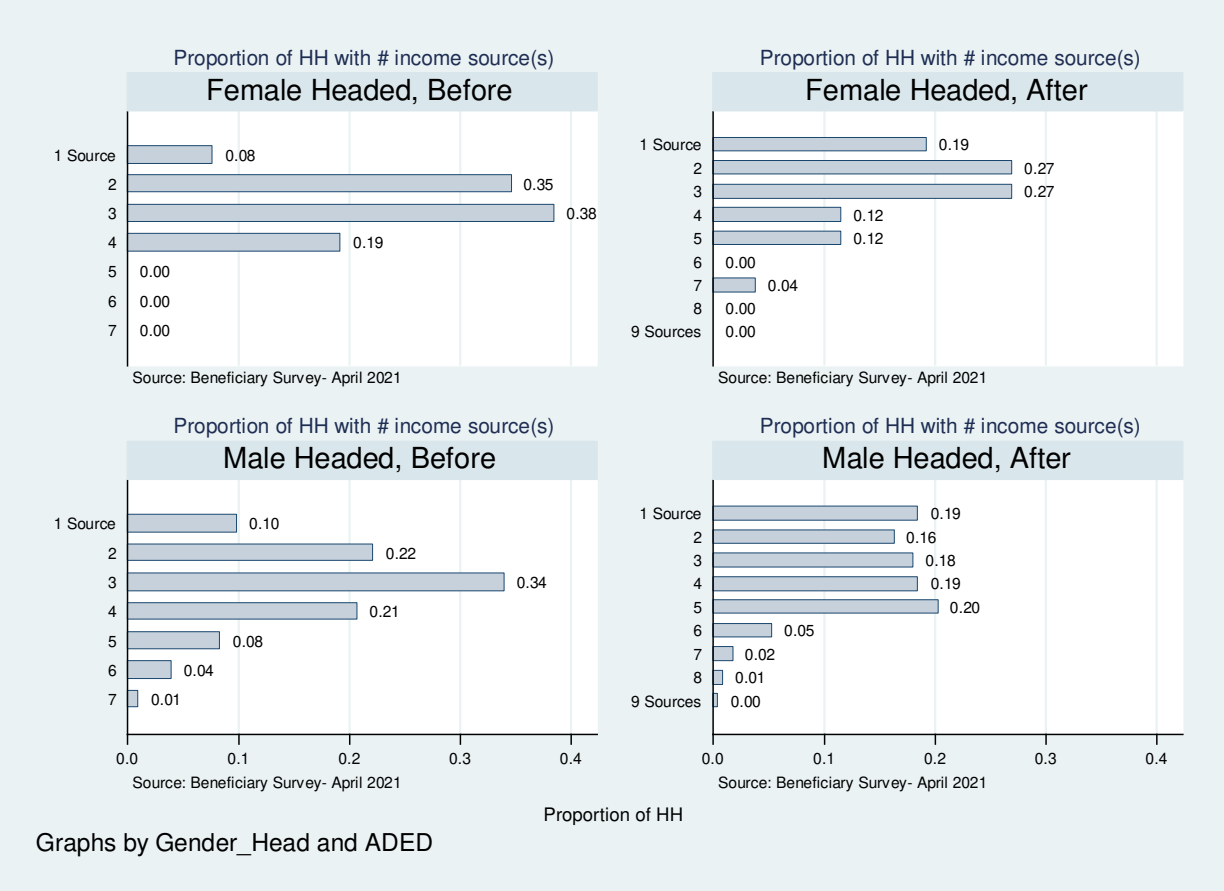

Figure 18: Source of income by sex of the household head

There was an increase in the proportion of households who generated income from sale of moringa and moringa products. Mostly, the proportion of households increased specifically from sale of moringa seeds from 1% at the start of the project to 23% by the close of the project (Figure 19).

Annual average incomes at household level changed driven by the project interventions. Evidence shows that there was a considerable increase in income from sale of milk from farm from an annual average of KShs 61,261 to KShs 63,840 over the project implementation period. Sale of livestock and livestock products also increased over the project period (Figure 20). The increase in the proportion of household generating income from sale of moringa did

not translate into increased absolute income from moringa as this showed decline in the incomes, perhaps as the productivity declined.

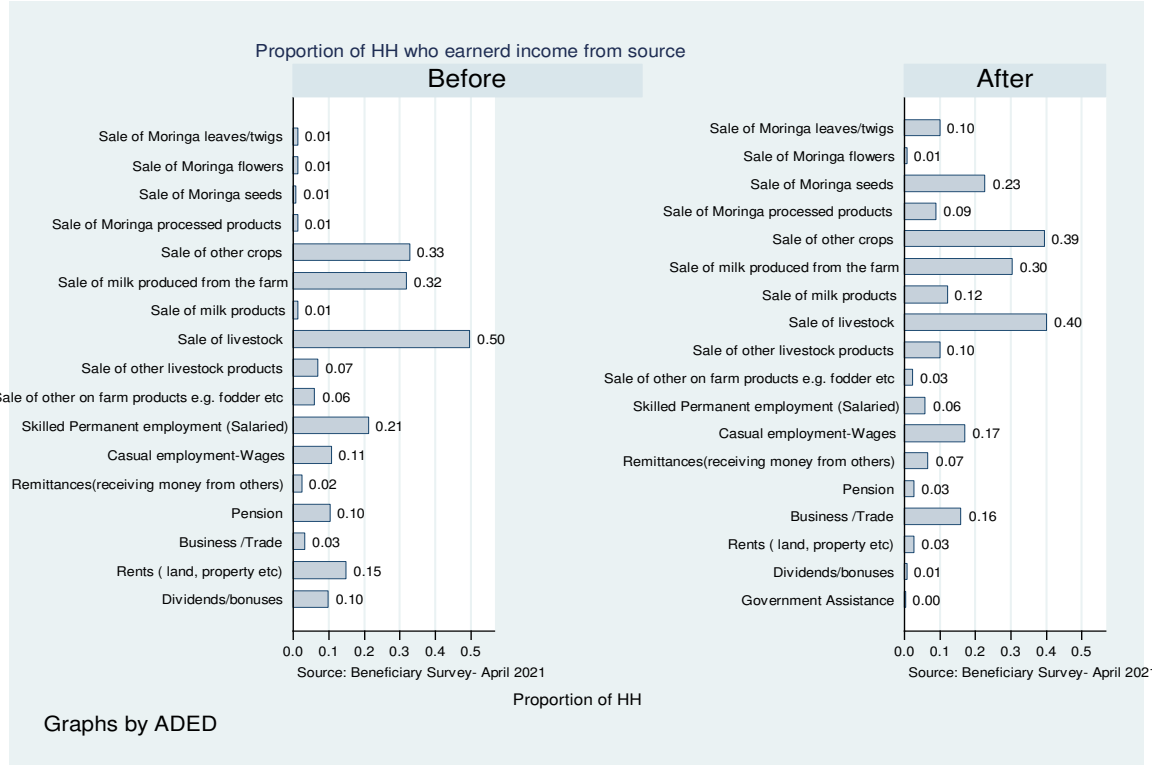

Figure 19: Proportion of Households earning income from various sources

In the total annual household income, dairy and moringa value chain contribute a considerable share of income. Both, before and after contribute over 15% of household income The share of income contributed by dairy increased marginally from 18% to 20% over the project implementation period while the share of moringa income increased to 2.0% from 0.6%. However, the absolute average incomes showed a different trend average annual income from dairy increased from KShs 57,375 to KShs 58,773 per household or 2.4%. Annual income from moringa significantly declined from KShs 32,600 to KShs 7,830 in line with the productivity decline. Despite this increment in annual income from dairy, the total household income declined marginally from KShs 136,377 to KShs 132,161 or 1% to imply that the decline in other sources offset the income effect of the ADED project.

Households were asked on how they utilize income generated from sale of Moringa products. Several options including start a business, school fees, buy food, hospital bills, pay debts and buying assets and farm inputs were floated. Evidence shows that income from sale of Moringa products is largely used to buy food (82%) and for paying school fees (67%)- (Figure 21**Error! Reference source not found.**). The use of income from sale of Moringa products confirms its important in food security and in child wellbeing in terms of school attendance. The survey results collaborate the KIIs and FGDs information that adoption of Moringa has helped households enhance their incomes which is used in purchase of food and in support to school fees and consequently increased school attendance.

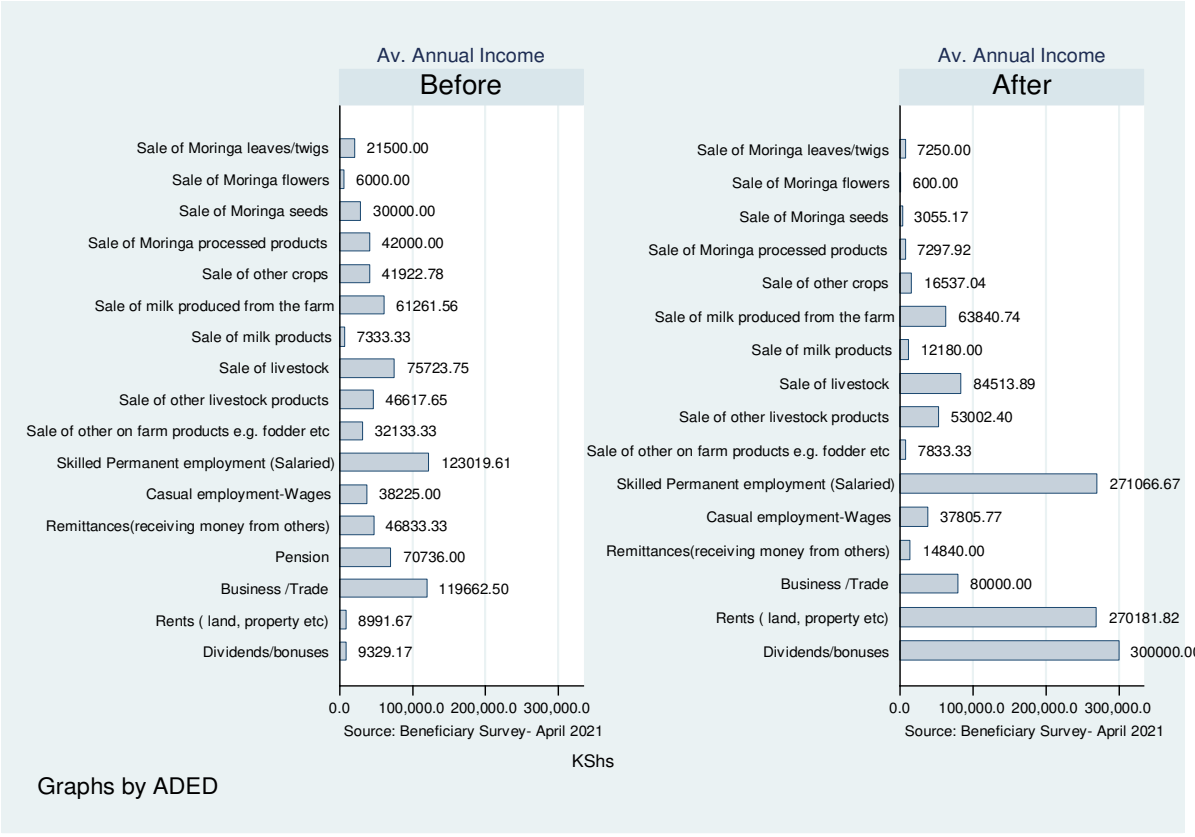

Figure 20: Annual Average household income from various sources

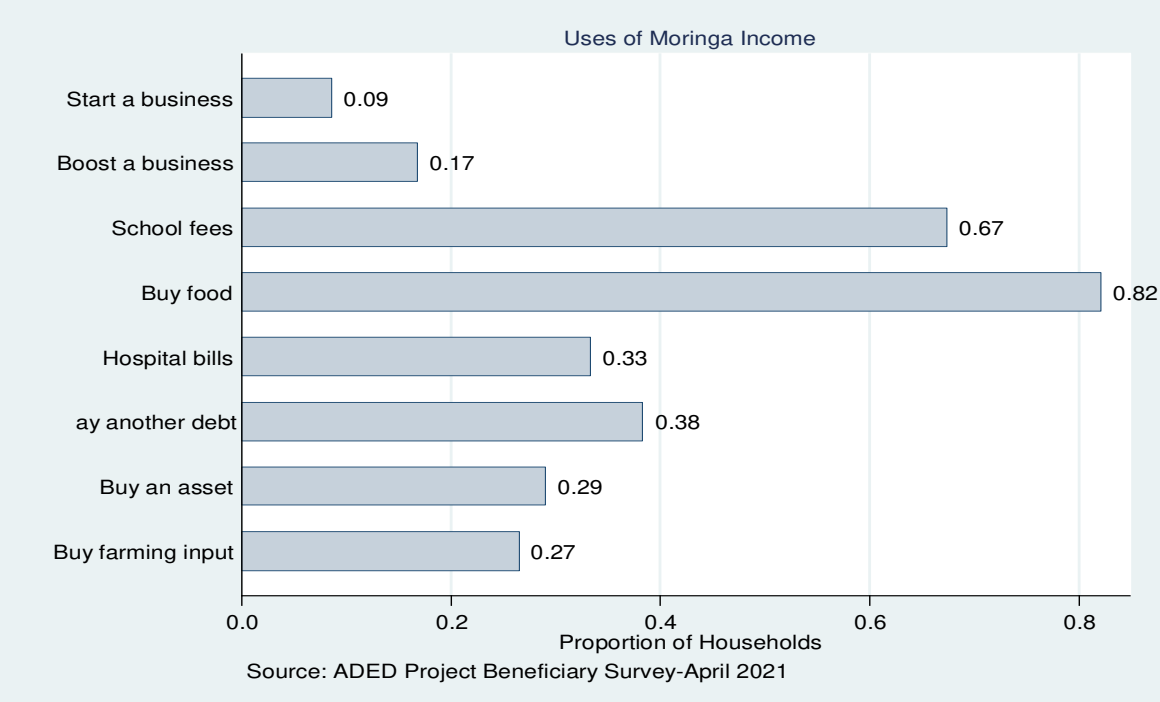

Figure 21: Uses of Moringa income

4.5 Sustainability of Dairy and Moringa activities Post ADED project

Although communities have alluded to the fact that the closure of the ADED program well adversely affect them and almost stall the already started projects, there are elements that are likely to propel the continuity of the project beyond ADED if well harnessed. These include the already established cooperative movement, the infrastructure on milk value addition and the skills and knowledge obtained from the several project sessions.

4.5.1 The cooperative movement

The cooperative movement established for dairy and moringa is likely to spur continuity after the exit of ChildFund. However, before the exit, proper rules of operation and management need to be put in place. The SAMLI dairy and EMUKA moringa cooperatives will face challenges of management if they are not grounded on good governance and management of resources. Heavy costs of operation especially on value addition and lack of strong market linkages may weigh down on the sustainability of activities already supported by ChildFund.

4.5.2 The infrastructure development in Dairy and Moringa

Already, the project has established infrastructure especially in dairy production. The support to Mashimba milk aggregation and cooling centre, together with the County Government of Kajiado, pivots an important value addition aspect. It is expected that with the linkage to Brookside, the dairy infrastructure will be able to sustain the operations and costs of the infrastructure.

4.5.3. Skills and knowledge acquired during training and capacity building

Farmers have gained skills and knowledge through training offered by the program. The knowledge and information is likely to drive moringa and dairy production and value addition activities even after the project pools out. For instance, training on hygienic handling of milk is expected to support supply of quality milk and hence reduce post harvests loses in milk. The market linkage developed through Brookside will likely continue driving milk production. The value addition in moringa, especially in powder, will continue to drive moringa production and value addition as long as there are market linkages to sell off the products.

4.5.4. Pasture and fodder development

The increase in the proportion of households and acreage of pasture and fodder is likely to support dairy development. Since poor rainfall is among the main challenges that impede livestock production, production of pastures and fodder is likely to increasingly be adopted by more farmers so as to reduce the effects of lack of pasture during dry season. Already on increase, such steps are likely to support livestock production, reduce livestock migration post the project closure.

5.0 LESSONS LEARNT

We draw lessons from the foregoing. The lessons are drawn for both moringa and dairy value chains.

On the moringa production, the implementation of ADED elicits the lessons that;

- Potential exists for increased moringa production given that more households have adopted and practice moringa production.
- There is an increased awareness and adoption of moringa production as well as dairy production driven by the ADED interventions that mobilized farmers into cooperative and provided input support through distribution of seedlings and training of farmers on production and value addition. This support, particularly the market linkages have also led to an increase in the proportion of households selling moringa leaves and seeds.
- Lack of or inadequate knowledge of husbandry practices is a setback to moringa production and value addition.

In the dairy value chain,

- Increased training on livestock husbandry practices is likely to have a positive impact on milk productivity (production per cow per day). This means that continued training on livestock husbandry practices will increase milk productivity per cow. In particular, increased trainings on dairy cow breed identification, routine practices, silage making, health management and disease prevention, milk hygiene, milk preservation and treatment, record keeping, business planning, environmental conservation, utilization of farm yard manure and use of biogas are positively and significantly correlated with milk productivity.
- Expansion in area under pasture, a proxy indicator of increased pasture and fodder production has is likely to result into increased number of dairy cattle, dairy calves and heifers. This implies that continued expansion of the pasture and fodder could spur increased milk production as dairy livestock population expands. In particular, those farmers who want to expand their dairy herds should focus on expanding the acreage under napier grass, Maasai love grass and kikuyu grass.
- Pests and diseases and poor rainfall are the most important impediments to dairy production in the area.
- That organization of milk collection into aggregation centres and linkage to markets has a direct result of increasing the volumes of milk collected and sold and hence, the revenue generated.

On sustainability of the value chains;

- Both value chains are depended on the skills and knowledge build within the community members. Capacity building of farmers on livestock and crop husbandry practices has a huge impact in enabling continuity of the value chains as these skills and knowledge underlie the production systems.

- Further, the continuity lies in the institutions that are built in the course of the project implementation. That there are cooperatives in both value chains that bring farmers together to benefit from economies of scale, ensures the continuity of ADED associated activities.
- For dairy development, sustainability will, in addition to the skills and knowledge, depend on the pasture and fodder development that has the effect of reducing livestock migration and reduces the effects of dry spells when water and pasture are scarce.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

This ETE was commissioned by ChildFund to evaluate the performance of the ADED project implemented in Makueni and Kajiado counties. The project was implemented over five years June 2017 and May 2021. The aim of the project was to improve agricultural production, diversify livelihoods and develop reliable and beneficial market pathways for 1,250 farming households. The project focused on moringa and dairy value chains with a broad objective of enhancing household livelihoods, food and nutrition security.

The evaluation followed a mixed-methods approach guided by the OECD-DAC criteria, which focused on the relevance, effectiveness, outcomes and sustainability of the ADED project. Data was collected from 279 randomly sampled farmers' representative of the moringa and dairy value chain. Key informants and Focus Group Discussions were also selected and interviewed straddling the value chain stages-production, value addition and marketing including service providers.

- The ADED program, despite its administrative and managerial challenges, made notable achievements in moringa and dairy value chains as well as in diversification of livelihoods and food security. The proportion of households with more than 2 income sources increased over the project period, driven by the interventions made by the project. Before the ADED project started an estimated 32% of households relied on at more than 2 sources of incomes. However, the proportion of households depended on more than 2 sources of household income increased to 45% by the end of the project implementation. Moreover, the proportion of households who reported experiencing months of food deficit declined significantly. Further, the proportion of households who consumed three to four meals a day increased.
- Whereas the annual average income from dairy increased marginally the income from moringa declined significantly. The overall result over the project period was a 1% decline in the average annual household income, partly occasioned by the decline in moringa revenue and other exogenous factors such as Covid-19, which has negatively affected consumption levels of many agricultural produce and products.
- The households trained on crops husbandry practices that would otherwise have led to positive outcomes in moringa, especially yield, were on a declining trend when compared to the baseline. This could have occasioned the decline in yields and

consequently income from moringa. Crops husbandry training has a positive effect in production of moringa leaves and seeds.

- Over 58% were trained on livestock husbandry practices compared to 29% at the baseline. The adoption of dairy practices had increased and the frequency correlated positively with milk productivity. Whereas the training positively influences milk productivity, we find that the most important modules include dairy cow breed identification, routine practices, silage making, health management and disease prevention, milk hygiene, milk preservation and treatment, record keeping, business planning, environmental conservation, utilization of farm yard manure and use of biogas.
- The training on dairy husbandry practices led to increased frequency of practice and consequently, positive effect on milk productivity. Practices such as keeping milk records, use of AI to serve cows, use of aluminum cans to store and transport milk were found to significantly to lead to increased milk productivity.
- The ADED project led to a shift in the agriculture enterprises with a significant expansion of the crops enterprise. To the effect, the proportion of households aware and involved in moringa increased significantly. The increase in the proportion of households engaged in moringa farming also translated to an increase in proportion of households participating in the market. Specifically, there was significant increase in the participation of households in seeds and flowers.
- The potential of moringa was estimated to 3,634 Kgs for seeds, 2,589Kgs for flowers and 6,284Kgs for leaves. Medicinal use is the most important use of moringa in the project area. Other uses include as a vegetable and used in beverages. Similarly, there is high potential for milk production. Estimates show that there is possibility of increasing productivity of milk per cow per day is the necessary training and breeds are adopted. Milk production per day is estimated to go above 5,000 litres assuming the good husbandry practices and breeds.
- Whereas lack of appropriate information on moringa production and marketing is the most important challenge, in dairy production, the single most important challenge in dairy production are pests and diseases.
- A check on the child Well-being indicators indicate that all the children in the project area attended school. Evidence shows that the attendance was spearheaded by the income from moringa for which 67% goes to settle school fees bills.

6.2 Recommendations

The evaluation draws recommendation that are useful in the subsequent phases of ADED program. Owing to that the potential for moringa and milk production is still far from being achieved, recommendations are drawn to inform subsequent programing phase of ADED or any new project that would continue the activities of ADED.

- *Focus on training on moringa husbandry practices*: Moringa production is still low despite high potential for production and existing market especially for seeds. However, moringa production faces challenges related to inadequate knowledge of

production. This implies that the subsequent phase, if any, should still focus on training on husbandry practices for moringa.

- *Support to moringa value addition into soap:* Whereas there still exists little value addition, it is emerging that moringa is an additive into the soap industry. The emergency of Geisha Moringa soap product is a sure bet that training on how moringa can be used in the soap industry will be an economic venture in the local community if well linked to the market. This will include support towards acquisition of medium scale value adding equipment to do value addition on seeds especially oil extraction.
- *Promote consumption of moringa in the local community.* Moringa has been used as medicinal and in small proportions as vegetables and beverage. These proportions are not adequate to create any meaningful influence on production. There is need to promote consumption of moringa through nutritionally demonstrated approaches such as nutritional additives into children foods among others. There is evidence that moringa leaves are used to flavor different types of foods. This is yet to be exploited in the area to promote increased consumption and thus backward, drive the production and household incomes.
- *Focus on livestock husbandry practices on diseases and pests:* Livestock or dairy production is still bedeviled by diseases and pests, there is need to still continue supporting trainings and husbandry practices that reduce the impacts of diseases and pests especially use of the appropriate chemical sprays, spraying techniques and timeliness.
- *Fodder and pasture production techniques:* Poor rainfall patters will still persist making pastures and fodder scarce as well as water. This implies that there is still need for concerted efforts in pasture and fodder development and development of water sources.
- *Diversification and strengthening the milk outlets:* there still exists only one market outlet-Brookside dairies who seemingly are the sole collectors of milk aggregated across all the milk collection centres. This is risky because if Brookside pulls out of operation, then farmers will slide back to the era of milk wastage. In the subsequent phase, there is increasing need to diversify milk outlets in order to reduce the risk in case one outlet collapses.
- *Value addition in dairy products.* There is no venture in the value addition of milk in all the MCCs yet, in Mashimba aggregation centre, there exists facilities that can value add milk into yoghurt. This value addition of milk with better market linkage has a high potential for better returns on milk.
- *Encourage localized private investment in the value addition.* Local private sector investment in the value addition is lacking and the local dairy producers rely on external investors. There is need to encourage the locals, especially the youth, to venture into value addition of milk.

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8.0 ANNEXES

8.1 ANNEX 1: Indicator Fact Sheet

Outcomes and outputs	Indicators for measuring performance	Baseline data	Planned targets	Actual measurement (against targets using indicators)	*Endline Survey*	Methodology/Data Sources
Long term Outcomes (post implementation)						
Enhanced food security and livelihoods from agriculture	Agriculture sector – added value of GDP	5.6%[12]	7.2% by 2017	3.6%[13]	3.6%[14]	The decelerated growth was occasioned by insufficient rainfall that led to constrained agricultural production in 2019. Lower supply of key food crops in 2019 was manifest in moderate increases in their prices compared to 2018.
Medium Term Outcomes (after 4 years)						
1.Maximised livestock and crop returns	a. Volume of moringa crop yield per hectare	46 kgs	50kgs	**43.1 kgs**	69.6Kgs	End line survey findings
	b. Milk productivity per cow	4.5 litres	6 litres by Year 4Q3.	**5.4 litres**	5.4 litres	End line survey findings
2. Increased household income	Increase in household monthly income from the sale of crops; livestock; milk or moringa products	From sale of moringa: KES 2,055	KES 2671.50 30%	KES 2,410.99	KShs 2,570	end line survey findings
		From the sale of milk: KES 6,087	KES 7913.10 30%	**KES 12,960**	25,930	end line survey findings
		From the sale of moringa products: 0	KES 500 (powder)	**0**	0	Endoline Survey findings

[12] Kenya National Economic Survey 2016

[13] Kenya National Economic Survey 2020

[14] Kenya National Economic Survey 2020

Outcomes and outputs	Indicators for measuring performance	Baseline data	Planned targets	Actual measurement (against targets using indicators)	*Endline Survey*	Methodology/Data Sources
		From the sale of milk products: 0	KES750	**KES 15,937**	95,805	Endoline Survey findings
Short Term Outcomes (1-4 years)						
1. Households practice climate-sensitive crop diversification	Proportion of farmers trained that report increased knowledge of crop diversification and apply that knowledge	0	Increased knowledge: 75% in Year Two	**99.46%r7**	66.3%	Endline Survey findings
		0	Application of knowledge: 60% in Year Three, 75% in Year Four	**99.46%**	99.46%	Endline Survey findings
2.Improved practice in livestock productivity and diversified livelihoods	a. Proportion of people trained that report increased knowledge of improved livestock productivity and apply that knowledge	0	Increased knowledge: 75% in Year Two	**58%**	58.4%	Endline Survey findings
		0	Application of knowledge: 60% in Year Three, 75% in Year Four	**58%**	58.4%	Endline Survey findings
	b. Proportion of people trained that report increased knowledge of diversified livelihoods and apply that knowledge	0	Increased knowledge: 75% in Year Two	**87%**	48%	Endline Survey findings
		0	Application of knowledge: 60% in Year Three, 75% in Year Four	**87%**	48%	Endline Survey findings
3.Value added to agricultural products through processing	a. Proportion of people trained that report increased knowledge of agri-business and apply that knowledge	0	Increased knowledge: 75% in Year Two	**21%**	21%	Endline Survey findings
		0	Application of knowledge: 60% in Year Three, 75% in Year Four	**21%**	21%	Endline Survey findings
	b. Volume of moringa processed	0	To be determined in Year Two, during Moringa Workshop set-up	**43.1%**	21.9%	Endline Survey findings

Outcomes and outputs	Indicators for measuring performance	Baseline data	Planned targets	Actual measurement (against targets using indicators)	*Endline Survey*	Methodology/Data Sources
	c. Proportion of milk samples meeting agreed quality standards	0	>95%	**98%**	98%	Endline Survey findings
	d. Volume of milk sold daily	0	2,000 litres by Year Four	**1,342 litres**	1, 342 litres	Endline Survey findings
	e. Additional value of agricultural production	0	To be determined in Year 2 once the moringa workshop has been established.	0	0	Endline Survey findings
Outputs						
1. Farmers trained and resourced to introduce moringa crops	a. Business Plan identifying potential moringa markets completed	0	Completed by the end of Year One	Complete.	completed	Project reports
	b. Communal moringa farm established with access to communal water point	0	Established by the end of Year One	Complete.	completed	Project reports
	c. Number of crop farmers trained in growing moringa and intercropping	0	100 (75 women, 20 men 5 youth) by the end of Year One	126 (94 women; 28 men; 4 youth) farmers	67% (187; -103F and 84M))	Project reports
	d. Proportion of crop farmers trained that report satisfaction with the quality and relevance of training	0	75% by the end of Year One	**93%**	93%	Quality satisfaction survey
2.Households supported with adaptation techniques and inputs for improved livestock and diversified livelihoods	a. Environmental impact assessment of proposed farming activities completed	0	Completed by the end of Year One	Completed	**completed**	**Project progress reports/Document review**
	b. Number of dairy farmers trained in stock management	0	603 (452 women – 75%) by the end of Year One (NB: original RMT specifies 238)	1773 (1165 F -66%)	1773 (1165 F -66%)	**Project reports**
	c. Proportion of dairy farmers trained that report satisfaction with the quality and relevance of training	0	75% by the end of Year One	90%	**90%**	**Quality satisfaction survey**

Outcomes and outputs	Indicators for measuring performance	Baseline data	Planned targets	Actual measurement (against targets using indicators)	*Endline Survey*	Methodology/Data Sources
	d. Five-acre demonstration plot with irrigation established	0	Established by the end of Year One	Established	**Completed**	**Project progress reports/Document review**
	e. Number of farmers trained in pasture management	0	25 (75% women) by the end of Year Two	**44 farmers trained (54% women)**	**44 farmers trained (54% women)**	**Project progress reports/Document review**
	f. Proportion of farmers trained that report satisfaction with the quality and relevance of training	0	75% by the end of Year Two	82%	82%	Quality satisfaction survey report
	g. Number of Animal Health Assistants trained in cattle health, disease management and animal husbandry	0	6 Animal Health Assistants	5 Animal Health Assistants trained.	5 Animal Health Assistants trained.	**Project progress reports/Document review**
	h. Proportion of Animal Health Assistants trained that report satisfaction with the quality and relevance of training	0	75% by the end of Year Three	67%	67%	Quality satisfaction survey
	i. Number of Vet Clubs established in primary and secondary schools	0	3 primary and 2 secondary schools by the end of Year One	Vet clubs established at 3 primary & 2 secondary schools	**5 vet clubs established, 2 active (all primary)**	**Project progress reports/Document review**
	j. Number of Vet Club members trained in livestock health and productivity	0	50 children (50% girls) by the end of Year Two 5 patrons (40% women) by the end of Year Two	50 children (25 girls) & 6 (2 women/ 4 men) patrons received training 33% women 50% girls	50 children (25 girls) & 6 (2 women/ 4 men) patrons received training 33% women 50% girls	**Project progress reports/Document review**
	k. Proportion of vet club members trained that report satisfaction with the quality and relevance of training	n/a	75% by the end of Year Two	100%	100%	Quality satisfaction survey
	l. Number of goat and poultry farmers trained in small livestock management and business plan development	0	50 (90% women) by the end of Year One	66 farmers trained (48 female - 73% women)	66 farmers trained (48 female - 73% women)	**Project progress reports/Document review**
	m. Proportion of goat and poultry farmers trained that report satisfaction with the quality and relevance of training	n/a	75% by the end of Year One	96% goat farmer & 89% poultry farmers	96% goat farmer & 89% poultry farmers	Quality satisfaction survey

Outcomes and outputs	Indicators for measuring performance	Baseline data	Planned targets	Actual measurement (against targets using indicators)	*Endline Survey*	Methodology/Data Sources
	n. Number of women in established VS&L groups develop farm business plans	0	50 (75% women) by the end of Year Two	65 farmers have (74% women)	65 farmers have (74% women)	**Project progress reports/Document review**
	o. Proportion of people trained to develop farm plans that report satisfaction with the quality and relevance of training	n/a	75% by the end of Year Two.	81%	81%	Quality satisfaction survey
	p. Number of goats and chickens distributed	0	50 alpine goats, 50 gala goats, 656 chickens by the end of Year Two	100 goats, 656 chickens	100 goats, 656 chickens	**Project progress reports/Document review**
	q. Number of livestock farmers that received a heifer	0	8 Heifers distributed by the end of Year One	10 in-calf heifers were procured and distributed in Year Three	10 in-calf heifers were procured and distributed in Year Three	**Project progress reports/Document review**
	r. Number of livestock farmers that received artificial insemination services	0	603 farmers (35% women) by the end of Year Three	696 farmers (55%) trained on artificial insemination services	696 farmers (55%) trained on artificial insemination services	**Project progress reports/Document review**
3.Household members trained and resourced to generate income through innovative agri-business	a. Five milk collection centres (MCCs) established and equipped to receive and hold raw milk daily	0	Established by the end of Year Three	4 milk collection centres (MCCs) established and equipped to receive and hold raw milk daily	4 milk collection centres (MCCs) established and equipped to receive and hold raw milk daily	**Project progress reports/Document review**
	b. Number of cooperative members trained in milk production, storage and transport	0	603 (75% women) by the end of Year Two	378 farmers trained (48% women)	378 farmers trained (48% women)	**Project progress reports/Document review**
	c. Proportion of cooperative members trained who report satisfaction with the quality and relevance of training	n/a	75% (50% female, 50% male) by the end of Year Two	100%	100%	Quality satisfaction survey
	d. Number of moringa cooperative members trained in moringa processing	0	100 (75% women) by the end of Year Two.	65 cooperative members trained (70% women)	65 cooperative members trained (70% women)	**Project progress reports/Document review**

Outcomes and outputs	Indicators for measuring performance	Baseline data	Planned targets	Actual measurement (against targets using indicators)	*Endline Survey*	Methodology/Data Sources
	e. Proportion of moringa cooperative members trained who report satisfaction with the quality and relevance of training	n/a	75% (50% female, 50% male) by the end of Year Two	89% report satisfaction with training	89% report satisfaction with training	Quality satisfaction survey
	f. Moringa processing workshop established and equipped with oil pressing and drying equipment	0	Established by the end of Year Two.	Not established	Not established	**Project progress reports/Document review**

9.2 ANNEX 2: Data collection tools


Beneficiary Questionnaire


KII Development Partners


KII Administration and other Opinion l


FGD Crops


FGD Livestock


KII EDCA and ChildFund Project St