

Supporters Services and Private Sector To Scale Up Climate-Smart Dairy in Ziway-Hawassa Milk Shed, Ethiopia

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Ziway-Hawassa Milk Shed, Ethiopia**

**This research has been carried out as part of the project “Climate Smart Dairy in
Ethiopia and Kenya” of the professorships “Dairy value chain” and “Sustainable
Agribusiness in Metropolitan Areas.**

**A Research Project submitted to Van Hall Larenstein University of Applied Sciences in partial
fulfilment of the requirements for the degree of master in Agricultural production chain Management,
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September 2018**

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DEDICATION

This work is dedicated to the Almighty God and St. Mary who were always there for me, and I couldn't achieve anything without him.

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ABSTRACT

The study was carried out in Ziway- Hawassa milk shed, Ethiopia entitled “Supporter services and private sector to scale up climate-smart dairy in Ziway-Hawassa milk shed, Ethiopia. The objective was to design business models for two leading supporters to scale up climate-smart practices in the milk shed. Five districts namely Dugda, Adami Tulu, Arsinegele, Shashemene and Kofele were selected purposively. The research is qualitative research and data were collected through desk study, case study and focus group discussion. A total of 24 respondents were selected 12 from the government organisation, ten from the private sector and two from NGO. During data collection interview with checklist were used. Focus group discussion was used to collect data about the challenges and opportunities. Data were analysed using ground theory method, chain map used to overview the dairy value chain in the milk shed, power and interest grid used to show the power and interest of the supporters, PESTEC AND SWOT used to analyse the challenges and opportunities.

The result showed that the government organisations were providing like training, Artificial insemination, improved forage production and financial support through microfinance. The private sectors were supplying drugs and balanced ration in three level basic excellent and super. The policy environment in the country like constitution, investment policy, livestock master plan and Ethiopian meat and dairy industry development institute was played the role for the improvement of the dairy sector. The innovative learning platforms were farmers training centre, farmer research group and one to five development teams. Business Model Canvass was recommended for the Adami Tulu Agricultural Research Center, and livestock and fishery office to scale up climate-smart dairy in the milk shed.

Keywords: Business Model Canvas, private sector, policy and innovation plat forms

CHAPTER ONE INTRODUCTION

1.1. Background

Ethiopia is leading in livestock numbers in Africa. Smallholder farmers keep the majority of the cattle, and 95% of them have less than five head of cattle. Moreover, 5% of the farms have 10 or more head of cattle. Indigenous breed produces 97% of the milk, and the exotic and cross breed cattle produce the remaining 3% (FAO, 2017a and Yilma et al., 2011). Besides milk production smallholders keep animals for traction, manure and meat.

At present time climate change is one of the most pressing environmental issues facing all countries (Das, 2015). The change is recognised as severe environmental issues, which threaten human society, and to the socio-ecological systems that are so valued by humans. The farmers and livestock keepers are the most severely challenged by long-term climate change around the globe (Shaw et al., 2016).

The country is among the top 10 highly vulnerable to the dangerous effect of climate change (Tesfagebriel, 2017). Climate change in Ethiopia poses particular risks to poor farmers who have an immediate daily dependence on climate-sensitive livelihoods and natural resources (Gashaw et al., 2014) which makes the prospect of economic development harder by reducing agricultural production and output in the sectors (Mideksa, 2010).

The milk shed is the third in market potential among the eight-milk sheds in the country. It has untapped opportunities to supply milk and milk products to towns and cities. The small private and cooperative processing facilities so far can collect, process, and market limited volumes of milk. This milk shed has the potential to be enlarged with bordering areas nearby (Wolayta and Dodola) (Brandsma et al., 2013).

The government strategy in agriculture emphasises a significant effort to support the intensification of marketable farm products by both small and large scale farmers. Investments include the construction of farm-to-market roads and area irrigation through multipurpose dams. Other related services include measures to improve land tenure security, reforms to improve the availability of fertiliser and improved seeds, and specialised extension services for differentiated agricultural zones and types of commercial agriculture (Ahmed et al., 2009).

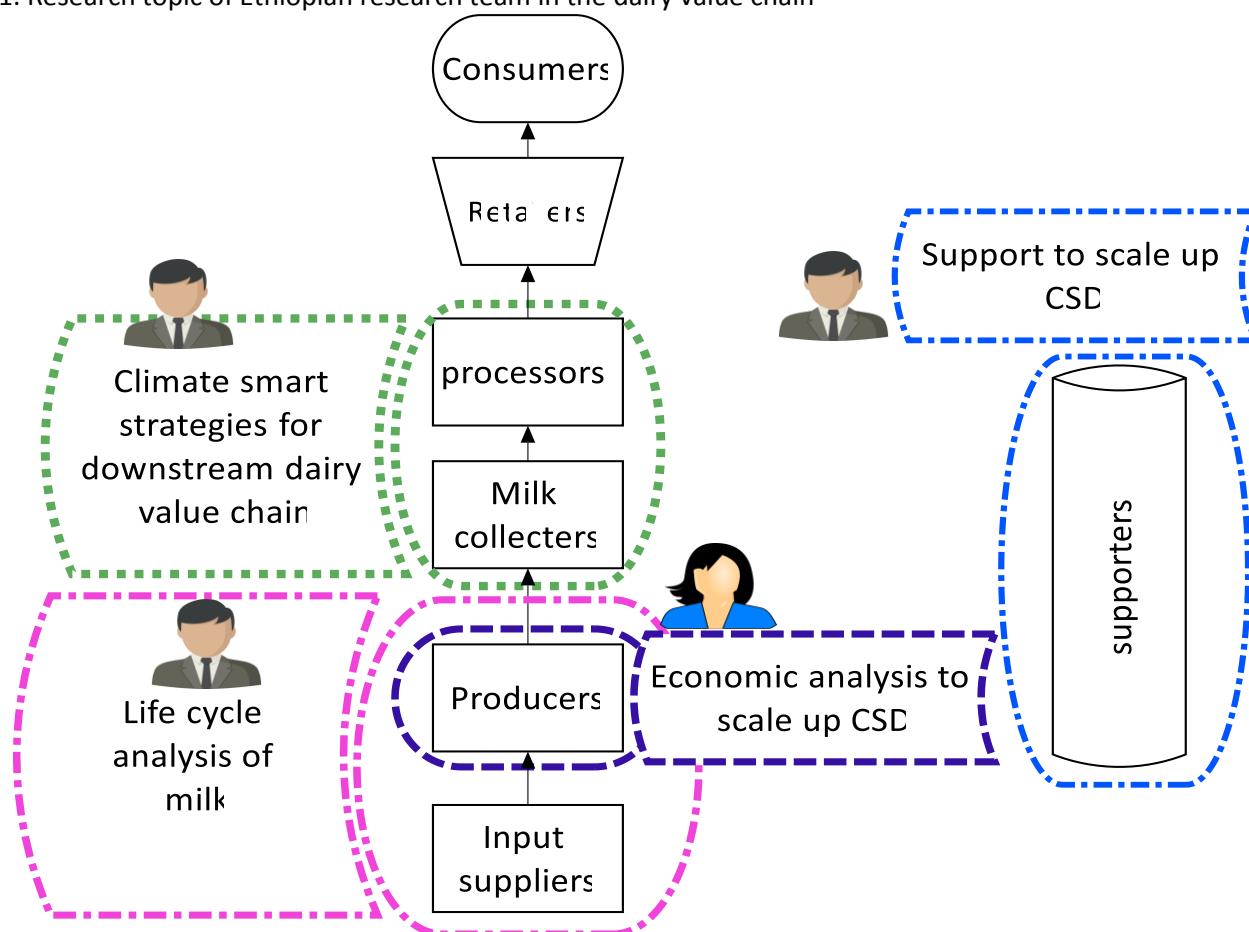
The role of educational and research centre in climate-smart agriculture includes research and development, capacity building related to both technical skills and knowledge diffusion. And sometimes provide training material for various stakeholders (Todd, 2017). The private sector, NGO and agricultural office, are the other supporting institutions in the dairy sector.

Finance in the dairy sector is playing a vital role in the dairy sector development (Yilma et al., 2011). However, the financing is suitable for high-level chain actors, like processors, whereas it is difficult to access finance for farmers, individual collectors, cooperatives and unions (Haile, 2010).

1.2. Project Description

Van Hall Larenstein University of Applied Sciences got research call from CCAFS (Research Program on Climate Change Agriculture and Food Security) in scaling up climate-smart agriculture. The research aims to describe business models of chain actors and supporters to identify opportunities for scaling up good climate-smart dairy practices in Ethiopia and Kenya. It is linked to NAMA (Nationally Appropriate Mitigation Actions) of Kenya to reduce GHG emissions from dairy production. In this research project master students (agricultural production chain management students of VHL University of Applied Sciences) were involved. Students were grouped into two research teams (Ethiopian and Kenyan) to research these two countries. Four master students participated in the Ethiopian group focusing on climate-smart dairy in Ziway -Hawassa milk shed. The students divided the portions of milk value chain; i.e. life cycle analysis of milk on producer and input supplier level of the milk chain, economic analysis of milk on producer level, the economic analysis and quantification of GHGs on the upper stream (collection processing) and support to upscale smart climate dairy. The main aim of these four research topics is to design climate-smart business models for the chain actors and supporters. These four topics finally combine to give the overall picture of the milk value chain. I focused on the supporter services and private sector to scale-up climate-smart dairy (figure 1).

Figure 1. Research topic of Ethiopian research team in the dairy value chain



Source: Ethiopian research team sketch (2018)

1.3. Problem Statement

Anderson et al., 2015 stated that there are ongoing successful climate-smart Agriculture (CSA) practices across Africa. Agriculture in Ethiopia faces challenges as a result of climate change. In Ethiopia, there is a lack of adequate research findings on CSA practices for the various agro-ecological zones, soil types, and farming system (Jirata et al., 2016). Identifying and documenting successful CSA practices has been a challenge and scaling up of good practices is lagging behind (NWO, 2018). There is lack of information available about supporters' roles in climate-smart dairy practices in the milk shed. Hence, Van Hall Larenstein (VHL) University of applied sciences in collaboration with Climate Change, Agriculture and Food Security (CCAFS) took the initiative for this study linking with Adami Tulu Agricultural Research Center and livestock and fishery office in developing a business model for supporters in the dairy value chain to scale up climate-smart practices.

Objective

- To design business models for two leading supporters to scale up climate-smart practices

1.4. Research question

The following main question and sub-questions were developed to achieve the stated objective.

1. What are the service provision of supporters and business models to scale up climate-smart dairy in the milk shed?
 - 1.1. What are the services provided, power and interest of supporters in the dairy chain?
 - 1.2. What are the policy frameworks in climate-smart dairy?
 - 1.3. What are the innovative platforms in the milk shed?
 - 1.4. What are the business models for leading supporters in the milk shed to scale up climate-smart dairy?

CHAPTER TWO LITERATURE REVIEW

2.1. Overview of the Dairy Sector in Ethiopia

Ethiopian cattle population is estimated to be about 59.5 million. From the total population, 98.24% are local breeds of low genetic potential for milk production. The remaining 1.54 and 0.22% are hybrid and exotic breeds, respectively. The annual milk production in Ethiopia is estimated at 3.1 billion litres, and the average milk yield is 1.37 litres/day in six-month lactation period (CSA, 2018).

The dairy sector contributes 40% to the agricultural Gross Domestic Product (GDP) and 12-16% in the national GDP. Despite such a substantial potential, the dairy sector is not developed to the expected level and is dominated by an informal chain and smallholder farmers (Zijlstra et al., 2015). The growth of milk yield is 1.2% per annum, which is behind the human population growth estimated at 3% (FAO, 2017b).

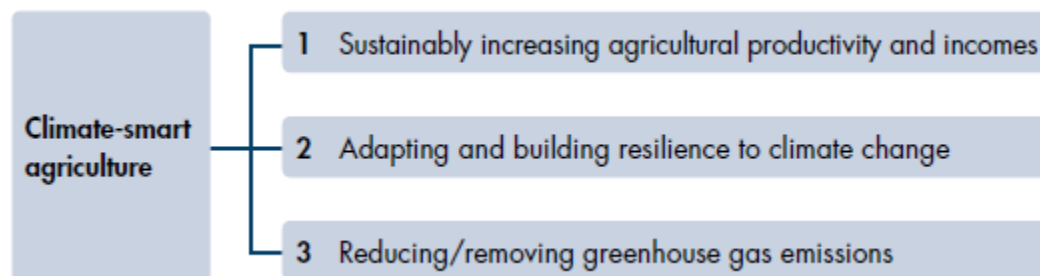
2.2. Climate Smart Agriculture in Ethiopia

Climate Smart Agriculture is an approach to improve the integration of agriculture development and climate change. The initiatives of CSA are sustainably increasing productivity, enhance resilience and reduce the emission of greenhouse gases (FAO, 2010).

The Ethiopian economy depends on the agricultural sector, and it is the backbone of the economy and livelihoods. Heavy reliance on rain-fed systems has made the sector particularly vulnerable to variability in rainfall and temperature. Climate change may decrease national gross domestic product (GDP) by 8–10% by 2050, but adaptation action in agriculture could reduce the losses by half (CIAT, BFS/USAID, 2017).

Ethiopia's economy is dependent on the success of smallholder farming to provide jobs and secure most of the country's food security. Government and development agencies are now emphasising that future agriculture development should be climate-smart, enabling systems that are more resilient and adaptive to climate change (Yirgu et al., 2013).

Figure 2. The three main pillars of CSA



Source: Suleman, 2017

2.3. Policy Environment in Ethiopia

Ethiopian dairy sector has supported by the government for many decades. But only recently, with regulations establishing the Ethiopian Meat and Dairy Industry Development Institute (EMDIDI), has it sought to increase milk supply to processing industries and to upgrade the capacity of milk processing companies in product development and processing. The draft breeding policy is expected to substantially advance the country's genetic improvement activities through selection and cross-breeding (Shapiro et al., 2015).

The policy environment includes a policy regarding quality and standard assurance, enabling an environment for chain actors to work in coordination for common benefits. In Ethiopia, there is no functional platform where dairy value chain actors get together to discuss their major challenges and look for improvement interventions accordingly (Yilma et al., 2011).

Policies and strategies relevant to climate change in Ethiopia include the Climate Resilient Green Economy Strategy (CRGE). CRGE has four pillars; agriculture (improving crop and livestock), forest, power and transport (FDRE, 2011). The CRGE is aimed to develop a green economy in the country by reducing emission from different sources including livestock.

2.4. Supporting Institutions

Chain supporters are the service providers like microfinance institutions, the private sector, NGOs, research centres and agricultural offices.

2.4.1. Non-Governmental Organisations (NGO)

Non-governmental organisations NGOs are typically active in providing social services, especially when supporting poor smallholder farmers (Swanson and Rajalahti, 2010). Organizing farmers into groups to formulate solutions for their problems in collaboratively to bring positive effect at the local level. Sometimes NGOs can also be valuable partners for implementing projects, conducting research and carrying out outreach activities (FAO, 2013). Large NGO's that are active in dairy value chain development are Fintrac (USAID) and SNV.

2.4.2. Financial institutions

Implementing CSA requires a certain amount of capital to manage the transition to the new climate-smart practices. Liaising with credit-giving institutions to provide appropriate loans to smallholder farmers can enable a wider uptake of CSA practices. Reaching out to inform smallholder farmers about the available funding and insurance options is essential (FAO, 2013).

2.4.3. Ministry of Agriculture and Livestock Resources (MoALR)

The main government arm is on agricultural policy formulation and technical supervision including designing strategies, preparation of programs, capacity-building, providing training and coordinating national agricultural development projects. Dairy development in the country is undertaken by the Ministry of Agriculture and livestock Resources (MoALR). The principal function of MoALR is to provide technical backstopping and budgets to regional agricultural development bureaus, and direct farmer support through extension services (Yilma et al., 2011). In the livestock sector, MoALR retains control of

federal responsibilities in animal disease monitoring, vaccination campaigns and artificial insemination (AI) programs (MoARD, 2007).

MoALR is subjected to improve the livelihood and income of producers by improving livestock productivity and profitability. Extension services provision is vital to achieving livelihood of smallholder dairy producers. In addition, improved livestock technologies, building of technical capacity of producers, promotion of collective action (formation of cooperatives and unions), and facilitation of linkages with other national, regional and international organisations engaged in dairy research and development for further innovations are also important (Yilma et al., 2011).

2.4.4. Research Institutions

Dairy development research endeavours have been oriented towards genetics, husbandry, feed-resource management, animal nutrition, physiology, animal health, dairy processing technology, social economics and technology transfer. Research work has been undertaken on-station and whenever necessary followed by on-farm verifications. The Holeta Agricultural Research Centre (HARC) of the Ethiopian Institute of Agricultural Research (EIAR) serves as a centre of excellence for dairy research. The centre coordinates all dairy improvement research activities in the federal system as well as in different regional states including joint venture research activities with agricultural Universities and colleges. Both national and regional research institutions adopt and generate appropriate technologies for dairy development and are also involved in capacity building by organising and providing training. They verify and demonstrate promising technologies on farms with the participation of smallholder farmers (Yilma et al., 2011).

Adami Tulu research centre supports the agricultural development efforts through adapting, generating, multiplying, and disseminating appropriate agricultural technologies. So far, some research outputs including livestock, improved crop and NRM (natural resource management) have been distributed to the farming/pastoral communities.

2.4.5. Agricultural Extension Services

The extension services are conducted through Development Agents (DAs) who work closely with 'development groups' and a 'group leader' to reach farmers. Each development group has 20-30 members. Three DAs specialised in crops, livestock and natural resource management are assigned to each Kebele to provide extension services to development groups. DAs receive three years of training in agricultural technical and vocational education and training (ATVET) from within and outside the region (Farnworth and Gutema, 2010).

2.4.6. Private sector

Linkages between private sector and actors are often weak due to vast geographical distances, vulnerable communication systems and the mutual lack of trust and confidence (Drost et al., 2011).

The private sector constitutes an important part of the dairy sector. It is engaged in providing farm inputs (feed and veterinary drugs), animal health care, milk processing and storage equipment and serves as an essential market outlet for milk and milk products (Yilma et al., 2011).

2.4.7. Higher Learning Institutions

Higher learning institutions are involved in providing long-term training on a regular basis to high-level agricultural professionals and short-term training on request (Yilma et al., 2011). Also, they are engaged in research and training activity in the dairy sector.

2.5. Challenges and opportunities in the milk shed

The livestock productivity in the country is low particularly in smallholder producers. It is mainly attributed to a shortage of cross breed dairy cows, lack of capital by dairy producers, and inadequate animal feed resources, both regarding quality and quantity (Guadu and Abebaw, 2016).

In addition, poor animal husbandry, low milk production and supply to milk processing centres and poor marketing and market information systems (Brandsma 2013, Yilma et al., 2011 Getnet, 2009 and SNV, 2008) are challenges for the sector.

Besides the challenges, dairy has recently been identified by the federal government and regional governments as a priority commodity with promising growth and business opportunities. The availability of a large number of dairy cattle population, income generating to the livelihoods of society under low input production systems are the opportunities (Guadu and Abebaw, 2016). The numbers of Universities are increasing, and availabilities of ATVET colleges which produce a large number of development agents is another positive side of the sector. Private entrepreneurs (both local and foreign) are investing in dairy production and processing. The demand for investment exceeds the supply (Shapiro et al., 2015 and AGP, 2013). Besides, the dairy development activities have been carried out by donor-funded value chain development project (Wouters and van der Lee, 2010).

2.6. Inclusive Business Models

A social business venture is a business that is set up as a for-profit from the outset, though its specific mission is to drive transformational social and environmental change (Elkington & Hartigan, 2008). Within this category, two different business models can be distinguished: the social business model (Yunus et al., 2010) and the inclusive business model (UNDP, 2008; WBCSD, 2012).

Social business model is designed and operated just like a “regular” business enterprise, but the primary aim is to serve society and improve the lot of the poor (Yunus et al., 2010). A regular business model consists of three components; value proposition, value constellation and economic profit (Yunus et al., 2010), and to make a social business model, a fourth component is included, which is the social profit equation.

Inclusive business models include the poor on the demand side as clients and customers, and the supply side comprises employees, producers and business owners at various points in the value chain, and they establish bridges between business and the poor for mutual benefit (UNDP, 2008). They aim to provide affordable products and services to meet the basic needs of the poor for water, food, sanitation, housing and healthcare (WBCSD, 2012). The inclusive business model embeds its origin in the bottom of the pyramid theory (Michellini & Fiorentino, 2012), which is based on the concept of “serving the poor profitably”.

Similarly, Osterwalder and Pigneur (2010) reported triple baseline business models that have a strong ecological and social mission (figure 3). The triple baseline model seeks to minimise negative social and environmental impacts and maximise the positive (Osterwalder & Pigneur, 2010).

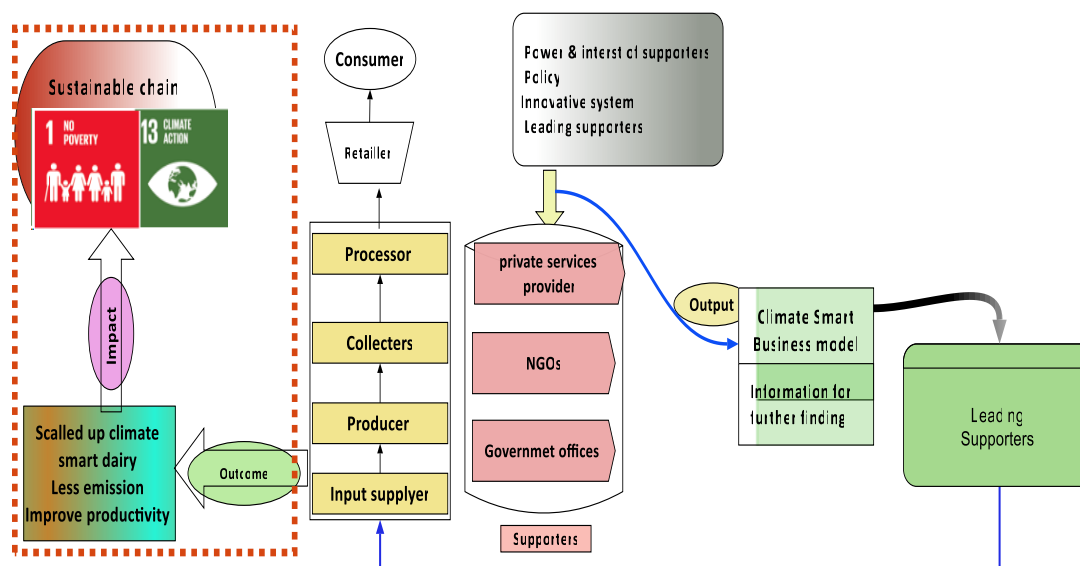
Figure 3. Triple baseline business model canvas

INFRASTRUCTURE MANAGEMENT		PRODUCT	CUSTOMER INTERFACE	
<u>Key Partnerships</u>	<u>Key Activities</u>	<u>Value Proposition</u>	<u>Customer Relationships</u>	<u>Customer Segments</u>
	<u>Key Resources</u>		<u>Channels</u>	
FINANCIAL ASPECTS				
<u>Cost Structure</u>		<u>Revenue Streams</u>		
<u>Social and environmental costs</u>		<u>Social and environmental benefits</u>		

2.7. Conceptual Framework

Based on the literature, the conceptual framework of the research was designed in the following ways (Figure 4). The framework shows the available supporters in the milk shed (private sectors, non-government organisations and governmental organisations). Based on the information from supporting organisation Business Models Canvas were developed which would apply to the chain actors to scale up climate-smart dairy in the milk shed.

Figure 4. Conceptual framework



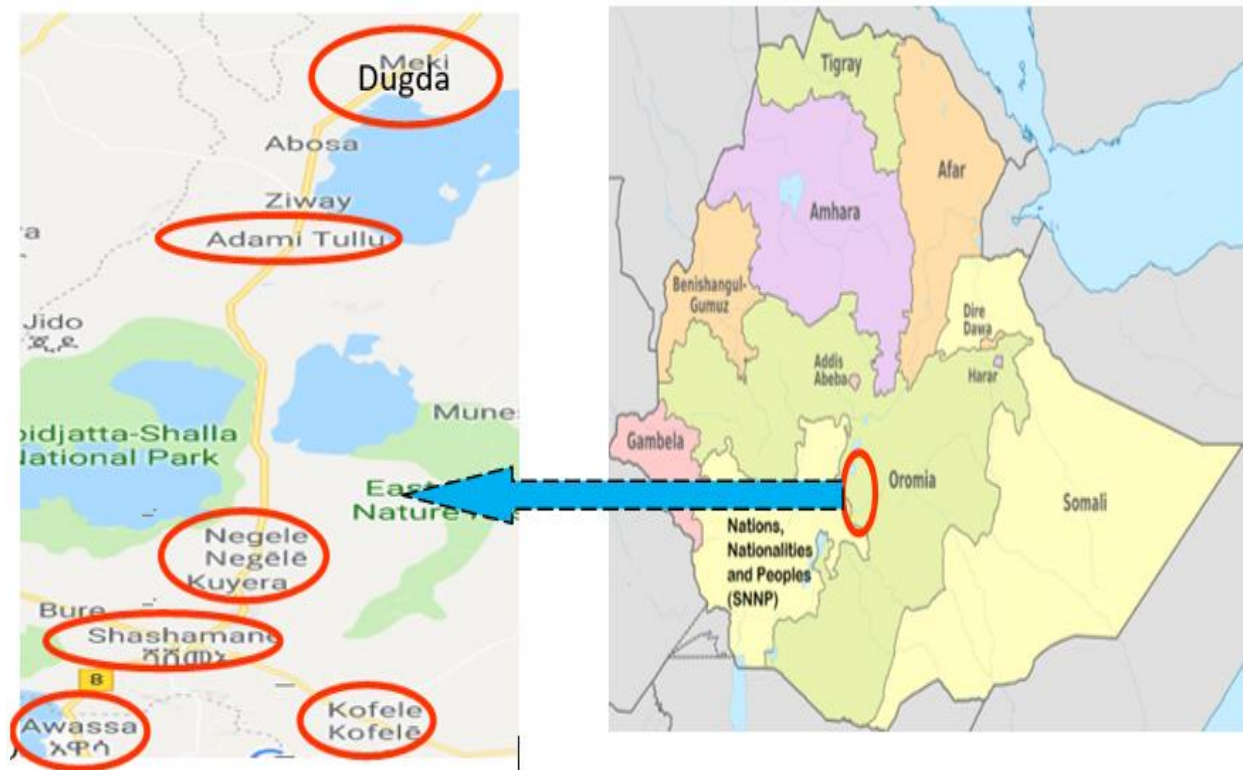
Source: Author sketch (2018)

CHAPTER THREE METHODOLOGY

3.1. Study Area Description

This study was conducted in the Ziway – Hawassa milk shed, located south of Addis Ababa in West Arsi and East Shoa zone of Oromiya and Sidama zone of SNNPR (South Nation Nationalities and People Region) state in the great rift valley of Ethiopia. The milk shed covers 112 km in Addis Ababa–Hawassa highway. Towns found in the milk shed are Ziway, Arsinegele, Shashemene and Hawassa. Major languages spoken in the area are Oromiffa, Sidama and Amharic (the national working language). The annual rainfall ranges from 500-1300 mm, and the temperature is between 12-27oC. Teff, Sorghum, Wheat, Maize, and root crops like Potato and Sweet Potato are the major crops grown in the milk shed. Vegetables like Cabbage and Onion are cultivated (Chalchisa et al., 2014, Negash et al., and Yigrem et al., 2008).

Figure 5. Study area map



Source: Adapted from Oromia administrative region map

(https://commons.wikimedia.org/wiki/File:Map_of_zones_of_Ethiopia.svg)

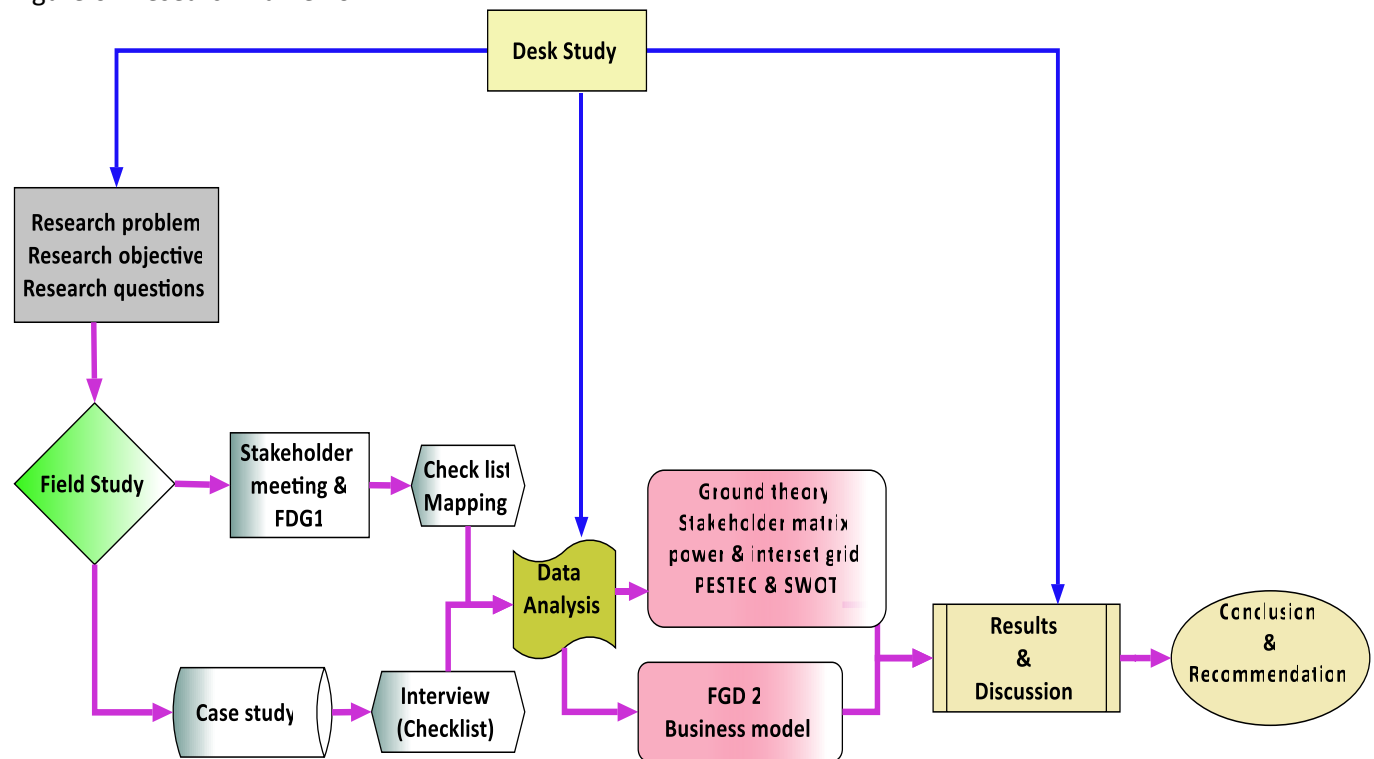
3.2. Research Strategy

The qualitative research design was used to undertake the current study. Types of support service, policy environment and innovative platform were the core point for this study. Desk study, case study and focus group discussion and interview were used.

Research framework

The research framework presented in figure 6 shows the whole activities of the research starting with the proposal development up to the end of the research work. A desk study was the used to start proposal development and end up with recommendations.

Figure 6. Research framework



Source: Author sketch (2018)

3.3. Methods of Data Collection

3.3.1. Desk study

The desk study was used to collect secondary information from different sources; from Google search, Google Scholar, journals and country/regional report on the available supporters, types and ways of services provided and to chain actors milk shed.

3.3.2. Case study

A case study approach was applied to this study since the nature of the study is the qualitative type. The interview was used as a method for the data collection. Checklists (Appendix 1) were prepared for available supporters in each district in the milk shed.

The total number of interviews was 24. During the interviews, language translator was first understood the checklist and translate the interview. In addition, voice recorder and taking note were used during the interview.

The supporters were categorised into three groups; two interviews from NGO, ten interviews from private sectors and twelve interviews from government institutions (financial institutions, Livestock and Fishery Office, Adami Tulu Agricultural Research Center and Hawassa University).

3.3.3. Focus group discussion (FGD)

Focus group discussions (FGD) were conducted at the beginning and end of the fieldwork. There was a stakeholder meeting to introduce the research idea to the stakeholders. The first FGD was used as an entry point for data collection in the fieldwork.

The first FGD was held in two places; Adami Tulu Agricultural Research Center for Dugda and Adami Tulu districts and Shashemene for Arsinegele, Shashemene and Kofele. The total numbers of persons were six in the group discussion. During the first FGD checklist (Appendix 2) were used to discuss the challenges and opportunities for the supporters. Chain mapping was used as a participatory tool; supporters drew a chain map for the service they provide.

The second FGD was also held in Adami Tulu Agricultural Research Center and Shashemene. The finding of the result was presented to the stakeholders. The supporters were discussing on the developed business model and forward comments for the improvement of the business models.

3.4. Research Units

Five districts were selected purposively by the interest of commissioner namely Dugda, Adami Tulu, Arsinegele, Shashemene and Kofele. The supporters in the selected district of milk shed were Alema Koudijs (feed suppliers), private drug suppliers, non-governmental organisation (sustainable Environment Development Action (SEDA). In addition, Oromia credit and saving share company, livestock and fishery officers, Hawassa University and Adami Tulu Agricultural Research Center were part of supporters from government institute. A total of 24 respondents were interviewed about the service type and ways to address the services and policy related to the dairy sector. The majority of the respondents were males; only five females' were interviewed. List of interviewees is indicated in Table 1.

Table 1. List of interviewee

Categories of interviewee	Position of Interviewee	Number of interviewees
Private supporters		
Alema Koudijs	Agents	4
Drug suppliers	Managers	5
Gobe farms	Expert	1
NGO		
SEDA (Sustainable Environment development action)	Expert	2
Government organisation		
Livestock and Fishery office	Dairy expert	5
OCSSCO (Oromia credit and saving share company)	Director	4
Hawassa University	School head of Animal and Range Sciences.	1
ATARC (Adami Tulu Agricultural Research Center)	Extension team leader and dairy expert	2
	Total	24

3.5. Data processing and Analysis

Analytical tools such as chain mapping used to have a visual representation of the whole chain in the milk shed and business model canvass was also used to design climate-smart business models for leading supporters. Data processing were supported by ground theory method (Baarda, 2014); the following steps were taken during the process:

After data collection, all information was recorded in the transcript.

- I. Organising the data in fragments: Text was organised within information units/labels.
- II. Relevance: All the labels, not relevant for the study were removed.
- III. Open coding: Comparisons of text between different labels had refined the information.
- IV. Axial coding: The related labels with specified properties and dimension were grouped into subcategories.
- V. Selective coding: All subcategories will be grouped around the core categories related to the research dimension

In the data analysis there were three clusters; private service providers, NGOs and government institutions (Livestock and fishery office, Oromia Credit and Saving Share Company, Adami Tulu Agricultural Research Centre and Hawassa University). A possible comparison was made between three clusters based on the services they provide to scale up climate-smart dairy.

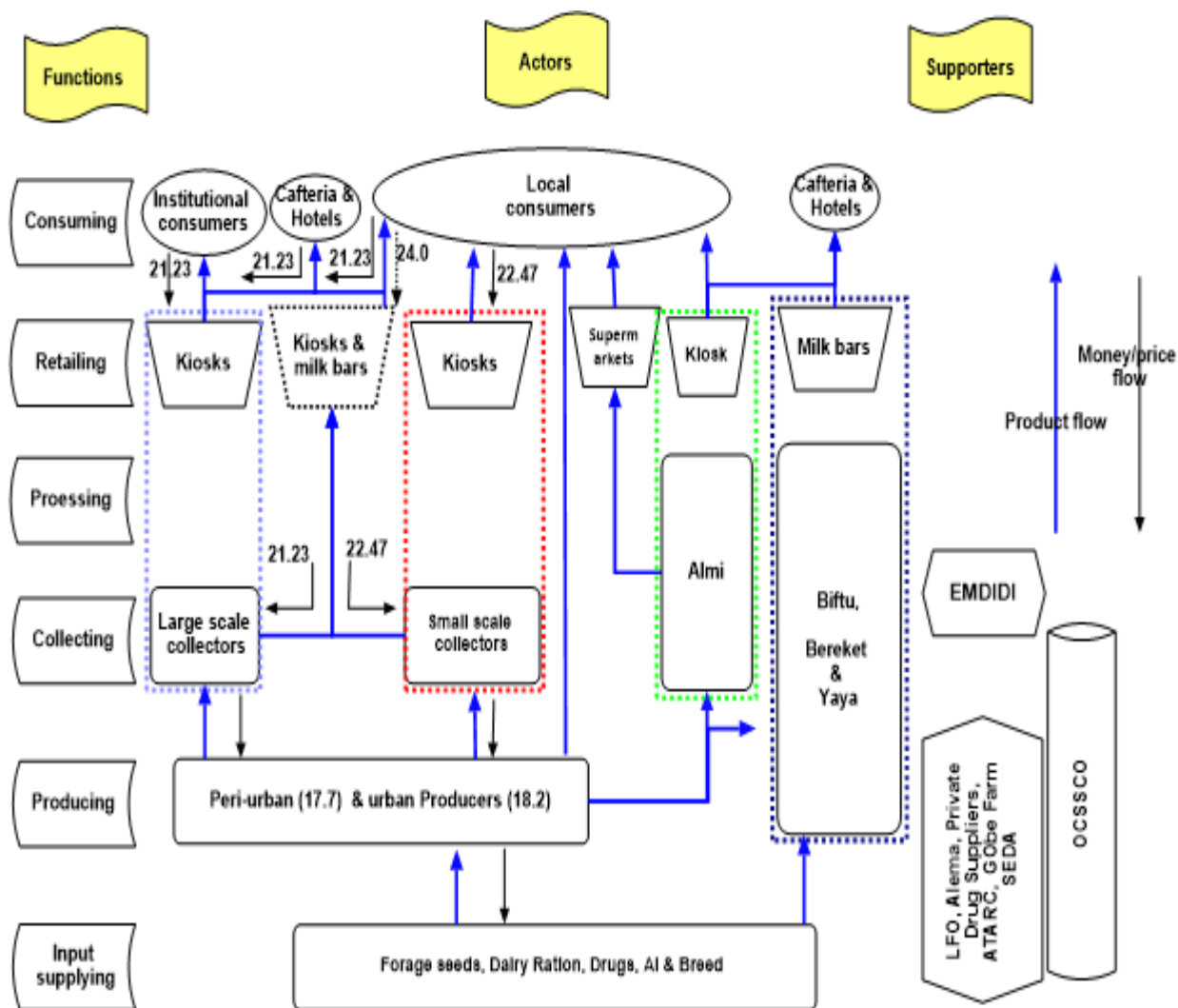
The Supporters matrix was used to identify supporters and their role. The power and interest of the supporters were used to analysed using the power and interest grid based on the service they provided. PESTEC and SWOT were used to analyse available opportunities and the challenges for supporters to scale up climate-smart dairy. After data analysis, the information was used to develop a business model for the two leading supporters (Adami Tulu Agricultural Research Centre and Livestock and Fishery Office).

CHAPTER FOUR RESULTS

4.1. Dairy Value Chain Map

The dairy value chain mapping was done during focus group discussion and by a team of the research after the finding of the result (figure 7). The chain map presents the functions, actors and supporters. The chain map shows direct sales of producers to consumers, collectors to retailer and processor dominated the whole activities except producing function.

Figure 7. Dairy value chain map in Ziway-Hawassa milk shed



All price are in Ethiopian Birr (1Euro= 32.13 ETB on July 2018)

4.2. Supporter matrix

Most of the supporters provided their services to the farmers. Private service providers were profit-oriented while the government institutions and NGO were non-profit oriented. Table 2 shows the roles of government organisation, private sector and NGO in the dairy value chain in the milk shed.

Table 2. Dairy value chain supporters matrix in the milk shed

List of supporters	Roles
Livestock and fishery offices	Provide Extension services Provide training in dairy husbandry Provide AI services Provide Healthcare services Licensing private feed supplier and follow up
Microfinance	Provide loan and saving for producers and business advising
Gobe Farm	Multiplication and distribution of heifer and bull, the collection of milk
Adami Tulu Agricultural Research Centre (ATARC)	Provide research finding Distribute cross breed heifers, bulls and forage Introduce new technology Train farmers and development agents
Hawassa University	Teaching students Conduct research Release finding in the scientific journal Train farmers, collector and processors
Alage ATVET College	Provide training to agricultural students in diploma level Development agent at Kebele level
Drug supplier	Sale of drug and advising
NGO (SEDA) sustainable Environmental Development Action	Distribute forage plants and training
Alema Koudjis feed supplier	Provide Balanced ration (basic, excellent and super)
SNV	Provide training manuals in local languages, distributes Mazigan (for milking and transportation), forage development

4.3. Supporters services in the milk shed

4. 3.1. Breed provision and artificial insemination services

Local breed of animal dominates the milk shed. From the government organisation, Adami Tulu Agricultural Research Centre and Gobe farm (private) distribute crossbreed heifers in the milk shed. Adami Tulu research centre distributes 76 heifers and 20 bulls. The bulls are used in a group of farmers to use for natural mating.

Gobe farm has initially been a state-owned farm. The farm was privatised before ten years and engaged in heifers multiplication and distribution ranch, which located in Kofele districts. The farm distributes

450 pregnant heifers for five Kebele in Kofele district in the past ten years as a form of loans and selling milk to the farm paid farmers. In addition to dairy farming, it was involved in the multiplication and distribution of 50% exotic blood level heifers. Besides heifer distribution, the farm was collecting 150-200 litre milk from the surrounding farmers and transported it to their selling unit in Shashemene and Kofele. The farm also provides corporate social activity like job creation for daily labour and Ambulance service to the society nearby. Currently, the farm is not in good condition there was political instability in the area its dairy house, feed storage and processing unit were fired and animal feed and animals were stolen.

Artificial insemination service was provided with improved breed semen by Adami Tulu research centre and Livestock and fishery office. The price per serving of artificial insemination was six birr, which was affordable to poor farmers. Two artificial insemination technicians were available in each district. But the numbers of Kebele are more than ten and challenging to address the service on time which might affect the efficiency of artificial insemination. A shortage of semen and nitrogen challenges the AI service. Of course, the skill of the inseminator is also the challenge.

One of the methods to scale up the dairy sector in the milk shed is replacing low producing local breed by high producing crossbreed. Artificial insemination and natural mating were used to replace the herd in the district.

4.3.2. Feed supply and improved forage crop distribution

Crop residues and industrial by-products (wheat bran and noug seed cake) were feed resource for smallholder farmers in pre-urban. Whereas in urban local liquor residue, noug seed cake, wheat bran, crop residues and balanced ration. Supplying nutritionally better feed like balanced ration and improved forage crops increases productivity.

Balanced ration: Alema Koudijs agents were supplying balanced ration feeds in three levels: basic, excellent and super. The basic was given to local cows, which produce low milk yields. Excellent and super were for the crossbreed cows and highest producing cow with more than 15 litres per day were subjected to eat super balanced diet. Alema Koudijs had agents in all districts except Dugda. Each agent had 10-20 producers permanently bought balanced ration. The agents provided brochures for their customers on how to feed the milking cow, heifer, calf and dry cow.

Forage crops: Livestock and fishery office, Adami Tulu Agricultural Research Centre and Sustainable Environment Development Action (SEDA) were provide forage crops to smallholder farmers in pre-urban areas. In the urban area, there is land shortage to grow forage crops. Elephant grass, Cowpea and Rhodes grass were distributed to 90 farmers in Dugda and Adami Tulu districts in the past two years (interview with Gemechu Ramatu). Livestock and fishery office was providing improved forage crops to the producers.

Feed treatment: Feed treatment is the one option to increase the digestibility of roughage feeds (crop residues). It reduces the wastage of feeds. Alema Koudijs agents sold effective microorganism (EM) to treat straws.

4.3.3. Research, extension and training

Research: Adami Tulu Agricultural Research Center and Hawassa University were engaged in research in the milk shed. According to the respondent from the research centre, more emphasis was given to crop research than livestock. The research centre was conducted researches on milk microbial quality and chemical composition, plastic churner evaluation compared to a clay pot. The centre also studied Handling, processing and marketing of milk. Forage development is also one of its tasks. One of the research findings was a partial replacement of conventional concentrate feed (noug cake and wheat bran) by 30% of poultry litter for Boran X Jersey F1 crossbreed heifers. There finding shows that no significant differences in body weight gain of heifers up to 30% substitution of poultry litter. The centre is planning to introduce the finding to the society where poultry litter is available. Currently, there are ongoing researches on composite breed development. The finding will be used to develop environmentally feet and high yield dairy breed. Animal health trials experiment on different stages (calves, heifers, bulls and cows) of dairy animals to minimise the risk of death in animals.

Hawassa University has a research site in Adami Tulu district, which focuses on animal feed research. The feed improvement research was one of the ways to make the dairy sector climate smart. Postgraduate and undergraduate students also conducted their research on milk composition, milk handling, transportation, artificial insemination, feed assessment and feeding experiment in and outside the milk shed. Staff was involved in milk value chains study in the milk shed.

Extension: Livestock and fishery office and Adami Tulu Agricultural Research Center (Extension department) transfer technology from the researcher to the farmers. Forage crops, crossbreed heifers and bulls, plastic churner and feed treatment, were done through extension agent.

Training: It can be short and long-term training. Hawassa University and Alage ATVET are providing long-term training. Hawassa University is training students at BSc, MSc and PhD level. The graduates were a source of experts for the government, NGO and private sectors. Alage ATVET train students at diploma level with three years duration. Livestock and fishery office and Adami Tulu Agricultural Research Centre delivered short-term training to create awareness about forage production, dairy husbandry and feed treatment and manure management.

4.3.4. Financial support

Financial services are vital for the development of the dairy sector, especially for smallholder farmers sector. Oromia Credit and Saving Share Company (OCSSCO) is found in all districts except Kofele. The company has the mission to provide financial services to rural and urban people to improve their income. It offered diversified loans, solidarity group-based loan (SGBL), women entrepreneurs development program loan (WEDP), general-purpose loan (GPL), micro and small enterprise loan (MSEL).

The company has been providing a loan to farmers in the solidarity group-based system. The group members were used as collateral for



the other members of the group. There was no special circumstance to provide loans for dairy farmers or those engaged in climate-smart practices. The criteria to provide a loan to farmers hadn't had a bad credit history, letter from the Kebele administration stated he/she is living in that Kebele, land ownership certificates and renewed identification card. In addition, credit clearance was required to ensure the bad credit history of the borrowers from other microfinance institutes in the district. Anyone who fulfils the criteria has the chance to access the loan. The farmers had the opportunities to buy the crossbreed heifers to replace the local breeds. The rural and pre-urban farmers took the loan to purchase fertiliser and oxen since their farming system is mixed farming. The urban farmers used to buy crossbreed dairy cows and for others purpose (house construction).

Micro and Small Enterprise Loan (MSEL) was targeted unemployed youth and cooperatives those engaged in any profitable business. There was a loan service for women, but only for those involved in business, either individually or in groups. Besides the loan service, saving service was also provided to the borrowers. In addition, Bunsu Gonofa, Meklit and Metemamen were other available microfinance institutions in the milk shed and engaged in providing loan and saving services like that of OCSSCO.

4.3.5. Animal health services

Animal health services are provided by under livestock and fishery office in the department of animal health. Animal clinic was found in each district, and private drug seller was found in the districts.

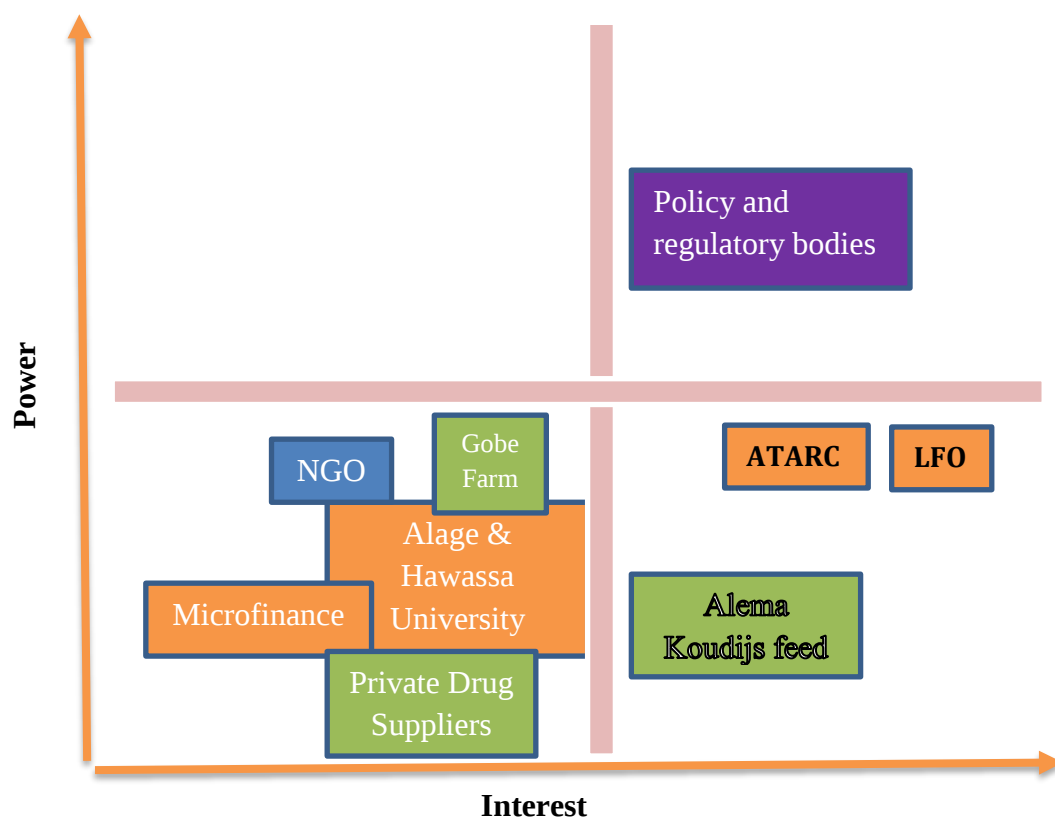
They provide different types of drug to the smallholder farmers, large-scale farmers cooperatives and experts. They advised on the application and the withdrawal period. They offer antibiotics, anthelmintics, vitamins and calcium. One of the suppliers responded that she gave priority to the client with the prescription of hypocalcemia. Suppliers would ask prescription for intra vein and intra muscular drugs. The respondents mentioned that unlicensed drug suppliers had existed. Expired drugs would be sold to the producers. In addition, resistance to the drugs will be developed.



4.4. Power and interest grid of institutions in the dairy sector

Supporters were assigned in the power and interest grid (figure 8) depending on the service they provide and their interest to support the chain. Adami Tulu Agricultural Research Centre (ATARC), Livestock and fishery office (LFO) and policy and regulatory bodies were aligned to support the high interest, and high-power group due to their service provision to the milk shed regarding climate smartness and their goals as an institution.

Figure 8. Power and interest grid of supporters in the chain

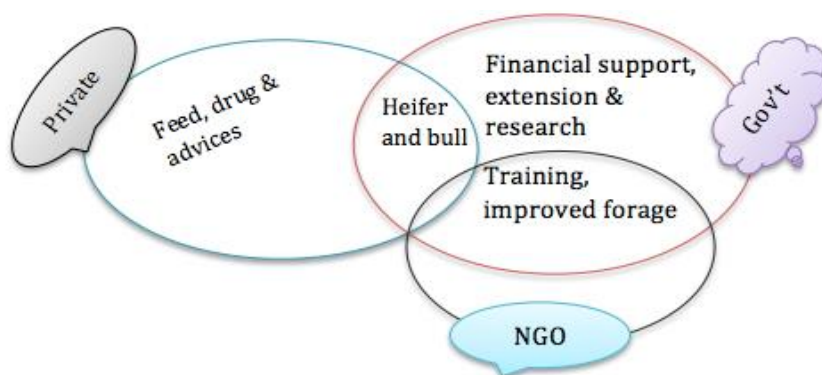


Source: Compiled by author (2018)

4.4. Supporter services provision per clusters

The supporters were classified into three clusters; the private sector, government organisation and NGO. The services they provided were presented in figure 9.

Figure 9. Supporters service per cluster



Source: Author sketch (2018)

4.5. Climate-smart Dairy

Climate-smart dairy is practised to meet future feed requirements by minimising emission. Climate-smart dairy farming can be achieved through the use of improved dairy animals which able to adapt to the environment. The carbon footprint of dairy animals can be minimised by producing high nutritive value forage crops and manure management. Supporting institution roles to climate-smart dairy in the milk shed were:

Improving productivity/yield: Productivity can be increased replacing the existing low producing local breeds with the crossbreed dairy animals or improving feed of animals. 76 heifers with subsided price and 20 bulls distributed supported Adami Tulu Agricultural Research Centre freely in the past four years. The bulls were used to natural mating in the village. Gobe farm is the only heifer multiplication ranch in the milk shed. The farm distributes 450 pregnant heifers for five Kebele in Kofele districts in the form of a loan, and they pay by selling the milk to the farm.

In addition to the provision of crossbreed artificial insemination were used to upgrade the blood level of the local cows to increase productivity. Artificial insemination mainly done by livestock and fishery office and rarely by Adami Tulu Agriculture Research Centre was evolved. Using artificial insemination solves the shortage of crossbred bulls. The farmers pay six birrs for one-time insemination.

In the improvement of local breeds, adaptability to the environment was a critical issue. Adami Tulu Agricultural Research Centre and Gobe farm provide 50 % blood level of Holstein and local breeds, which are adopted by smallholder farmers.

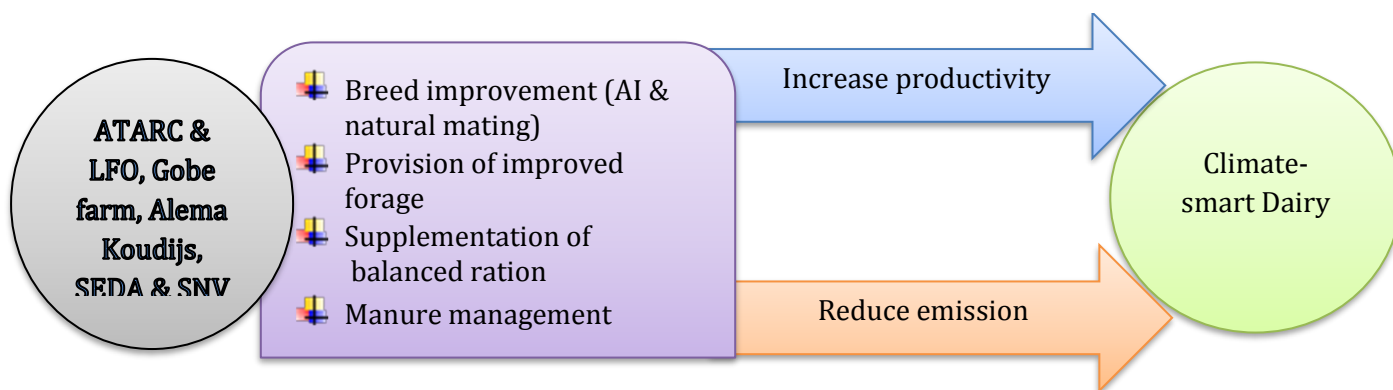
Improved forage production and supplementing balanced ration: The Adami Tulu Agricultural Research Center produces improved forage crops and distribute to farmers. Cowpea was distributed to the farmers. The livestock office also distributed forages crops (Alfalfa, Cowpea, Elephant grass and Desho grass that were adaptable in the area. SEDA was distributed to improved forage crops to 90 farmers in Adamitulu and Dugda Districts.

Besides the improved forage crop distribution to increase the productivity of the animals supplementing with a balanced diet is essential. Alema Koudijs are providing balanced ration to the producers. The agents brought the feed from Bishoftu and distributed. The farmers in urban are mostly used the balanced ration than the pre-urban producers.

Feed treatment is also the other option to increase the digestibility roughages/crop residues, which minimise the enteric fermentation time in the rumen. Effective microorganism and urea treatment used to treat straws.

Manure management: Proper manure management used to reduce emission from the manure. Adami Tulu Agricultural Research Center and livestock and fishery office in Dugda districts and 30 farmers have used produce biogas (interview with Gragn).

Figure 10. Climate-smart services in the milk shed



4.6. Effectiveness of the supporter in the provision of services

The efficiency of supporters in providing services to the producers was organised in Table 3. Some of the data were taken from the Ethiopian dairy research team, and some of them have no information to measure the efficiency of their services.

Table 3. Effectiveness of supporter services provision

Elements	Indicators	Supporters and private sector						SEDA	Microfinance	Remarks
		LFO	ATARC	Alema Koudijs	Gobe Farms	Alage ATVET	Hawassa University			
Breed provision and AI	Herd composition	-89% are cross in urban and 57% in pre-urban *	-89% are cross in urban and 57% in pre-urban *		89% are cross in urban and 57% in pre-urban*					
	Lactation length	Lactation length 8 months in urban & 7 month in rural**	Lactation length 8 months in urban & 7 month in rural**		Lactation length 8 months in urban & 7 month in rural**					
	Number of milking cow	Mean milking cow in urban= 4 and Pre-urban= 8**	Mean milking cow in urban= 4 and Pre-urban= 8**		Mean milking cow in urban= 4 and Pre-urban= 8**					
	Emission	2.07 and 4.71 kg eq CO ₂ /litre in Urban and pre-urban ***	2.07 and 4.71 kg eq CO ₂ /litre in Urban and pre-urban ***		2.07 and 4.71 kg eq CO ₂ /litre in Urban and pre-urban ***					
Supplementing balanced ration	Milk yield			9260/litre/year in urban 5504 litre/year in pre-urban** 51%,& 7% used						

				dairy ration in urban and pre- urban respectiv ely**						
Improved forage production	Percentage of farmers growing forage	3% out of 80 interviewed grow improved forage ***	3% out of 80 interviewed grow improved forage ***					90 farm ers grow ing forag e *		
Research			Composite breed development, feed replacement and in animal health.				Student s (BSc, MSc and PhD) doing research on dairy			
Training						DA graduat ed	BSc, MSc & PhD			
Monitoring and evaluation	Field visit	4 times per year*	4times per year*						2 times per year	
Manure management	Compost	2% & 3% out of 80 interviewed urban & pre- urban prepared								

		compost ***								
	Biogas production	30 producers use biogas in Dugda district*	30 producers use biogas in Dugda district*							
Financial services									5-10 groups of farmers borrowed*	

NB: the sources are from the Ethiopian research team (* Author, **Sara, 2018, ***Biruh, 2018 and ****Godadaw, 2018)

SNV Achievement

SNV EDGET project for the last five years (2013-2017) had been working in Amhara, Oromia and SNNPR (South Nation and Nationalities Peoples Region) within 51 Woredas, to double income for smallholder dairy farmers at the end of 2017 (SNV 2018). The project was provided inputs (forage seed, calf feed, milking and transportation equipment (Mazigan), processing equipment for emerging processor/collector strengthen agro-dealer.

Achievement of EDGET project

Expected output	Indicators	End-of-project targets	Achieved targets
Dairy farmer groups promoting milk production and marketing organized and strengthened	Number of dairy farmer groups promoting milk production and marketing organized and strengthened	2,600 (2600)	>2,600 / 100%
	Number of dairy extension service providers who received ToT Training on different dairy training packages	490 (490)	1,476 / 301%
	Number of dairy farmers who received training and extension support on dairy development	65,000 (65,000)	56,107 / 86%

Source: SNV, 2018. The achievement is for the three regions

4. 7. Robustness, reliable and resilience in the milk shed

Robustness is an efficient and trusted interaction between supply chain partners to reduce transaction cost and risk increase product quality and safety. Trust covers highest proportion than contract agreement, incentive-based system and creating fair value share to maintain relationship between collectors and producers in Kofele, Arsinegele and Dugda districts (Godadaw, 2018).

Reliable governance: reliable governance covers policies frameworks that are supportive of private investment, public-private cooperation, co-innovation and enhances opportunities for (inter) national trade. The investment policy, cooperative proclamation and GTP (Growth and Transformation Plan) II are the supportive policy in the dairy sector. Ethiopia has policies and strategies related to climate change adaptation and mitigation as well as agriculture and food security. What remains to be done is creating awareness about the policies as well as promoting their implementation at all levels, for example through mainstreaming of the policies into agricultural extension and the development of national CSA and conservation agriculture implementation manuals (Jirata et al. 2016).

Resilience of innovation support: Ability to address the challenges and opportunities in the dairy chain hinges on actors and supporters exchanging and applying knowledge mobilizing resources and coordination.

- **Stakeholder collaboration:** the linkages between actors are generally weak this might be due to a lack of shared vision in the development of the dairy industry. This characterised by supply-driven research, unresponsive to the sector needs, extension and advisory support system. The Alage ATVET is unable to meet the demand for skilled personnel. There is need to strengthen networks through platforms to foster dialogue and co-learning to drive innovation in the sector. The ATARC will be key facilitator for the platforms.
- **ICT infrastructure:** development of ICT infrastructure has provided new opportunities for strengthening of innovation support systems. The ICT initiatives are promising and can be accessed in rural area (mobile networks).

4.8. Policy Environment

4.8.1.The Ethiopian constitution

The constitution gives freedom for people to move and work in any part of the country without restriction. This right would provide an advantage for a domestic investor from other parts of the country to come and invest in the milk shed.

4.8.2. Investment policy

The investment policy allowed for a domestic and foreign investor to invest in different sectors of the country. The dairy and animal feed sectors are those invested by foreign and domestic investors. The foreign investor can run the business alone or in a joint venture. Having these encouraging policies helps the sector to develop from the existing to a better situation. Alema Koudijs played the role of providing the balanced ration for dairy animals. A balanced ration is highly digestible converted to production of milk with less methane emission. Hence, Alema Koudijs provide service used to scale up climate-smart dairy in the milk shed.

The investment policy provides a tax exemption for two to nine years; in the dairy sector, the exemption was three to four years. Thanks to an encouraging investment policy, the new milk processing plant is

under establishment in the Adami Tulu district, and feed processing plant (Alito) was established in Hawassa that will provide balanced ration feed in the future. The new processing plant would contribute to the formal chain development in the district. The producers would need to keep high producing cow to supply milk for the processing plant.

4.8.3. Cooperative Proclamation

The cooperative proclamation was approved in 1998. According to the respondent, the approval of the proclamation gave an opportunity for the development of dairy cooperatives (Biftu in Shashemene). The proclamation gave the cooperative power to produce, collect and process milk. Also, it gave the opportunity for the establishment of the microfinance (Metemamen, Meklit and Busa Gonofa).

4.8.4. Agriculture Growth Program II (AGP II)

The respondents' result showed that the AGP II program constructed the animal health clinic in the Kebele level to strengthen animal disease prevention and control, which affect smallholder dairy farmers. In addition, they supported motorcycles for artificial inseminators that employed to disseminate genetic improvement.

4.8.5. Livestock master plan

The livestock master plan in the dairy sector had the vision to become self-sufficient in milk and milk products per capita consumption to reach world average in 2025. The master plan stated that improved dairy cattle would increase from 10.3% to 42.3% in 2025 and the milk yield will increase in cross breed cows from 1.5 to 8 litres. The initiative was good. But, seems unrealistic to bring 32% increment within the next seven years. It may take more years. Breed improvement is the one way to decrease the emission released from a litre of milk.

4.8.6. Higher education and ATVET proclamation

The government of Ethiopia expands its higher institution in the country. The number of Universities in the country is more than 30. Universities are knowledge banks of experts for the private, NGO and government organisation at different office levels. Students graduate in BSc, MSc and PhD levels in different disciplines. While ATVETs provided diploma program, which was key human resources in the extension service at Kebele, level.

4.8.7. Ethiopian Meat and Dairy Industry Development Institute (EMDIDI)

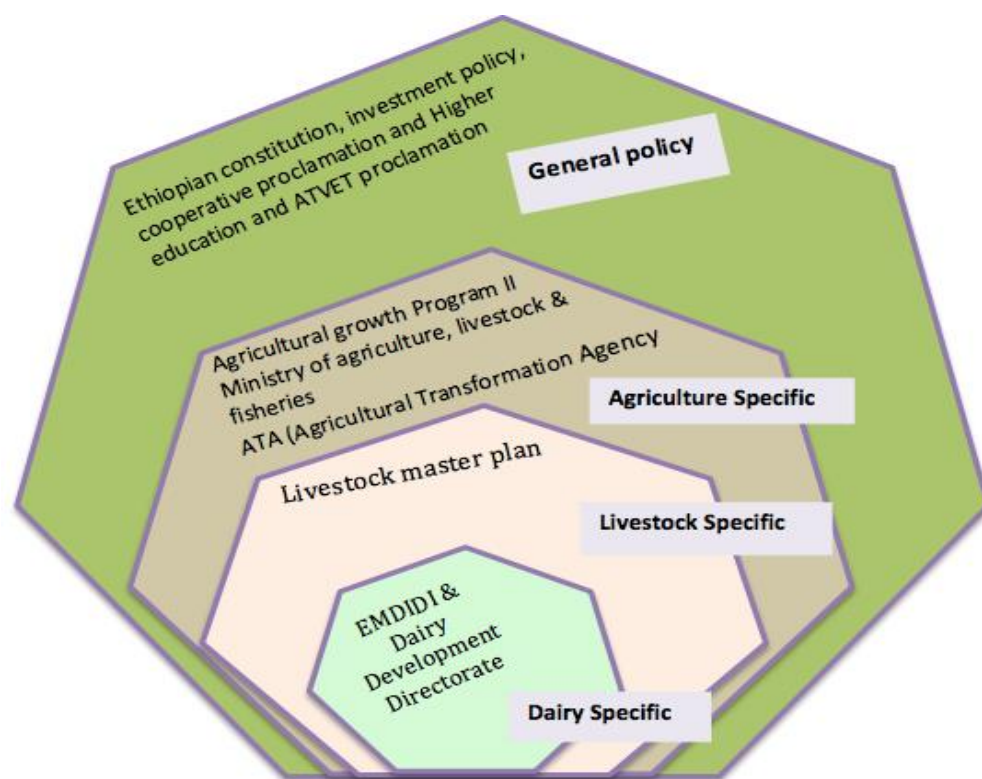
The regulation of Ethiopian meat and Dairy industry in 2013 gave the mandate to ensure that dairy products meet quality standards, to develop a marketing system based on quality. In addition, it had the mandate of capacity building for producers, collectors and processors. The information from the respondent showed that the institution provided training for the collectors and processors.

4.8.8. Ministry of Agriculture, Livestock and fisheries

The MoA (Ministry of Agriculture) previously leads the crop and livestock together, and in the meantime, the MoA split into minister of livestock fisheries and ministry of agriculture. The livestock and fishery ministry develop the livestock master plan to improve the production and productivity.

Currently, the minister merged and called the ministry of agriculture, livestock and fisheries since April 2018. The minister is responsible for implementing the livestock master plan and assigning regional agriculture, livestock and fisheries offices and extension staff at districts and Kebele levels.

Figure 11. Policies and proclamations; the wider hexagon represent policies and proclamations that have less specific target the dairy sector.



Source: Author sketch (2018)

4.8.9. Opinions of dairy supporters on policies

The opinions of chain supporters on policy issues in the dairy sectors were seen in three different ways (Table 4). Some of them had a supporting role, and others had also hindering effects on the dairy farming.

Table 4. Supporters' reflection on policy issues

Supportive policies	Challenging policy	Policies require enforcement	The new area for policy
- Constitution - Investment policy - Assigning of three DAs at Kebele level - Cooperative proclamation	- Withdraw of state from managing heifer multiplication ranches	-Land use policy (does not clearly allocate land for different uses) - Lack of	-Quality-based pricing -Livestock breeding policy not yet a law

- Free market policy - Infrastructure policy - Livestock master plan -Higher education and ATVET proclamation -Ministry of agriculture and livestock resources -Dairy development board		enforcement structure in quality and standard authority.	
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Sources: compiled by author (2018)

4.9. Innovation platforms

Informal chains and local breeds dominate the Ethiopian dairy sector. There was support from Universities, ATVETs, public extension services through livestock and fishery office, ATARC (Adami Tulu Agricultural Research Centre) and private service providers (Alema Koudij and drug) and non-governmental organisation.

Research and capacity building in dairy is national, regional and international organisations responsibilities. ATVETs had the mandate to train students for three years in diploma programs in the various field of study including animal sciences and animal health. Hawassa University offered dairy technology at master level and conducted research in dairy and forage improvement. Additionally, they provided training for producers, collectors and processors.

In University, research and training were not mostly demand driven instead supply driven. In addition, an extension service provided by the University was limited. ATARC (Adami Tulu Agricultural Research Centre) was identifying problems through farmer research group and prioritised to find solutions. For those existed problems depending on severity. Training or research was conducted to address problems (interview with Tesfaye).

Three development agents were assigned in each Kebele to facilitate the extension service provided to farmers. Beside the development agent platform, there were farmer training centre, farmer research group, farmers field day. In addition, there were one to five development teams in each Kebele. The team was led by the model farmers (farmers practising the farming activities in the better way and adopt technology or willing to adopt technology). The livestock and fishery office monitored and evaluated the service provided to the farmers. The office mentioned that low motivation of the farmers to adopt technology was the challenge in the extension activities. The farmer-training centre was used to demonstrate on-farm experiments so that the farmers observed it and put it into practice. In the field day, farmers learn from each other, i.e. some farmers' may be best in feed production or conservation and the other in dairy cow management. The knowledge sharing among farmers was created in the field day programs.

4.10. Interactions patterns of supporters

Private services provider organisation had limited interaction with the research centre and University, for acquiring inputs (genetically improved heifer and bull) and knowledge sharing through training. But the research centre had not the adequate capacity to provide inputs for the private supporters.

The non-governmental organisation has interaction with livestock and fishery office in providing services. Livestock and fishery office identify the producers with the help of development agents in the

interest of the service providers. NGO working with livestock fishery office by providing capacity development training for the staffs and development agents

Livestock fishery office was the responsible body to provide services in the dairy sector. The office was the source of information in the dairy sector in all districts.

4.11. Challenges and opportunities

The dairy sector is lagging behind compared to a neighbouring country. The livestock number is leading in Africa, and the productivity is low. The dairy sector contributes high emission from the other livestock animals. Governmental and non-governmental and private institutions were involved in the sector, but the change in development is still slow. Table 5 indicates the challenges and opportunities identified during the interview and focus group discussion were presented using PESTEC and SWOT.

Table 5. PESTEC-SWOT analysis of dairy value chain supporter in the milk shed

PESTEC	SWOT			
	Strengths	Weakness	Opportunities	Threats
Political	-Existence of Regional government offices and extension staff assigned for the area -Presence of livestock master plan -Availabilities of microfinance	-Draft breeding policy -Limiting land acquisition policies -Bureaucratic procedure in government offices -Unlicensed drug supplier/ retailer - Week quality assurance in a collection	- Investment policy	Political instabilities in the milk shed
Economical	-Availabilities of microfinance -Availability commercial feed supply -Existing new feed supplier (Alito) -Establishment of a new milk processing plant	-Shortage of logistic -The expensiveness of dairy ration -The expensiveness of improved dairy breed -A limited amount of credit for farmers	-High Demand for milk - Nearest to urban -Demand for dairy ration	Difficulties to return the loan
Social	-Population available as force work			
Technological	-Availabilities of ICT infrastructure	-Shortage of semen and Nitrogen for Artificial Insemination -Limited infrastructure to access rural areas -Shortage of AI Skilled/trained personnel -Shortage of improved dairy breed -Willing less to adopt the technology -Inefficient AI services.	Presence of research centre, ATVET and Universities in the milk shed	

		-Shortage of improved forage crops		
Environmental			Suitable climate for dairy production	-Prolonged dry season -Epidemic animal disease

4.12. Business model Canvas

The supporting services provided in the milk shed were identified. Two leading supporters were selected based on climates smart services they provide as compared to others. The leading supporters were livestock and fishery office and Adami Tulu Agricultural Research Centre. Business models canvas are prepared for the two leading supporters (figures 11 and 12). The texts in red colour in the business model canvas are newly added to the existing models to scale up to climate-smart dairy.

Figure 12. Business Model Canvas for Livestock and Fisher office

Key Partners • NGO (SEDA) • Microfinance • Adami Tulu Agricultural Research centre • Hawassa University • Cooperative office • Energy and mining office • EMDIDI • ILRI (International Livestock Research Institutes) • NAIC (National Artificial Insemination centre)	Key Activities • Training and extension • Improved forage development and distribution • Artificial Insemination services • Organise workshop • Oestrous synchronisation Key Resources • Development agents • Microfinance • Farmer training centre • Farmer research group • ICT	Value Proposition • Knowledge support • Input delivery (AI, feed, drug/medication) • Mass Artificial insemination	Customer Relationships • Loyalty • Impartiality in service provision • Commitment • Supervision	Customer Segments • Smallholder farmers • Medium and large-scale farmer • Private feed supplier • Private drug supplier • Dairy Cooperatives • Milk collector • Milk processor • Retailers
			Channels • Personal interaction with the farmers • Farmers day • Farmer training centre • Farmer research group • Monitoring and evaluation • Website /Facebook platform • Mass media like FM Radio	
Cost Structure • Transport, Cost of inputs, maintenance cost and Salary			Revenue Streams • Service fee (AI and Medication)	
Social and environmental cost • Emission through transportation		Social and environmental benefit • The society awarded about the environment		

Figure 13. Business Model Canvas for Adami Tulu Agricultural and Research Center

Key Partners	Key Activities	Value Proposition	Customer Relationships	Customer Segments		
• NGO  SEDA (sustainable environment development agent) • Microfinance • Livestock and Fishery Office • Hawassa University • Bishoftu agricultural research centre • NAIC (National Artificial Insemination Centre) • Cooperative office • Energy and mining office • Market development office • EMDI (Ethiopian meat and dairy technology institute) • NVI (National Veterinary Institute)	• Training and extension • Improved forage adaptation and distribution • Purchase of AI equipment • Provision of AI services • Synthetic breed development • Improved heifer and bull distribution • Conducting research • Release research output • Technology transfer • Oestrous synchronisation	• Knowledge support • Input delivery (AI, improved forage, heifer and bull) • Feed treatment • Technology transfer • Mass Artificial Insemination	• Loyalty • Impartiality in service provision • Fair selling price • Supervision	• Smallholder farmers • Medium and large-scale farmer • Milk collector • Urban dairy farmers • Milk Processor • Dairy Cooperatives • Private feed supplier • Retailer		
	<th>Key Resources</th> <td></td> <td><th>Channels</th><td></td></td>	Key Resources		<th>Channels</th> <td></td>	Channels	
	• Farmer training centre • Farmers research group • Skilled manpower • ICT • Dairy cows • On station and farm research sites • Labour		• Farmers day • Farmer training centre • Farmer research group • On-farm experiments • Monitoring &evaluation stage • Website /Facebook platform • Mass media FM Radio and television			

Cost Structure	Revenue Streams
Transport, Cost of inputs, Salary, labour and maintenance cost	- Sell of forage seed, milk heifer and compost - Consultation fee
Social and environmental cost Emission in transportation and animal feed	Social and environmental benefit Awareness created, enhance nutritional security

CHAPTER FIVE DISCUSSIONS

The chapter focuses on the comparison of the findings from the interview and focuses group discussion with literature.

5.1. Supporter Services in the milk shed

Breed provision and artificial insemination: Government on private organisations were involved in crossbreed provision. Government organisations (Adami Tulu Agriculture Research Centre and livestock and fishery office provided Artificial insemination service to the smallholder farmers. Crossbreeding is one the practice to increase the productivity of dairy cows, which used to scale up climate-smart dairy. De Vries et al., (2016) stated that replacing local cows with crossbreed were effective intervention to reduce global warming per kg of milk. Thornton and Herron, 2010 also found that switching to high producing crossbreeds cattle result in the reduction the amount of methane produced per tonne of milk. Breed improvement one of the climate-smart dairy pillars was done through natural mating and artificial insemination.

Feed supply and improved forage distribution: To make climate-smart dairy, feed processing plants play a vital role. Alema Koudijs was supplying balanced ration for smallholder, cooperatives, medium and large-scale dairy farmers. The balanced ration was supplied in three forms basic, super and excellent depending on the milk yield of the cows. The amount of energy, minerals and vitamins increased from basic to excellent and super. Negash (2017) also stated balanced ration must be adequately consumed to provide the desired level of milk production.

As breed improvement is the tool to go climate-smart practices in dairy there should be appropriate feeding and management should undergo together. Hence improved forage production is the key to address the feed shortage for smallholder farmers to boost milk production. González et al., (2016) also stated that improved forages have a high potential return for dairy producers in East Africa. The government organisation (ATARC and LFO) and non-governmental organisation SEDA and SNV were provided forage crops in the milk shed. The finding is in line with the result (Debele 2012) found non-governmental organisations providing forage and training.

Research, extension and training: Adami Tulu Agricultural Research Centre and Hawassa University have conducted researches in the milk shed. Researches on milk microbial quality and chemical composition, plastic churner evaluation compared to a clay pot were the completed research in the milk shed. Partial replacement of conventional concentrate feed by poultry litter was experimentally tested, and it can be used up to 30% replacement level. There is ongoing research in synthetic breed development. The synthetic breed development will create environmentally adapted and high producing breed. MSc and BSc students were conducted research in milk composition and dairy feed assessment and artificial insemination. De Vries et al., (2016) also stated that Hawassa University was doing research on milk composition and milk handling.

The livestock and fishery office and Adami Tulu Agricultural Research Centre mainly do the extension activities. They have a separate department to run the extension tasks. Through the department of extension plastic churner, improved crossbreed, improved forage and Mazigan (milking and collection). However, there was limited logistic to provide the service to the smallholder farmers. As Drost and Van Wijk, 2011 stated agricultural research centre provide inputs for money years not only in temporarily.

According to Yilma et al., (2011) higher institutions were involved in providing long-term training and Alage ATVET trained development agents who are extension agent in Kebele level. Hawassa University was involved in the long-term training of graduates, research and community service and short-term training on request. Short-term training mostly provided by Livestock and fishery office and Adami Tulu agricultural Center were provided before extension and adoption.

Financial services: Smallholder farmers had access to finance from microfinance institutions. Likewise (Feleke et al., 2010) found that microfinance was the most suitable finance source for smallholder farmers, but the loan is too small to invest at the small-scale level. Having credit access for the farmers gave opportunities to replace their local breed with the crossbreed dairy animals, to construct a house and to buy fertiliser. Similarly, Kenduiwa et al., (2016) found credit received by dairy farmers was utilised for AI service, purchasing of feed and expanding land areas. There was no specifically credit service for smart climate practices.

Animal health services: The government organisation (Livestock and fishery office and Adami Tulu Agriculture Research Centre were providing animal health service. Private drug suppliers were providing on selling of drugs, and some of them gave door-to-door health services. Similarly, Auma et al., (2017) found that private and government were providing the animal health service in Kenya.

5.2. Policies and regulation /proclamations

The constitution of Ethiopia gives full rights to move in the country freely. Besides, it provides the right to start any farming/business as means of livelihood (Debeso 2010) also stated similarly.

The investment policy of the country attracted domestic and foreign investors to invest in government priority areas of development like the dairy sector. There is a tax exemption to import equipment and 15 % for spare parts. Jan (2006) found that capital required by the foreign investor was reduced to 100,000 dollars from 500,000, which encourages investors to invest in the milk shed. Similarly, Land O'Lakes (2010), the dairy sector in Ethiopia had attractive investment policy like exemption of tariffs and duties. Investment opportunities gave a chance for a new milk processing plant establishment in Adami Tulu district.

The cooperative proclamation was in law starting from 1998. It gives a chance for the interested individual to be in a group to run a business. Working in a cooperative gives power for individual farmers to be strong and sustain in the chain. In the milk shed only Biftu cooperative in Shashemene was involved in the dairy business (Brandsma et al., 2013). The livestock and fishery office with the collaboration of cooperative office can encourage farmers to be in cooperative in the other district like Shashemene.

The country is running the second Growth and Transformation Plan (GTP) after completion of its first plan. According to FDRE (2016) in the GTP I (2010-2015) the crossbreed cattle proportion increased from 10.37% at the beginning of the plan period to 14.53%. AGP II is working with the Adami Tulu Agricultural Research Center and livestock and fishery office in the animal healthcare and breed improvement programs by providing financial support and logistic support (MoE 2015).

5.3. Innovation platforms

According to Lemma et al., (2010) innovation is an interactive learning process, integration of knowledge, idea and experiences. The result showed that farmers training centre and farmers research groups are used as a learning process for farmers. Farmers research groups were found in only two districts (Dugda and Kofele) (interview with Tesfaye) that used as entry point to Adami Tulu Agricultural Research Center. Farmers research group composed of adopters and non-adopters. Research groups control over the decision making of the practices to scale up to others. The farmer research group was used as a platform to bring farmers, researcher and extension workers together to identify problems and to set solution together. Farmers research group an easy way to adopt and disseminate best practices and technologies. In addition as Worku 2017 stated farmers research group also to create room to convince non-participating farmers to participate in the approach (Worku, 2017).

5.4. Challenges and Opportunities

The dairy sector in the country is under development. The identified challenges in the dairy sector are inefficient AI services, small numbers of crossbreed, the absence of breeding policy and the shortage of improved forage seeds. The result was in line with other (Shapiro et al., 2015, Yilma et al., 2011) findings.

Limited credit services and group-based collateral were reported as limiting to commercialise climate-smart dairy. There is no financial loan for individual farmers; it is group based. The microfinance institutions also face challenges in collecting loans from farmers, especially when farmers fail to harvest crops result of catastrophic environment. Kariuki (2016) reported that smallholder producers in Africa have a poor record for repaying loans.

The Alema Koudijs agents responded that unavailability and high price of raw material made the price expensive for the dairy producers. Yami et al., (2012) supported in his findings that the price of balanced ration was expensive and unaffordable for smallholder farmers. Dejene et al., (2014) stated that price might be the higher depending distance away from feed processors.

According to Shapiro et al., (2015) in Ethiopian livestock master plan an aim to increase the milk production and cross breed dairy cows is an opportunity for the sector. And also there are extension service providers in each district, and DAs at Kebele level were tools to access the farmers at the farm gate. Investment policy would create opportunities to attract investors to invest in the district. The new milk processing plant is under establishment in Adami Tulu, which would create an opportunity for farmers to produce and supply in a better way.

CHAPTER SIX CONCLUSIONS

Climate-smart services were provided by the governmental and non-governmental organisation to scale up the dairy sector in climate-smart context. Breed provision and artificial insemination, improved feed production and distribution and training on forage manure management were provided to the producers.

Policy environment in the dairy sector includes the constitution of the country, the Agricultural Growth Program (AGP II) livestock master plan and EMDIDI, which has the positive contribution to the development of the dairy sector. The farmers training centre, farmers research group and one to five development teams were used as a learning platform in the milk shed.

The challenges in the sector are inefficient AI services, small numbers of crossbreed, and a shortage of improved forage seed and land. The microfinance institutions also face challenges in collecting loans from farmers especially when farmers fail to harvest crops result of catastrophic environment.

Ethiopian livestock master plan aims to increase milk production and crossbreed dairy cows, which is an opportunity for the sector. Presence of development agents as extension service provider in each district and establishment of a new milk processing plant were identified as an opportunity to scale up climate-smart dairy in the shed.

CHAPTER SEVEN RECOMMENDATIONS

Based on the findings, discussion, and conclusion, the following are possible areas of intervention for supporters to scale up climate-smart dairy in Ziway- Hawasa milk shed.

Livestock and Fishery Office

- ✚ Awareness creation for producers, collectors and processors on climate-smart dairy through training.
- ✚ Provide continuous training for AI technicians to upgrade their skills with the collaboration of national artificial insemination centre. In addition, selecting farmers from the community and train AI techniques to solve the shortage of AI experts.
- ✚ Organising a workshop to discuss and share ideas between actors (producers, collectors and processors). This helps the sustainability of the chain what producers, collector and processor require.
- ✚ Conduction field days across districts. Farmers in one district share their practices with other districts.
- ✚ Using mass media FM radio programs weekly or once in two weeks as a learning platform.
- ✚ Use of oestrous synchronisation to enhance crossbreeding practices.

Adami Tulu Agricultural Research centre

- ✚ Produce and distributes forage seeds at affordable prices for smallholder farmers which solve the shortage animal feed.
- ✚ Doing research in collaboration with Universities and EMDIDI to solve the shortage of experienced experts in the livestock in the centre. In addition, train staffs at PhD level in the country or abroad.
- ✚ Using mass media, web pages, facebook and FM radio/regional TV programs as a learning platform for the producers, collectors and processors.
- ✚ Use of oestrous synchronisation to enhance crossbreeding

Alage ATVET

- ✚ Provide capacity building training with the collaboration of EMDIDI and Hawassa University to upgrade practical skills trainers

Microfinance

- ✚ To start livestock and crop insurance for the producers to minimise the risk of loan return and collateral issues for farmers

Ministry of Agriculture, Livestock and fisheries

- ✚ Implement draft livestock breeding policy
- ✚ Encourage/ establish private or government heifer multiplication ranches, which help to solve the shortage of, crossbreed animals.

Generally, business model canvass is recommended for Livestock and fishery (figure 11) office and Adami Tulu Agricultural Research Center (figure 12).

Specific recommendation to the CCAF project

1. Oestrous synchronisation and AI services				
Input	Activities	Responsible body	Output	Impact
-Budget -Hormone -Cow/heifer -District skilled AI technician -Prostaglandin F2 α -Trained farmers AI technician -Cattle Crush -Smallholder dairy farmers	-Cow/heifer selection Cattle crush construction -Semen selection and buying - Prostaglandin F2 α -Hormone ejection -Insemination	-Livestock and Fishery Office	-Hormone injected -Heifer/cow inseminated	-Increase number of Crossbreed calves -Increase in milk production - Emission reduced
2. Improved forage production and distribution				
Input	Activities	Responsible body	Outcome	Impact
-Budget - Improved forage seed -Forage seed -Land -Producers -Farmer Training Centre -Farmers Research Group	-Seed buying -Ploughing and preparation of land -Sowing of forage seed -Fertiliser application - Forage seed harvesting -Forage seed distributing	Adami Tulu Agricultural Research Centre	-Forage distributed -Forage sowed -Forage harvested	-Feed shortage decrease -Milk production increase -Emission decrease -Reduce the budget for concentrate feeds -Emission reduced

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APPENDICES

Appendix 1 Interview Checklist for dairy chain supporters

Government offices	NGOs	Private supporters
Financial institutions ✓ Name of interviewee ✓ Sex ✓ Name of institution ✓ The position of the interviewee ✓ Task/main function of the institution ✓ How long do you provide the services ✓ Your client ✓ Criteria to offer credit services ✓ Collateral to offer credit services ✓ Do you give prioritise for different client ✓ criteria to prioritise ✓ Ways the farmer access the credit ✓ Challenges you faced in credit service provision ✓ Opportunity in credit service provided ✓ Things to be improved in the future	NGOs ✓ Name of interviewee ✓ Sex. ✓ Name of institution ✓ The position of the interviewee ✓ How long do you stay in the area and in providing services? ✓ Types of service you provide ✓ Reason for supporting the dairy sector ✓ Is there sector prioritisation in providing services ✓ Criteria for prioritization of sectors ✓ Relation with other stakeholders ✓ suggested improvement in the sector ✓ Partners working together	✓ Name of interviewee ✓ Sex ✓ Name of institution ✓ The position of the interviewee ✓ Task/main function of the institution ✓ Reason to engage in this business ✓ Your client ✓ Idea about climate change ✓ Your contribution against climate change ✓ Types of service provision for the client ✓ Criteria to provide service ✓ Challenges and opportunities ✓ Relationship with actors and other supporting organisation ✓ Network system with the client ✓ Source of experts ✓ Prioritization of
Adami Tulu Research centre ✓ Name of interviewee ✓ Sex ✓ Name of institution ✓ Position of the interviewee ✓ Main task /function of institution ✓ How long do you provide the services ✓ Types of services provided to actors ✓ Your client ✓ Types of research finding released for the community ✓ What are the services you provide ✓ Any training you provide ✓ In which area (feed, genetic health improvement) ✓ system of evaluation in your support ✓ Partners are working with you ✓ Perception of the farmers on the support service	Livestock and fishery offices ✓ Name of interviewee ✓ Sex. ✓ Name of institution ✓ Position of the interviewee ✓ Experience working in the dairy sector ✓ Your interest as an officer to work in the development of dairy...	

✓ do your support is climate-smart ✓ Adoption technology/Package released for the community- (Feed, manure management, breed improvement... ✓ disease control, management aspect, ✓ Types of research currently ongoing, Challenges in supporting the dairy sector) ✓ The opportunities you have ✓ Partners working together ✓ Things to be improved in the future	✓ Climate change action taken by your office ✓ Innovative practices you provide ✓ Technology packages released ✓ The effectiveness of the package ✓ Farmers awareness about climate change ✓ Supporting policy ✓ Opportunity vs ✓ Opportunity you have	service provision ✓ Policy/ enable disenable ✓ Things to be improved ✓ The innovative system of service provision
Education institution (Hawasa and ATVET (if available)) ✓ Name of interviewee ✓ Sex. ✓ Name of institution ✓ Position of the interviewee ✓ Types of support provided for dairy farmers ✓ Types of farmer do you support ✓ Reason for supporting ✓ Technology released to the smallholder farmer ✓ Monitoring and evaluation of your support system ✓ Climate-smart practices done by the department ✓ Challenges and opportunity ✓ Partners working together ✓ Existing gaps in the service you provision ✓ Ways of knowledge transfer (theoretical vs practical) ✓ Relationship with other supporters i.e ATVET	- Source of the expert in the area (University/ATVET - No expert in the sector (shortage of expert or not - Training for development agent to upgrade - Types of services provided for the chain actors - The network platform with actors/ other supporters - Role of farmers research group (learning each other) - Is there sector prioritisation in providing services - Criteria for prioritization of sectors - suggested improvement in the sector... - Partners working together - Relationship with other supporters	

Appendix 2. FGD Checklist

Stakeholder	- NGOs - government (Agriculture office, Research Center, Microfinance & Hawassa University) - Private supporter	Researcher Remark
Role on the Dairy value chain	✓ Training, ✓ Organising smallholder farmers Cooperatives ✓ consultancy ✓ credit ✓ linking farmers with market, ✓ input supply ✓ technologies (types/adoption of technology)	
Challenges, opportunities and why of improvement	✓ Challenges and opportunity in supporting the smallholder farmers ✓ Reason to support, ✓ challenges and opportunities ✓ Service /support overlap with other organisation ✓ Partners working together ✓ Policy support	
Future improvement		

Appendix 3. Photos during the research work

First stakeholder



Photo at Data collection



Final stakeholder meeting

