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**ASSESSMENT OF RESILIENCE OF DAIRY FARMING IN BISHOFTU AND ASELLA
AREAS, OROMIA REGIONAL STATE, ETHIOPIA**

MSc THESIS

By:

Abera Jabessa Fufa

**Addis Ababa University College of
Veterinary Medicine and Agriculture, Department of Animal Production Studies**

June, 2018

Bishoftu, Ethiopia

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AREAS, OROMIA REGIONAL STATE, ETHIOPIA**



**A Thesis Submitted to the School of Graduate Studies
Addis Ababa University in Partial Fulfillment of the Requirements for the Degree of
Master Science in Animal Production**

By:

Abera Jabessa Fufa

June, 2018

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Addis Ababa University

College of Veterinary Medicine and Agriculture

Department of Animal Production Studies

As members of the Examining Board of the final MSc open defense, we certify that we have read and evaluated the Thesis prepared by: Abera Jabessa Fufa Entitled: “**ASSESSMENT OF RESILIENCE OF DAIRY FARMING IN BISHOFTU AND ASELLA AREAS, OROMIA REGIONAL STATE, ETHIOPIA**”. And recommend that it be accepted as fulfilling the thesis requirement for the degree of: Masters of Animal production.

Birhan Tamir (Professor)	_____	_____
Chairman	Signature	Date
Kelay Belihu (PhD, Assoc. Prof.)	_____	_____
External Examiner	Signature	Date
Gebeyehu Goshu (PhD, Assoc. Prof.)	_____	_____
Internal Examiner	Signature	Date
1. Ashenafi Mengistu (PhD, Assoc. Prof.)	_____	_____
Major Advisor	Signature	Date
2. Jan van der Lee (Mr., Researcher)	_____	_____
Co- Advisor	Signature	Date
3. Birhan Tamir (Professor)	_____	_____
Department chairperson	Signature	Date

DEDICATION

This work is dedicated to my most beloved father and mother who facilitated all the means to go to school.

STATEMENT OF AUTHOR

First, I declare that this thesis is my bonafide work and that all sources of materials used for this thesis have been duly acknowledged. This thesis has been submitted in partial fulfillment of the requirements for an MSc degree at the Addis Ababa University and is deposited at the University Library to be made available to borrowers under the rules of the Library. I solemnly declare that this thesis is not submitted to any other institution anywhere for the award of any academic degree, diploma or certificate.

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Name: Abera Jabessa Fufa

Signature: _____

Place: Bishoftu, Addis Ababa University

Date of Submission: _____

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LIST OF ABBREVIATIONS

AAH	Action Against Hunger
ADIAS	Assessing and supporting Dairy Input and Advisory service Systems
AI	Artificial Insemination
AKF	Alema Koudys Feeds
CSA	Central Statistical Agency, Ethiopia
ESAP	Ethiopian Society of Animal Production
FAO	Food and Agricultural Organization of the United Nations
FGD	Focus Group Discussion
GDP	Gross Domestic Product
HHs	Households
ILCA	International Livestock Centre for Africa
ILRAD	International Laboratory for Research on Animal Diseases, Kenya
ILRI	International Livestock Research Institute
IPMS	Improving Productivity and Market Success
MOA	Ministry of Agriculture
NGO	Non-Governmental Organization
NVI	National Veterinary Institute, Ethiopia
SACCO	Savings and credit co-operatives
SE	Standard Error
SNV	Netherlands Development Organization
SWOT	Strength, Weakness, Opportunity, and Threat
USAID	United States Agency for International Development
VAS	Visual Analogue Scale

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ABSTRACT

This study was carried out in Bishoftu and Asella areas, Oromia Regional State, Ethiopia with the objectives to identify the coping strategies that dairy farmers employ to deal with the shocks and stresses that they encounter in dairy farming, and to assess the resilience of dairy farming activities as part of socio-ecological systems. The data were collected from December 2017 to April 2018 by individual interview of 120 households (60 from Bishoftu and 60 from Asella), field observations and 8 focus group discussions. A STATA, version 12 software was used for analyses. The result showed that daily milk production were significantly higher for the entrepreneurial dairy farmer as compared to typical dairy farmers in both rainy and dry seasons ($P < 0.05$). Livelihood strategies of the dairy farmers were dependent on both combinations of on-farm and off-farm activities to deal with the risk which associated with dairy farming. Vaccination, treatment, deworming with commercial drugs, and keeping animal & barn hygiene were the main coping strategies to deal with diseases, parasites and pests in both study areas. Utilization of crop residues, supplementary feed, fodder, and non-convectional feed were the major coping strategies to deal with feed shortage. The present study indicated that typical and entrepreneurial dairy farmers living in the same geographic locations have different levels of resilience to deal with risks that affected dairy farming. The entrepreneurial dairy farmers in both study areas were relatively more resilient than the typical dairy farmer to deal with risks that are associated dairy farming. Overall, the present study indicated that the dairy farmers in Bishoftu area were relatively more resilience as compared to dairy farmers in Asella area. It was concluded that resilience is a prerequisite for achieving sustainability of dairy farming in the turbulent environment. Therefore, in order to develop the resilience of dairy farming, they dairy farmers should be aware of the capacity of resilience such as absorptive, adaptive and transformative capacity in an efficient and effective manner to deal with varies risks.

Key words: Asella; Bishoftu; coping strategies; dairy farming; resilience; risks

1. INTRODUCTION

In Eastern Africa, the dairy sector is crucial for economic development, poverty reduction and food and nutrition security. Yet, its potential remains underexploited. Despite a strong interest from policymakers and investors and the on-going re-structuring of dairy value chains, a number of production, marketing and trade constraints hinder their development (Bingi and Tondel, 2015). Climate change has increased uncertainty and risk, predominantly in the farming sector. Thus, to ensure food security and resource conservation, it is urgent to find new pathways that will help to manage those changes and further disturbances (Gliessman, 2007; Ericksen, 2008). Resilience thinking is aimed at better understanding the interconnections and challenges involved in moving towards sustainable food production (Moller *et al.*, 2008). As the result the demand for dairy products in East Africa is expected to increase by 43% by the year 2050, mainly due to the rapid increase in urbanization, population and economic growth (Ugo *et al.*, 2013).

Dairy farmers have numerous opportunities to increase milk production to meet the increasing demand. However, intensification of the dairy sector requires efficient use of the natural resources in a sustainable way to safeguard livelihood of future generations (van der Lee *et al.*, 2016). Hence, the long-term sustainability of the dairy farming should be measured, monitored and documented for future policy decisions (Goswami *et al.*, 2017). To cope with a turbulent environment, dairy farmers need to build the capacity of their businesses to be able to better deal with periods of poor performance and capture the opportunities that arise to perform better (Detre *et al.*, 2006).

Resilience perspective offers three key conceptual strengths to policymakers, development and relief agencies, and researchers. First, resilience incorporates fundamentally important dynamic concepts —the dynamics of moving in and out of poverty, hunger, and malnutrition —that few other paradigms can. Second, it emphasizes the central role that risk plays in human lives, both the stressors people face on a daily basis (the risk of something bad happening) and their experience of shocks (bad things actually happening). Third, the resilience focuses our attention

on interconnected social, economic, and ecological systems, and on the way that these subsystems critically interact with each other (Barrett and Headey, 2014).

Overall, livestock in Ethiopia is an integral part of agricultural livelihoods for most smallholder farmers (Tegebu *et al.*, 2012). Ethiopia has a large livestock population but the contribution to the national economy is still low due to constraints associated with risk and inadequate management responses. Hence, it is important to understand the impact of risk and improve the existing risk management strategies of smallholder farmers (Bishu *et al.*, 2016). As a result, strengthening the resilience and adaptive capacity of smallholder dairy farmers are necessary so as to cope with this additional threat (Asfaw *et al.*, 2017).

Ethiopia has largest cattle population in Africa (CSA, 2017). However, the dairy industry is not as developed as that of East African countries like Kenya, Uganda and Tanzania. National milk production remains among the lowest in the world, even by African standards (Yigezu, 2003). The low productivity is principally due to inefficient nutritional and management practices, low genetic potential of the indigenous cows, high level of disease and parasitic incidence, poor access to extension and credit services, and inadequate information to improve animal performance (Yigezu, 2003; Aynalem *et al.*, 2011). The annual per capita milk consumption was 19 liters (Melesse and Beyene, 2009; Alemayehu *et al.*, 2012). While in Kenya, the annual per capita milk consumption was estimated at 110 liters, this makes highest sub-Saharan Africa (Bingi and Tondel, 2015; Rademaker *et al.*, 2016).

In dairy farming, resilient farming systems have been described as “those with the capacity to not only adapt to change in the environment, but also take advantage of opportunities created by a disturbance while maintaining productive capacity in the face of variability in production, financial and market related factors” (Rusito *et al.*, 2011). Bene (2013) defines resilience as any capacity, skill, and action, strategy, investment and anticipation, which helps individual, households and communities to anticipate, absorb, accommodate, or recover from the impacts of a particular adverse event (shock, stress, or (un)expected changes. Studies have been done resilience assessment of dairy farming in developed countries concur that in order to cope with a turbulent environment, farmers must build resilient farm systems (Crawford *et al.*, 2007;

Darnhofer *et al.*, 2010; Rusito *et al.*, 2011; Shadbolt *et al.*, 2013; Forney and Stock, 2014; De Olde *et al.*, 2016). However, little attention had been given on resilience assessment of dairy farming in developing countries. The fact that economic, social, and environmental realities in developing countries are often different from those prevailing in developed countries makes it difficult to realize results from developed countries. In this regard, the present study had been proposed to fill this gap in Ethiopia particularly in Bishoftu and Asella town by applying applicable resilience assessment tools within existing socio-economics perspective of dairy farmers. Therefore, the objectives of the current study was:

- To identify the coping strategies that dairy farmers employ to deal with the shocks and stresses that they encounter in dairy farming.
- To assess resilience of dairy farming activities as part of socio-ecological systems of smallholder dairy farmers in Bishoftu and Asella..

2. LITERATURE REVIEW

2.1. Farming System's Resilience

2.1.1. Resilience concepts

Resilience is defined in several ways since it is a term used across different disciplines (Choptiany *et al.*, 2015). The concept of resilience has been transferred from the field of ecology to the economic and social field (Allison and Hobbs, 2004). Farming systems are in between those different fields and, even though there are some differences, they can be considered as social-ecological systems since humans manage and use communities of plants, animals, their biophysical environment and their interactions (Gomiero *et al.*, 2006; van Apeldoorn *et al.*, 2011). A farming system is social-ecological system since in it is a unit composed of the farmer (with his/her social and cultural capital) and the physical farm (with its natural and economic capital) allows to apply the social-ecological resilience concept of farming systems (Gunderson and Holling, 2002; Moller *et al.*, 2008).

The concept of resilience can be detailed more in terms of social resilience, engineering resilience, ecological resilience, sustainable resilience and agriculture resilience as follows: Social resilience is defined by as the ability of groups or communities to cope with external stresses and disturbances as a result of social, political, and environmental change (Adger, 2000). Ecological resilience- resilience, in terms of the stability landscape, implies the ability of a stable system to keep the values of its state variables within a given domain of attraction in the face of perturbations, and is not concerned with the stability or constancy of the state within the basin. Ecological resilience can be measured by the magnitude of the perturbation that can be absorbed before the state of the system falls outside its domain of attraction (Gallopín, 2006). Sustainability resilience- Resilience thinking offers a vision of sustainability, which is not reduced to stability (Walker *et al.*, 2004). So, the concept of resilience appeals to the notion of sustainable and dynamic development (Carpenter *et al.*, 2001; Kremen and Ostfeld, 2005). Resilience focuses on the capacity to change and bring to light the shortcomings of focusing on

stability along with the command-and-control approach of classical resource management which will be further developed below. Resilience is also a prerequisite for being sustainable (Milestad and Darnhofer, 2003).

Agriculture resilience: The concept of resilience when applied to agriculture (Milestad and Darnhofer, 2003; Crawford *et al.*, 2007; Darnhofer *et al.*, 2010) defines a resilient farming systems as having the ability to buffer and respond to change so resilience is considered a key attribute to help farmers deal with future challenges and shocks (Crawford *et al.*, 2007). As with the ecosystem literature it also identifies resilience as not only persisting and maintaining farming systems through shocks but also adapting and adopting new systems when needed (Darnhofer *et al.*, 2010). Resilience farm system denotes the capacity of a system to absorb and thrive in a changing and uncertain production environment. Resilient farm businesses must, therefore, have a plan (strategy) for how the farm will run in an ‘average’ year (Roche and Horan, 2015).

Based on the broad definition of resilience by (Mitchell and Harris, 2012), the resilience of dairy farming can be defined as the ability of the farming system and its components to absorb, accommodate and recover from effects of different stress/shock in an efficient and timely manner. Furthermore, the resilience of farming system requires a combination of strategies that may successful allow a farm to navigate from external disturbances or changes (Darnhofer *et al.*, 2010). Another farm management study on dairy farm business resilience defined the resilience of a dairy farm business as “ the capacity of a farming system not only to adapt to change in the environment, but also take advantage of opportunities created by a disturbance while maintaining productive capacity in the face of variability in production, financial and marketing related factor (Rusito *et al.*, 2011).

Boka (2017) also showed as resilience comprises the capacity to anticipate, mitigate, adapt to, react to and recover from shocks and stress. Mitchell and Harris (2012) suggested that resilience of a system can be attained by ensuring effective risk assessment and management strategies. However, since decision making on farming systems is under the direct influence of humans (as well as biotic and abiotic factors), much consideration is required on rethinking about the social-ecological domain of resilience (Darnhofer *et al.*, 2010). Broadly speaking, a resilient farm

should be able to withstand and/or bounce-back from sudden or acute shocks (such as a spike in input prices, a disease outbreak). What determines the fate of a business in turbulent market environment is how resilient the business is to turbulence (Shadbolt *et al.*, 2017).

2.1.2. Aspects of resilience

Three common aspects of resilience have been identified that are used in the understanding of resilience for farm management. These are buffering capacity, adaptive capacity and transformative capacity Rusito *et al.* (2011). Bene *et al.* (2016) also define resilience capacities as a “set of conditions, attributes, and skills that are thought to enable households to achieve resilience in the face of shocks,” and further subdivide these capacities into adaptive, absorptive, and transformative capacities.

Buffering (Absorptive) capacity: According to Carpenter *et al.* (2001), the buffering capacity is the magnitude of shock that a system can absorb and remain within a given state. Buffering capacity is akin to persistence (Folke *et al.*, 2010). It denotes the ability to assimilate a perturbation without a change in structure or function. A shock such as a sudden price increase, a disruption in feed supply, the breakdown of a piece of machinery or a drought, is weathered without substantial changes on the farm. While there may be an impact, the farm activities bounce back, through the temporary reallocation of resources. Further mechanisms include conservation, maintaining production with fewer inputs; as well as input substitution, shifting input combinations to achieve the same function or level of productivity (Rose, 2009). The buffering capacity is thus not akin to rigidity, but ability of the farm to maintain itself through a disruption. Buffering capability is particularly important to buffer small disturbances (weather events such as low rainfall at crucial periods of crop development) and in the initial phases of coping with large shocks (Darnhofer, 2014).

Adaptive capacity: Adaptive capacity defined as being, in farm management, the degree to which the farming system is capable of responding to change (Crawford *et al.*, 2007). It is reflected, amongst others, in the learning aspect of the system’s behavior (Rusito *et al.*, 2011). It is the ability of a system to adjust in the face of changing external drivers and internal processes, there

by allowing for development while staying within the current stability domain (Folke *et al.*, 2010). It requires resourcefulness, the ability to identify problems, establish priorities, and mobilize resources in face of disruption, to combine experience and knowledge to adjust responses to a changing context or internal preferences, to plan for the future. However, the changes implemented do not bring something that is radically new. It is something that is added, building on established structures and functions, marked by path dependence. The changes are thus incremental, guided by the same goals and values, which are not questioned. There is learning, from both success and failures (Glover, 2012).

Transformative capacity: According to Walker *et al.* (2004) describe transformative as the capacity to create fundamentally new systems when ecological, economic or social conditions make the current existing system unsustainable. Transformation is the only option if disturbances from the highly dynamic environment push a farming system beyond what it can tolerate. Transformability has been recognized as a key characteristic of resilient farming systems (Darnhofer *et al.*, 2008) who described it as the ability of a manager to find new ways of arranging resources when conditions make the current systems untenable. Transformability represents the ultimate level of change.

Therefore, resilience is not only about “persistence to change” but includes as well taking advantage of opportunities that stem from disturbance in terms of farming system reconfiguration or transformation (Rusito *et al.*, 2011). Likewise, resilience is not merely about a systems robustness (bounce back), it is also about the opportunities that arise from disturbance (Carpenter *et al.*, 2001; Folke, 2006), and the capacity of an organization to adapt to change (McCann, 2004; Lengnick-Hall and Beck, 2005).

Note that absorptive, adaptive and transformative capacities can occur concurrently and are not strictly dependent on the severity of a shock or stressor. For instance, transformative capacity can be built during less stressful times. Moreover improving enabling environments (e.g., service delivery, governance, infrastructure, policies, and access to social protection) can also have a positive synergistic effect on the absorptive and adaptive capacities of households, communities, and higher-level systems (Bene *et al.*, 2015).

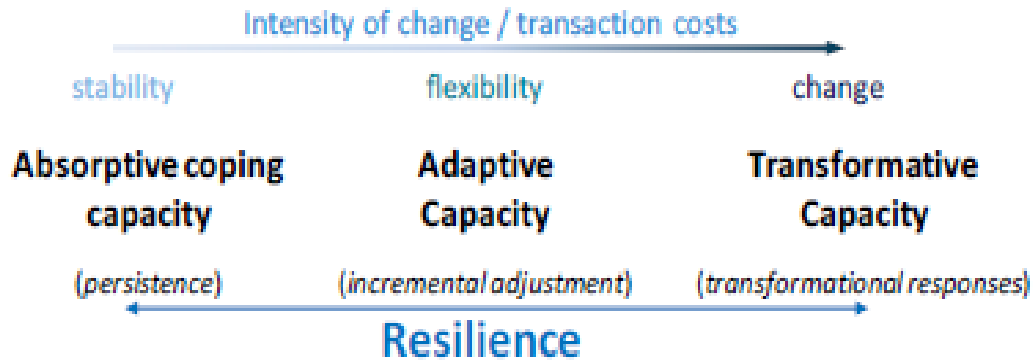


Figure 1: The 3D resilience framework Source: Bene *et al.* (2012)

Figure 1 also suggests that these different responses can be linked (at least conceptually) to various intensities of shock or change. The lower the intensity of the initial shock, the more likely the household (or individual, or community, or system) will be able to resist it effectively, i.e. to absorb its impacts without consequences for its function, status, or state (Bene *et al.*, 2012). As pointed out by Norris *et al.* (2008) ‘the ideal outcome after a crisis is resistance, meaning that the resources have effectively blocked the stressor and, accordingly, there is virtually no dysfunction, no matter how temporary’. However, when the absorptive capacity is exceeded, the individual will then exercise their adaptive resilience (Cutter *et al.*, 2008). This adaptive resilience refers to the various adjustments (incremental changes) that people undergo in order to continue functioning without major qualitative changes in function or structural identity. These incremental adjustments and changes can take many forms (e.g. adopting new farming techniques, change in farming practices, diversifying livelihood bases, engaging in new social networks) (Bene *et al.*, 2012).

Eventually, if the change required is so large that it overwhelms the adaptive capacity of the household, community or (eco) system, transformation will have to happen. In that case, changes are not incremental any longer. Instead they are transformative, resulting in alterations in the individual or community’s primary structure and function. These transformational changes often involve shifts in the nature of the system, the introduction of new state variables and possibly the loss of others, such as when a household adopts a new direction in making a living or when a region moves from an agrarian to a resource extraction economy (Bene *et al.*, 2012).

Finally the top part of the figure reflects the assumption (yet to be fully investigated) that, as we move from absorptive resilience, to adaptive resilience and finally to transformative resilience, the transaction costs and risks associated to these changes increase. The underlying idea is that ‘the more you change the higher the transactional costs’. In other words, it costs more to transform a system than to maintain it as it is or to rebuild it as it was (Bene *et al.*, 2012) .

Though there are numerous aspects to a successful dairy operating system, Roche and Horan (2015) illustrate four “pillars” to represent a resilient farming system, regardless of region, rainfall and farming values.



Figure 2: The ‘pillars’ of a resilient farm system Source: Roche and Horan (2015)

The fundamental pillars (Figure 2) of a resilient farm system illustrate the efficient utilization of land, business and management acumen, a strategy of continuous improvement for all parts of the business, and a fit for purpose motto (Roche and Horan, 2015). This model suggests that successful farming systems require a constant system foundation (strategic plan), with the strategic proficiency to undertake tactical management decisions (Roche and Horan, 2015). Farming systems that are resilient should be set up being mindful of the land production capability, typical rainfall, soil type, and the welfare of high performing animals. They must be very efficient per unit, be it land, labour or capital. This business and system must provide a

sustainable return financially, be environmentally benign, and offer pleasant and gratifying work and lifestyle for those employed (Roche and Horan, 2015).

2.2. Resilience Characteristics of Farmers

The difference between high resilient and low resilient farmers with respect to the use of strategies and the importance given by the farmers to each strategy or indicator for managing risk in their farm businesses. High resilient farmers were more likely to adopt the strategy of geographic diversity than low resilient farmers (Shadbolt *et al.*, 2015). Folke *et al.* (2010) and Darnhofer *et al.* (2010) also suggests that with resilience theory that diversity, on its many forms, is a key strategy for spreading risks and creating buffers against variability, and thus strengthening systems resilience. High resilient farmers are used and placed more importance on, strategies that coped with risk in a more proactive way than low resilient farmers (Shadbolt *et al.*, 2015).

High resilient farmers were likely to use, and give more importance to, the strategy of gathering market information than low resilient farmers. This may have been a reflection of their higher social sense-making skills and, therefore greater farmer learning about the environment, in this case related to the market. The gathering of any kind of information for decision making is also described as an important strategy that ensures adaptive capacity through learning (Darnhofer *et al.*, 2008; Folke *et al.*, 2010; Shadbolt *et al.*, 2015). Another important characteristic of high resilient farmers was that they used, and placed relatively high importance on, managing debt and planning capital spending (Parsonson-Ensor and Saunders, 2011; Shadbolt *et al.*, 2015).

High resilient farmers were also more likely to adopt, and give more importance to, implementing technological innovations. This may be related to these farmers' willingness to change, and thus results in adaptation in the form of new techniques or approaches to cope with risk in the form of either threats or opportunities. However, the idea that these innovations result in a resilient farm business can be debated because it depends on how useful or successful the implementation of the innovation is (Shadbolt *et al.*, 2015).

Low resilient farmers placed relatively more importance on strategies which were more reactive and targeted to buffering the negative effect of risks such as not producing to full capacity and keeping debt low, strategies that aimed to reduce the threats to production and financial risks. Low resilient farmers were not seeking opportunities; not producing to full capacity; coping with threats in the short-term those who have reflection of a farm's buffer capacity; rather, they felt more comfortable in managing what they knew (Folke *et al.*, 2010; Darnhofer *et al.*, 2010; Shadbolt *et al.*, 2015). Rusito *et al.* (2011) recognize that a core competency of a resilience farming system is its ability to adapt to shifts in the environment, to capture the opportunities that might arise from disturbance and hence outperform those who do not adapt.

2.3. Measuring Resilience Level

Conceptually, it is difficult to measure something unless we know exactly what it is that has to be measured, but definitions of resilience do not facilitate this. Theoretical resilience frameworks are often not linked to attempts to measure resilience (Levine, 2014).

The measurement of resilience is a new and rapidly developing area of research and practice (Winderl, 2014; Bahadur *et al.*, 2015). Resilience should not be seen as the final goal of a development programme. Instead resilience should be seen as an intermediate outcome required for achievement of a more fundamental goal related to a longer-term developmental ambition (Bene *et al.*, 2014; Brown, 2015; Bene *et al.*, 2016), typically a measure of wellbeing (e.g., food security, health/nutrition status, poverty) (Constas *et al.*, 2014). However, Levine (2014) proposed that numerically measuring resilience is impractical; highlighting that resilience cannot be measured as a singular entity due to the different degrees of threat or risk to which people are exposed. Resilience is clearly dependent on the farmers' perception of change and her/his creativity in the combination of resources. Indeed, resilience builds on the ability of actors to interpret and make sense of disruptive challenges, rather than just reacting or limiting themselves to 'off-the-shelf' responses (Pike *et al.*, 2010).

A growing number of civil society and other organizations have developed and highlighted resilience indicators as key components of a successful measurement program. Some believe that

resilience and vulnerability has no clear and direct statistical method to measure resilience ,are still contested (Luers *et al.*, 2003; Hinkel, 2011; Patt *et al.*, 2012; Winderl, 2014), and instead require the identification of measurable “proxies” to represent the various ways in which resilience manifests. These can be taken from data-driven field studies, or deduced from assumptions about social, environmental, economic, and political circumstances. However, basing proxies on assumptions means that if the rationale behind the assumptions is incorrect, the proxies will not portray resilience accurately. The assumptions may be based on generalizations about certain groups of people based on gender, age, ethnicity, or inferred implications about resilience from the proxies without any statistically proven relationship between the two (Rohrbach and Mazvimavi, 2006).

Unfortunately, the assessment of resilience is fraught with complexity: both the definition of resilience and the methodologies used to measure it are heavily contested (Cumming *et al.*, 2005; Winderl, 2014). One reason why measuring concepts such as resilience and adaptive capacity is challenging is because we can only assess whether a system has successfully coped or adapted after the fact (Satterthwaite and Dodman, 2009; Dodman *et al.*, 2009). In other words, we have to wait until after the shock or change has taken place in order to assess the effectiveness of the intervention in question. Many academic publications have put forward models that require complex and sophisticated mathematical modeling and calculation of resilience, which cannot be easily used by community members to measure and understand their degree of resilience (Rose, 2009; Arianoutsou *et al.*, 2011; Zobel, 2011).

However, Barrett and Headey (2014) set five criteria of good measurement of resilience in terms of risks, vulnerability, chronic and transient poverty; and complex interactions between shocks and stressors, and between households and their social, economic, and ecological environments. First, and most importantly, resilience measurement must involve sustained, higher-frequency surveys than are currently standard in most of the social sciences (Constas *et al.*, 2014). Second, resilience needs to be measured repeatedly over the longer term. Third, resilience indicators should include sufficiently sensitive indicators of stressors, shocks, coping strategies, and human welfare. Fourth, resilience needs to be measured at multiple levels: for individuals (particularly nutritional status), households, and communities, but also for local economies and ecologies.

Fifth, while there are many advantages of common measurement strategies across different contexts (particularly in terms of using surveys for targeting resources and for comparative analysis and program evaluation), there will also be some need for context-specific measurement.

So, additionally, how can we quantify resilience? For this question, there has been progress in forming general principles to underpin attempts to quantify resilience and in constructing relevant indicators for use on programmes. These include the 3D Resilience Framework; the Food Security Information Network's principles and common analytical model; and 'costs of resilience'. In the 3D Resilience Framework, (Bene *et al.*, 2012) propose that resilience emerges as the result of three capacities: absorptive, adaptive and transformative capacities. Each capacity leads to a different outcome: persistence, incremental adjustment, or transformational responses (figure one above).

2.4. Risk Perceptions and Management Strategies of Farming in Developing Country

Risks are concepts intimately linked to resilience. Crawford *et al.* (2007) suggests that building resilience in a dairy farm is about being able to successfully manage the risks to which the farm business is exposed. Natural and human induced risks, however, impose severe constraints on agriculture (Hardaker *et al.*, 2004). Poor rural people in developing countries are exposed to numerous risks while often lacking the means to manage them adequately, and so are highly vulnerable (Barnett *et al.*, 2008; Gilligan *et al.*, 2009; Tadesse *et al.*, 2015).

While livestock farmers' perceptions of risk and management strategies have received some attention in developed economies, little specific attention has been paid to developing economies (Ahsan, 2011). This is despite the fact that risk in livestock farming is reported to be increasing in the arid and semi-arid regions of East Africa (Doss *et al.*, 2008; Mutsaers *et al.*, 2011; Chantarat *et al.*, 2013; Headey *et al.*, 2014). Risk reducing strategies are often used in combination with one another, because no single strategy can cover all of the risk likely to be encountered (Kahan, 2008). To reduce the impact of a range of risks, farmers use various risk management strategies such as diversification of their livelihood activities, saving, debt management, membership of

marketing cooperatives, control of pests and diseases and participation in public works programs (Ellis, 2000; Andersson *et al.*, 2011; Gebreegziabher and Tadesse, 2014; Headey *et al.*, 2014).

Risk prevention and mitigation are parts of the ex-ante risk management strategies, while risk coping is part of the ex-post shock coping strategies (Holzmann and Jorgensen, 1999). Likewise, Legese *et al.* (2017) argued that risk management strategies described into three measures in which by using of mitigation or preventions measurement such as: vaccination against major livestock diseases , growing cereal crops using early rain and harvesting before the occurrence of head smut and soil conservation measures, second short term coping strategies against food shortage such as: borrowing money, selling livestock, off farm wage labor, farm wage labor and renting out agricultural lands, and third long term adaptation strategies such as: use of drought tolerant, early maturing crop varieties, crop diversification, better forage management to reduce feed shortage and strengthening informal institutions. Other studies of risk management in livestock farming in East Africa have focused on the role of insurance in poverty reduction (Matsaert *et al.*, 2011; Chantarat *et al.*, 2013).

Good risk management decisions depend on accurate information, which, in turn, requires reliable data. Good information is one of the most useful assets a farmer can have to help make rational risk management decisions. There are many sources of information available. The most appropriate place to look for information depends on the type of risk the farmer has to manage. A farmer can find information from many sources including: other farmers, agricultural supplier, traders, extension services, private/commodity advisory services, agricultural statistics, publications, and broadcasts (e.g. radio) farming magazines and newsletters (Kahan, 2008).

2.5. Constraints and Coping Strategies of Dairy Production in Ethiopia

There are multiple risks which constrain dairy production; even the nature and magnitude of the problems are different between production systems and agro-ecologies. Some factors are cross-cutting regardless of dairy production system and agro ecologies that can have influence on dairy production; others are system specific (Tegegne *et al.*, 2013). The most important constraints associated with livestock development in Ethiopia are technical and institutional factors. The

technical constraints include poor genetic makeup of the animals, insufficient and low-quality feed sources, unavailability and prohibitive prices of improved breeds, and widespread disease. Limiting institutional factors include poor linkages between technology sources such as research centers and end users, policy, and limited extension and financial services (MOA, 2013; Shapiro *et al.*, 2015). Similarly, Wouters and van der Lee (2009) revealed that small scale milk producers in developing countries are facing a number of challenges that can be grouped in market, production and institution related challenges.

Recent studies in the Gonder town revealed that land shortage, scarcity of feed and high price, seasonality of demand particularly in fasting time and absence of processing industry were the major challenges of dairy production and marketing in the area (Getachew and Tadele, 2015). Correspondingly, Duguma and Janssens (2016) studies in Jimma town stated that feed shortage was as a major problem to increase milk production especially in the dry seasons. These authors reported that to farmers adopted different strategies to cope with dry season feed scarcity increasing use of agro-industrial byproducts and concentrate mix, increasing use of conserved hay, increasing use of non-conventional feeds, purchasing green feeds when available and reducing herd size.

In additional, Galmessa *et al.* (2013) and Getachew and Tadele (2015) reported that most important challenges of dairy production were feed shortage, disease and parasite (poor veterinary services), shortage of breeding bull or A.I. service, poor knowledge of dairy cattle management, unavailability of improved genotypes and poor genetic make-up of indigenous animals which actually reflected in low milk production and dairy products marketing. According to, Lijalem *et al.* (2015) studies showed that feed shortage was the first major constraints which accounted for a large proportion in dairy cattle production and followed by health problem, water and labour scarcity. Dairy production system is highly constrained through shortage of feed in terms of quality and quantity. Insufficient supply of quality feed is the main thing restraining dairy efficiency in the region. Land scarcity is also another major problem in urban and pre-urban dairy farming system (Tegegne *et al.*, 2013). The other authors also reported the most important problems of livestock production supposed by the dairy farmers were feed shortage, animal disease and water shortage and poor quality during dry season. Farmers ranked

feed shortage as key constraint to livestock production. There were coping strategies to alleviate the constraints to livestock production through improved feed production and conservation, veterinary health care and services, increased availability of water and quality during the dry season (Hussen, 2007; Belay *et al.*, 2013; Duguma and Janssens, 2016).

The milk marketing system is not well developed in Ethiopia (Ahmed *et al.*, 2003). Where infrastructures are very restricted and market channel has not been developed, as a result, marketing fresh milk will be difficult. Waste disposal is also another challenging factor for farmers. Urban production system has been constrained through waste disposal. However, manure can balance crop production in rural dairy production systems. Dung is a source of bad odor and flies, conflict may arise with neighbors, and diseases may pass from animal to human, if it is not properly managed (Sintayehu *et al.*, 2008; Tegegne *et al.*, 2013). In addition, farmers pay extra money for manual workers to clean the dung. Although, place is not assigned for disposing this animal dung (Sintayehu *et al.*, 2008). Risk management strategies depend on the type of risk and on the costs, effectiveness of the available instruments, education status, technology and infrastructure development (Hoogeveen *et al.*, 2004).

Table 1: Farmer perception of problems to livestock rearing, causes for the problems and (potential solutions) coping strategies in Ginchi watershed area

Problems	Possible causes	Potential solutions
Feed shortage	Land shortage, increased human and stock population, intensive crop production, long dry season, water logging, lack of information and inputs on forage development technologies.	Conserving and utilization of crop residue and hay, limit livestock number based on available feed resource, using some crop land for pasture and forage production, culling unproductive stock.
Livestock diseases and lack of access to vet. services	Internal and external parasites, outbreak of contagious diseases, feed shortage, water logging, lack of capital to buy medicine, lack of veterinary care and service.	Access to low cost drugs, regular vaccination, accessible vet services, use of traditional medicines and improved water quality (dry season).
Reduced water quantity during the dry season.	Lack of rain, deforestation and increased human and livestock population, use of irrigation at up stream	Reforestation, additional water development uses big rivers at far distant and traditional dam construction.
Poor water quality in the dry season	High prevalence of leech in the dry season, contamination due to washing and bathing, reduced flow and quantity of water, runoff into water sources.	Use of herbs against leech, access to drugs that eradicates leech, seclusion of drinking, bathing and washing points, water development, construction of small dams.

Source: Belay *et al.* (2013)

2.6. Importance of the Livestock Sector in Ethiopia

The contribution of livestock to the national effort to ensure food self- sufficiency both at the national and household level is significant (Tegegne *et al.*, 2006). Livestock in Ethiopia perform important functions in the livelihoods of farm owners, pastoralists and agro-pastoralists.

Livestock are sources of food (meat and milk), services (transport and traction) cash income, manure (for soil fertility and fuel), and serve as store of wealth and hedge against inflation. The subsector also provides year-round employment for a significant part of the rural population, which would perhaps remain unemployed otherwise (Gebremedhin, 2009). Livestock are especially important sources of cash income to the poorer sections of the Ethiopian rural population and women, as is also true in many other developing countries (Delgado *et al.*, 2001; Thornton *et al.*, 2002; Gebremedhin, 2009). Among livestock production, dairy plays an important role in the Ethiopian agricultural sector and the national economy (Tegegne *et al.* 2013). Beneficial income diversification investments can arise from cash income generated from livestock (Teka and Azeze, 2002; Gebremedhin, 2009).

The Ethiopian economy is highly dependent on agriculture. Despite being more subsistence, agricultural production plays an important role in the economy. In the late 1980s, agriculture contributed about 45% of national GDP while the livestock sector, despite large population size, contributed about 12-16% of national GDP, 30-35% of agricultural GDP, 15% of export earnings and 30% of agricultural employment. Livestock contributes to the livelihoods of 60-70% of the Ethiopian population (Aklilu, 2002; Solomon, 2003) in one way or the other. It is raised in all of the farming systems by pastoralists, agro-pastoralists, and crop-livestock farmers. The rural dairy system is part of the subsistence farming systems that are mainly concentrated in the highlands, but also in the lowlands. Pastoralism is the major system of milk production in the lowlands. It is estimated that about 30% of the livestock population are found in the pastoral areas. Nevertheless, because of the erratic nature of rainfall that results in shortage of feed availability, milk production is low and highly seasonal.

Over the last 30 years, national and per capita production and consumption of livestock products have declined (Solomon, 2003). Livestock production increased by much less than the production increase for the agriculture sector as a whole, so relative share of livestock to agricultural GDP declined. Hence, per capita livestock output fell by 5% while crop and agriculture grew by 14 and 6% respectively.

2.7. Livelihood Strategies in Ethiopia

Livelihood strategies are the combination of activities that people choose to undertake in order to achieve their livelihood goals (UNCDF, 2005). Livelihood strategies are at the center of human livelihoods (Eneyew *et al.*, 2012). A livelihood comprises the capabilities, which comprised of assets (including both material and social resources) and activities used by a household for means of living. Livelihood strategies of the farmer in Ethiopia depended on the combination of both on-farm and off-farm activities (Addisu, 2017). However, most of the income and food sources in Ethiopia had been obtained from on-farm and off-farm activities (Deresse *et al.*, 2008). Terefe *et al.* (2014) had reported that the sources of income for livelihood strategies of Dale and Shebedino woreda of Southern Ethiopia were mainly come from on-farm activities than off-farm. Out of on-farm activities in Ethiopia, income gained from livestock production and crop production were the major income sources for the farmer (Addisu, 2017). According to Gizaw *et al.* (2016) about (100%) livestock production was contributed to livelihood in urban dairy farmers in the highland of Ethiopia.

3. MATERIALS AND METHODS

3.1. Description of the Study area

The study was conducted in the central highlands of Ethiopia that fall in the administrative territory of Oromia Regional State, Ethiopia. Data were collected from in and around two towns namely Bishoftu and Asella. These two areas were selected based on the production potential, availability of dairy farming and marketing practices of milk. The brief description of the selected towns is presented below.

Bishoftu: Bishoftu is located at the distance of 45 km South East of Addis Ababa, Ethiopia. The town is located in East Showa Zone of Oromia Regional State and it lays 9° North latitude and 40° East longitude at an altitude of 1850 meters above sea level in the central high land of Ethiopia. It has an annual rainfall of 866 mm of which 84% is in the long rainy season (June to September) and the remaining in the short rainy season extending from March to May. The dry season extends from October to February. The mean annual maximum and minimum temperatures of the area are 26°C and 14°C, respectively, with mean relative humidity of 61.3%. Mixed farming system is practiced in the area. It is also well known for high agricultural potential, with good access to market for quality agricultural products, including milk products. In the areas there is fast growing dairy production and many households are engaged in dairy production for their income and consumption. Availability of feed processing plants, veterinary services and also access to market help them to expand their dairy production.

Asella: Asella town is located in Oromia Regional State, in Arsi Zone at a distance of 175 km from Addis Ababa. This town has a latitude and longitude of 7°57'N 39°7'E, with an elevation of 2,430 meters. The 2007 national census reported a total population for Asella to be 67,269, of whom 33,826 were men and 33,443 were women. The area receives an annual rainfall of around 1100 mm, of which more than 85% is during the main rainy season (June to November). The area is characterized by crop-livestock mixed farming system where livestock in general and dairy production in particular contributes significantly to livelihoods of the smallholder farmers.

Market oriented dairy production based on crossbred dairy cows is practiced in the district, but mainly in or close to the towns. The benefit fetched from livestock sector is not as significant as the district's potential. In order to improve livestock production and to enhance the benefits obtained from the sector understanding the problems, risks and shocks and opportunities existing with this sector is important.

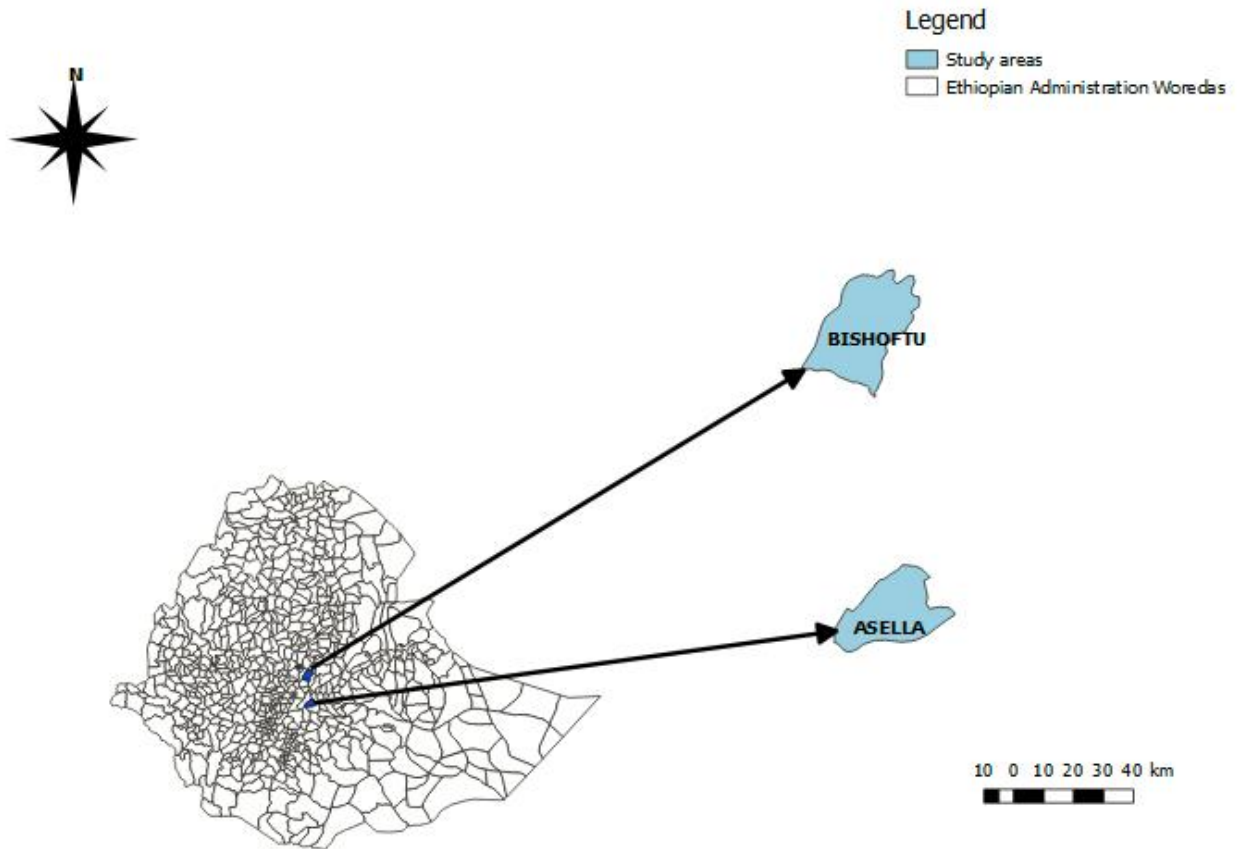


Figure 3: Geographical location of study areas

3.2. Study Design

A cross-sectional study was carried out to assess resilience of dairy farming activities as part of socio-ecological systems, and the coping strategies that farmers employ to deal with the shocks and stresses that they encounter in dairy farming. The individual smallholder dairy farmers were interviewed using structured questionnaire, and focus group discussion.

3.2.1. Sampling procedures

Both qualitative and quantitative research methods were used to employ the study in the areas. Secondary information from Woreda Livestock Development and Fisheries Offices, and dairy cooperatives were utilized to select villages (kebele's) and for categorizing of dairy farmers. Dairy farmers were purposely categorized into two groups (typical and entrepreneurial dairy farmers) based on the production potential, number of milking cows possessed and marketing practices (Shadbolt, 2016). Typical smallholder dairy farmers were those who have between 1-2 milking cows, supplying 5-12 liters/day to the market and economize on external inputs. Entrepreneurial smallholder dairy farmers who have above 3 milking cows, judging from their good dairy farming production and marketing practices, and marketed their milk to dairy cooperatives, restaurants, private processors and direct to costumers at least 25 liters per day the last past five years and those who do dairy as business, and hence buy more inputs and services from outside as compared to typical smallholders; are more willing to take loans. Sixty smallholder dairy farmers were chosen from Bishoftu areas (30 typical and 30 entrepreneurial dairy farmer), and similarly sixty smallholder dairy farmers were selected from Asella areas (30 typical and 30 entrepreneurial dairy farmer). Totally, 120 dairy household farmers were randomly included in the interview of data collection in both areas. The representative kebele of each study areas were purposely chosen based on the production potential, herd size and market their milk using secondary information (evidence) were obtained from Woreda livestock and development office, and dairy cooperatives. Such as: 01, 02, Dembi and Babogaya kebeles' were selected in and around Bishoftu areas. Whereas: Gora sirilingo, Dosha, Kombolcha, Areda, Welkessa and Burka chilalo kebeles' were chosen in and around Asella.

3.2.2. Sample size determinations

The sample size was determined by using mathematical model of (Arshame, 2007). The sample size, N, can then be expressed as largest integer less than or equal to $0.25/SE^2$.

$$N=0.25/SE^2$$

SE is standard error (considering SE of 0.0456 with 95 % coefficient interval as follows, $N=0.25/0.0456^2 = 120$). Accordingly, one hundred twenty (120) households were randomly selected in both study areas.

3.2.3. Method of data collection

3.2.3.1. *Survey questionnaire*

Structured questionnaire was prepared and pre-tested before implementation. Training was given to interviewers on how to administer the questionnaire to capture appropriate data. The design of the survey was pre-tested on two typical and entrepreneurial smallholder farms in Bishoftu area, after which the questionnaire was revised. Interview was carried out from December 2017 to April 2018, and done by the researcher together with the trained interviewer and facilitators/experts from the respective Livestock and Fisheries Offices, and dairy cooperatives. These facilitators/experts were used as a local guide to lead to the selected farmers. The interviews were carried out at the farmer's home to enable counterchecking of the farmer's response with respect to the availability of dairy farming, number of lactating cows and species and the overall management system of the dairy farming farm.

The interview focused on basic data such as, basic household characteristics (gender, age, and position of respondents, major household income, labor and skills), basic farm data (stock size, total number of milking and dry cows, livelihood strategies and sources of income, daily milk yield during rain and dry seasons, land size, and water source).

The survey questionnaires were also covered information on risk prioritize, smallholder dairy farmers coping strategies to deal with feed shortage, diseases, parasites and pests, issues of poor

genetics and reproduction, market fluctuation, difficulties input supply, water shortage, and manage manure. This sources of risks were drawn from previous studies on constraints of dairy farming undertaken in Ethiopia (Galmessa *et al.*, 2013; Tegegne *et al.*, 2013; Getachew and Tadele, 2015). The interviews were also focused on the resilience assessment of dairy farming based on the three top risks that threatening persistence and adaptation of dairy farms among other listed risk in order to measure the different parameter of practices and resources areas per risk areas. The parameter of practices and resources areas to deal with the most threatened risk of dairy farmer over the past five years of the top three risks were responded and weighted by using dichotomous (Yes/No) and VAS, respectively. Visual analogue scale (VAS) has most superior metric characteristics as compared to other scale since it was subjective measurements that cannot be measured directly. The VAS used in the current study have a scale of 0 to 10 points or 0 to 100% points (Not useful – Most useful/ No threat – Extreme threat/ Not effective – Very effective) depending on the level of understanding of the farmer (Hawker *et al.*, 2011). Then the dairy farmers make a mark reflecting his or her perception, and the distance from the left end point (0) to the mark was measured to the right end point (100). A higher score of VAS indicates very effective for her/his perception.

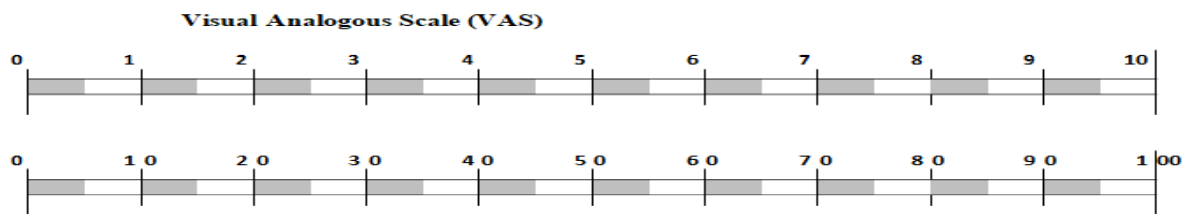


Figure 4: Visual analogous scale (VAS)

3.2.3.2. Focus group discussions

Qualitative data collection was used to obtain in-depth information by using a semi-structured focus group discussion after the results of survey questions were identified especially the frequency of the most important risks that threatened dairy farming per-study areas. It focused on capturing contextual information about resilience and the impact of shocks/risks in order to understand and explain outcomes, as well as used to interpret and supplement the

quantitative/survey results and discussion. Additionally, the focus group discussion helps to determine how communities were coping with the risks, how social capital balance in the face of risks, and how community structures held up under risks. FGD facilitators used the topical outlines to guide discussion, with focus on the nature of risks and stresses experienced by the community and common responses to them, and allowed digital voice recorder to record the discussions which participants. The total number of participants per group or categories was held within a range of 6-12 people. Separate FGDs were held for men and women smallholder dairy farmers per each smallholder dairy farmer categories, where one typical woman FGD, one typical man FGD, one entrepreneurial women FGD, and one entrepreneurial men FGD from each study areas. Totally, eight (8) FGDs were conducted from both study areas.

3.3. Method of Data Analysis

Quantitative data was transcribed and coded for each household. Data management and edition was made using Microsoft excel 2010. Data analysis was conducted using STATA software version 12. The same software was used for descriptive statistics, tabulation (percentages), Pearson Chi-square tests for association, and independent group mean t-test. Statistically significant difference was considered for P value <0.05. The qualitative information from the FGD (audio record and notes) were transferred into texts. The information was then used to identify patterns in responses and contextual information to help explain and interpret the survey/quantitative findings.

Resilience score

All the variables were combined (Appendix Table 7) into the following equation that gives an overall quantitative “resilience score.” Because the three components of resilience as being different perspectives of the same reality, rather than as three independent qualities that can be added, with resilience as the sum of them all (Bene *et al.*, 2012). Therefore, in order to accommodate all these collected of survey data which represented the resilience for the combination of practices and resources, and further the concurrently existence of components of resilience (absorptive, adaptive and transformative) the following equation (model) was set based

on the recommendation of different authors (Maxwell *et al.*, 2008; FAO, 2016; Boka, 2017). Since, resilience is clearly dependent on the farmers' perception of change and her/his creativity/practices in the combination of resources (Levine, 2014).

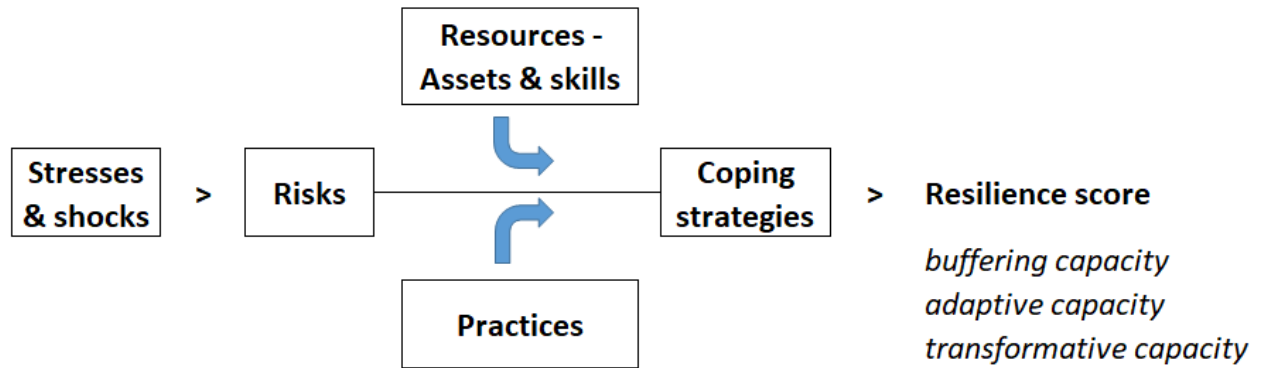


Figure 5: Analytical framework

The equation used to combine components of resilience score per risks areas as follows:

$$RS = \left(\frac{P_{ij} * WP_{ij}}{TP_{ij}} \right) + \left(\frac{r_{ij} * WR_{ij}}{Tr_{ij}} \right)$$

- Where
- i= represented an individual or dairy farmer
 - j= particular risk
 - P= Practices
 - r= Resources
 - RS = Resilience score of an individual per risk areas (0-100)
 - P_{ij} = Dichotomous response of an individual on practices area per risk (Yes/No)
 - WP_{ij} = VAS weighted of an individual on practice area per risk (0-100)
 - TP_{ij} = Total number of practices indicated an individual per risk
 - r_{ij} = Dichotomous response of an individual on resources area for per risk (Yes/No)
 - WR_{ij} = VAS weighted of an individual on resources area for per risk (0-100)
 - Tr_{ij} = Total number of resources indicated per individual on per risk

The resilience score of an individual response per smallholder dairy farmers for each risk areas were calculated on the Microsoft excels 2010 based on the model (equation) set accordingly. The overall average of VAS for each risks area per dairy farmers' groups were calculated on the same excel "in Appendix Table 6", and directly displayed on radar graph to interpret resilience. The radar graph values indicated that the resilience score were increased from closer to farther away from the center of the radar graph (0 near the center of axis which indicates that low resilience and 100 at the outer axis which indicates more resilience). The more resilience dairy farmers interpreted that those dairy farmers who produce /use full capacity of resilience, and low resilience dairy farmers were those who not use/produce full capacity of resilience to face the risks (Shadbolt *et al.*, 2015). The Resilience score systematically compares resilience level of both typical and entrepreneurial dairy farmer. Additionally, the score was imported to STATA software to analysis through independent group mean t-test in order to see the significant difference of resilience level between dairy farmers types that employed to deal with risks faced in their dairy farming.

4. RESULTS

4.1. Farming Characteristics

4.1.1. Households characteristics in the study areas

The household characteristic of the interviewed dairy farmers are presented in Table 2, 3 and 4. The percentages of the female respondents in both study areas were slightly higher 53.33% in Bishoftu and 51.67% in Asella. The P value was indicated that significant relationship between two groups of dairy farmers with gender of respondents in both study areas. However, for the entrepreneurial dairy farmers the proportions of male respondents were higher in both study areas. Overall percentages of the position of respondents of dairy farmers in both study areas were greater in owner of the farm 53.33% in Bishoftu and 73.33% in Asella. In both study areas of typical and entrepreneurial dairy farmers, the highest proportions of respondents were owner of dairy farms.

Table 2: Gender and position of respondents in Bishoftu areas

	Bishoftu		Overall (%)	X ² (P value)
	Typical (n=30)	Entrepreneurial (n=30)		
	Freq. (%)	Freq. (%)		
Sex of respondents				
Male	10 (33.33)	18 (60)	28 (46.67)	4.29 (0.04)
Female	20 (66.67)	12 (40)	32 (53.33)	
Position of respondents				
Owner	15 (50)	17 (56.67)	32 (53.33)	
Spouse	13 (43.33)	6 (20)	19 (31.67)	3.03 (0.03)
Son/daughter	2 (6.67)	1 (3.33)	3 (5)	
Manager	-	6 (20)	6 (10)	

Freq. = Frequency of respondents; n= number of respondents; X²= Chi square

Overall, higher percentages of age of respondents 31.67% ranged between 31-40 years of age in Bishoftu area, while about 30% ranged between 41-50 years in Asella. Overall, percentages (38.33%) of the respondents in Bishoftu had secondary education, while 43.33% had primary education in Asella. In both study areas, the entrepreneurial dairy farmers were educated (they could read and write).

Table 3: Gender and position of respondents in Asella areas

Categories	Asella			
	Typical (n=30)	Entrepreneurial (n=30)	Overall (%)	X ² (P value)
	Freq. (%)	Freq. (%)		
Sex of respondents				
Male	9 (30)	20 (66.67)	29 (48.33)	7.94 (0.06)
Female	21 (70)	10 (33.33)	31 (51.67)	
Position of respondents				
Owner	21 (70)	23 (76.67)	44 (73.33)	1.78 (0.15)
Spouse	8 (26.67)	3 (10)	11 (18.33)	
Son/daughter	1 (3.33)	1 (3.33)	2 (3.33)	
Manager	-	3 (10)	3 (5)	

Freq. = Frequency of respondents; n= number of respondents; X²= Chi square

4.1.2. Land holding

The overall mean/hectare land size per smallholder dairy farmer in the study areas is indicated in Table 5. The overall averages of total land size possessed in Asella were 0.60±0.12, out of which 0.29±0.06, 0.02±0.01 and 0.05±0.01ha of land were allocated for annual crops, grazing land and under the building, respectively. In Bishoftu town, the overall average of landholding 0.48±0.12 ha was slightly lower than Asella areas, and of which about 0.34±0.11, 0.03±0.01, and 0.07±0.01ha of land was used for annual crops, grazing land and building, respectively.

Table 4: Age and educational status of respondents

Categories	Bishoftu			Asella		
	Typical (n=30)	Entrepreneurial (n=30)	Overall (%)	Typical (n=30)	Entrepreneurial (n=30)	Overall (%)
	Freq. (%)	Freq. (%)		Freq. (%)	Freq. (%)	
Age of respondents						
<30yrs	7(23.33)	8(26.66)	25	6(20)	7(23.33)	21.67
31-40yrs	9(30)	10(33.33)	31.67	6(20)	9(30)	25
41-50yrs	6(20)	6(20)	20	10(33.33)	8(26.66)	30
>51yrs	8(26.66)	6(20)	23.33	8(26.67)	6(20)	23.33
Educational status						
Illiterate	3(10)	0	5	2(8.34)	0	6.67
Primary	6(20)	12(40)	30	13(43.33)	13(43.33)	43.33
Secondary	15(50)	8(36.67)	38.33	11(38.34)	13(43.33)	40
College	3(10)	8(26.67)	18.33	2(6.67)	2(6.67)	6.67
University	3(10)	2(6.67)	8.33	1(3.33)	2(6.67)	3

Freq. = Frequency of respondents

Table 5: Average of land holdings per dairy farmers

Land allocation	Asella			Bishoftu		
	Typical (n=30)	Entrepreneurial (n=30)	Overall	Typical (n=30)	Entrepreneurial (n=30)	Overall
	Mean(SE)	Mean(SE)	Mean(SE)	Mean(SE)	Mean(SE)	Mean(SE)
Land holding (ha)						
Total land	0.42±0.10	0.78±0.25	0.60±0.12	0.62±0.25	0.42±0.12	0.48±0.12
Annual crops	0.24±0.08	0.34±0.09	0.29±0.06	0.47±0.20	0.22±0.09	0.34±0.11
Sown grass	0.03±0.01	0.07±0.02	0.05±0.12	0.01±0.01	0.05±0.02	0.03±0.01
Grazing land	0.01±0.01	0.03±0.02	0.02±0.01	0.04±0.02	0.02±0.01	0.03±0.01
Under building	0.04±0.01	0.06±0.01	0.05±0.01	0.06±0.01	0.07±0.02	0.07±0.01
Homegarden	0.02±0.01	0.09±0.07	0.05±0.03	0	0.01±0.01	0.01±0.01
Land for other	0.07±0.03	0.19±0.08	0.13±0.04	0.01±0.01	0.02±0.01	0.01±0.01

SE= Standard error

4.1.3. Water sources

The main source of water for dairy farming in study areas is presented in Table 6. Almost all respondents in both study areas obtained water from tap 100%. However, few respondents of the dairy farmers in Bishoftu and Asella obtained water from borehole/well and rivers when tap water was not available.

4.1.4. Source of livelihood strategies

4.1.4.1. *On-farm and off-farm livelihood strategies*

The main sources of on-farm and off-farm livelihood strategies of the dairy farmers in the study areas were presented in Table 7 and 8. The major on-farm livelihood strategy was mainly dairy cattle/milk 100% in both study areas. Of the source of off-farm livelihood strategies, private business not related to agriculture accounted majorly 51.67% and 31.67% in Asella and Bishoftu area, respectively.

Table 6: Water sources for dairy farming

Source of Water	Bishoftu						Asella					
	Typical (n=30)		Entrepreneurial (n=30)				Typical (n=30)		Entrepreneurial (n=30)			
	N	%	R	N	%	R	N	%	R	N	%	R
Tap water	30	100	1	30	100	1	30	100	1	30	100	1
Boreholes / wells	6	20	2	6	20	2	1	3.33	3	1	3.33	3
Rivers / lakes	0	0	-	1	3.33	3	5	16.66	2	7	23.33	2
Natural springs	0	0	-	0	0	-	0	0	-	1	3.33	-3

N= Frequency of respondents; %= Percentage of respondents; R= Rank

4.1.5. Major sources of food and income

The major sources of food and income contributed to livelihood obtained from both combinations of on-farm and off-farm activities are presented in Figure 6. The sources of income and food

come from on-farm activities were significantly greater than off-farm activities in both study areas ($P < 0.05$).

4.1.6. Dairy farming experience

The farming experiences of dairy farmers are presented in Table 9. About 50% and 30.55% of the farm have experience ranging between 10-15 years in Asella and Bishoftu, respectively. The lowest frequency of respondents had greater than 20 years experiences in both study areas. However, the entrepreneurial dairy farmers had long years of farming experience as compared to typical dairy farmers in both study areas.

Table 7: On-farm livelihood activities of dairy farmers

On-farm activities	Bishoftu					Asella				
	Typical (n=30)		Entrepreneurial (n=30)		Overall (%)	Typical (n=30)		Entrepreneurial (n=30)		Overall (%)
	Freq.	%	Freq.	%	%	Freq.	%	Freq.	%	%
Dairy	30	100	30	100	100	30	100	30	100	100
Other livestock	14	46.66	8	26.66	36.67	13	43.33	10	33.33	38.33
Crop production	10	33.33	7	23.33	28.33	10	33.33	5	16.66	25
Fattening cattle	8	26.66	6	20	23.33	2	6.66	4	13.33	10
Tree planting	3	10	0	0	5	6	20	4	13.33	16.67
Heifers for sale	1	3.33	4	13.33	8.33	2	6.66	3	10	8.33
Backyard garden	1	3.33	4	13.33	8.33	2	6.66	3	10	8.33
Cash crops	1	3.33	0	0	1.67	1	3.33	4	13.33	8.33

n= Number of dairy farmers respondents; Freq. = Frequency of respondents in each activities

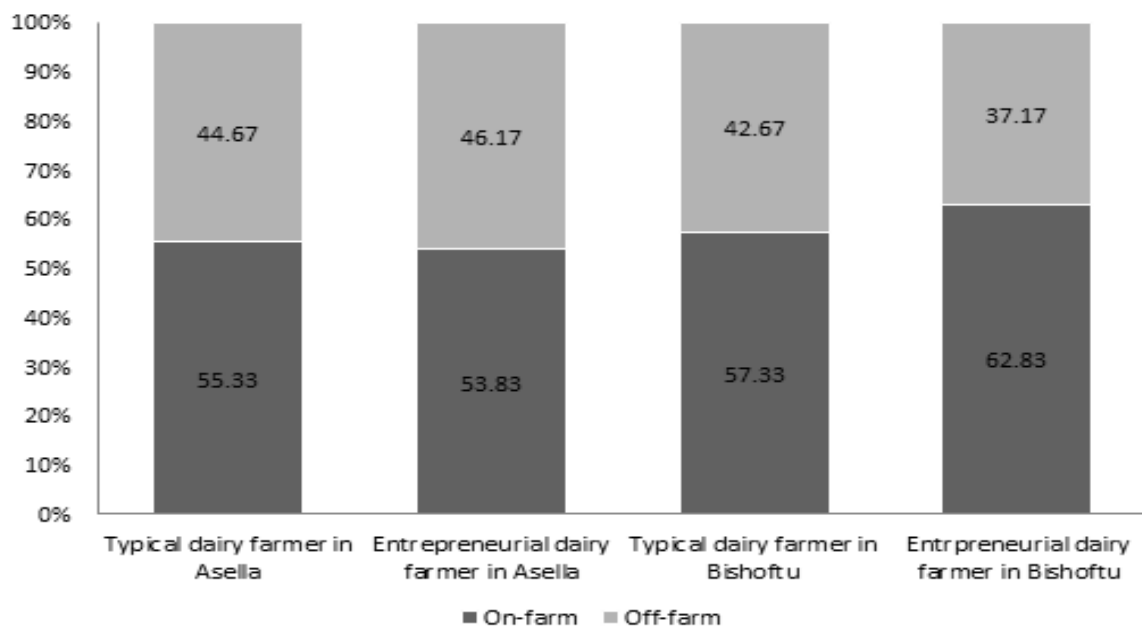


Figure 6: Proportion of food and income from on-farm and off-farm activities

Table 8: Off-farm livelihood activities of dairy farmers

Off-farm	Bishoftu					Asella				
	Typical (n=30)		Entrepreneurial (n=30)		Overall (%)	Typical (n=30)		Entrepreneurial (n=30)		Overall (%)
	N	%	N	%	%	N	%	N	%	%
Own private business, not agriculture-related	9	30	10	33.33	31.67	14	46.66	17	56.66	51.67
Rental properties	7	23.33	9	30	26.67	7	23.33	2	6.66	15
Pension	3	10	2	6.66	8.33	7	23.33	4	13.33	18.33
Employed by government/private	4	13.33	2	6.66	10	5	16.66	3	10	13.33
Remittances from relatives (overseas)	3	10	5	16.66	13.33	3	10	1	3.33	6.67
Casual labour outside agriculture	2	6.66	2	6.66	6.67	3	10	1	3.33	6.67
Casual labour on other farms	0	0	2	6.66	3.33	4	13.33	1	3.33	8.33

n= number of respondents; N= Frequency of respondents in each activities

Table 9: Farming experiences of dairy farmers in the study areas

Years	Bishoftu					Asella				
	Typical (n=30)		Entrepreneurial (n=30)		Overall (n= 60)	Typical (n=30)		Entrepreneurial (n=30)		Overall (n= 60)
	N	%	N	%		N	%	N	%	
less than 5 years	5	16.67	3	10	8(13.33)	4	17.78	7	26.67	11(21.67)
5- 10 years	4	13.33	6	20	10(16.67)	9	30	5	16.67	14(23.33)
10-15 years	17	56.67	13	43.33	30(50)	10	28.89	8	32.22	18(30.55)
16-20years	3	10	5	16.67	8(13.33)	2	6.67	7	23.33	9(15)
greater than 20	1	3.33	3	10	4(6.67)	5	16.67	3	10	8(13.33)

N= Frequency of respondents; n= number of respondents; Results in brackets show percentage

4.1.7. Cattle breed possession and composition

4.1.7.1. *Indigenous cattle breed*

The mean and standard error of indigenous breed cattle herd size and composition in both study areas is indicated in Table 10. Oxen 1.02 ± 0.25 contributed the highest herd size followed by local lactating cows 0.03 ± 0.23 in Asella areas. In Bishoftu areas, the overall average herd size of oxen was the highest 0.27 ± 0.09 followed by dry cows 0.05 ± 0.03 . Total numbers of oxen was relatively greater for entrepreneurial dairy farmers in both study areas.

4.1.7.2. *Crossbred cattle*

Table 11 indicates the mean and standard error of crossbred cattle herd size and composition in both study areas. In both areas, milking cows was higher followed by heifers. Overall mean \pm SE of milking cows number was accounted 2.61 ± 0.33 and 3.45 ± 0.36 in Asella and Bishoftu areas, respectively. The number of milking cows of entrepreneurial dairy farmers in Bishoftu was significantly higher than entrepreneurial dairy farmers in Asella ($P < 0.05$).

4.1.8. Milk production during rainy and dry seasons, and purposes of producing milk

Table 12 indicates the overall averages milk yield for all lactating cows during the rainy and dry seasons. Overall averages milk productions for all lactating cows in both study areas were significantly higher during the rainy seasons than dry seasons ($P < 0.001$). The mean and standard error milk production during both seasons was significantly higher for entrepreneurial dairy farmers than typical dairy farmers in Bishoftu and Asella areas ($P < 0.001$).

The main aim of dairy farmers for producing milk is shown in Figure 7. In both study areas, the objective of keeping dairy cattle was mainly to obtain income. As a result, 93.17% and 94.12% of the entrepreneurial dairy farmers in Asella and Bishoftu, respectively said they produce milk for sale. The typical dairy farmers in Asella and Bishoftu areas were also producing milk for sale 87.97% and 92.13%, respectively. There was also a significant difference ($P < 0.01$) in milk consumption and selling between the entrepreneurial and typical dairy farmers in both Bishoftu and Asella areas.

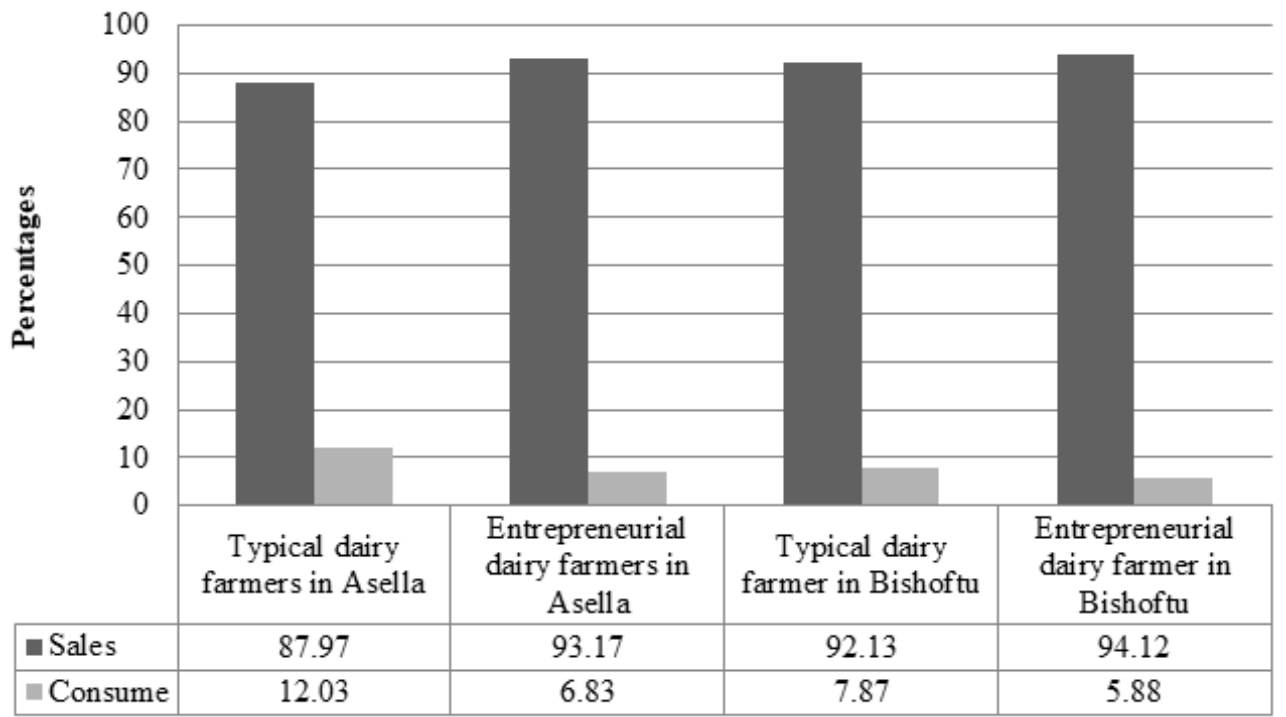


Figure 7: Proportion for purposes of producing milk

Table 10: Average indigenous cattle herd size and composition per farm in the study areas

Indigenous	Asella			Bishoftu		
	Typical (n=30)	Entrepreneurial (n=30)	Overall (n=60)	Typical (n=30)	Entrepreneurial (n=30)	Overall (n=60)
	Mean (SE)	Mean (SE)	Mean (SE)	Mean (SE)	Mean (SE)	Mean (SE)
Milking cows	0.07±0.05	0	0.03±0.23	0.1±0.06	0	0.05±0.03
Dry cows	0	0.03±0.03	0.02±0.02	0.1±0.07	0.07±0.05	0.08±0.04
Heifers	0.03±0.03	0.03±0.03	0.03±0.02	0.03±0.03	0.03±0.03	0.03±0.23
Calves	0.03±0.03	0	0	0.03±0.03	0.03±0.03	0.03±0.23
Bulls	0	0	0	0	0.1±0.1	0.07±0.05
Oxen	0.8±0.23	1.23±0.44	1.02±0.25	0.27±0.12	0.27±0.12	0.27±0.09

n = number of respondents; SE= Standard error

Table 11: Average crossbred cattle herd size and composition per farm in the study areas

Crossbred	Asella			Bishoftu		
	Typical (n=30)	Entrepreneurial (n=30)	Overall (n=60)	Typical (n=30)	Entrepreneurial (n=30)	Overall (n=60)
	Mean (SE)	Mean (SE)	Mean (SE)	Mean (SE)	Mean (SE)	Mean (SE)
Milking cows	1.53±0.09	3.7±0.59	2.61±0.33	1.97±0.11	4.93±0.60	3.45±0.36
Dry cows	0.53±0.10	0.93±0.36	0.73±0.19	0.73±0.14	0.93±0.25	0.83±0.14
Heifers	0.63±0.11	1.37±0.30	1.1±0.17	0.83±0.16	2.33±0.35	1.58±0.21
Calves	0.6±0.10	1.6±0.26	1.1±0.15	0.6±0.11	1.27±0.39	0.93±0.21
Bulls	0.03±0.03	0.17±0.08	0.08±0.04	0	0.2±0.10	0.1±0.05
Oxen	0	0.1±0.07	0.05±0.04	0	0.03±0.03	0.02±0.02

n = number of respondents per smallholder dairy farmers; SE= Standard error;

Table 12: Overall average milk production during rainy and dry seasons for all lactating cows

Location	Smallholder dairy farmers	N	Average milk production for all milking cows	
			Rainy season	Dry Season
			Mean \pm SE	Mean \pm SE
Asella	Typical	30	16.77 \pm 1.08	16.75 \pm 1.01
	Entrepreneurial	30	38.97 \pm 4.39	38.37 \pm 4.86
	Overall	60	27.87 \pm 2.67	27.61 \pm 2.84
	P-value		***	***
Bishoftu	Typical	30	23.7 \pm 1.52745	22.47 \pm 1.53
	Entrepreneurial	30	63.23 \pm 6.38	60.33 \pm 6.08
	Overall	60	43.47 \pm 4.14	41.4 \pm 3.97
	P-value		***	***

N= Number of respondents; SE= Standard error; ***= highly significant (p<0.001)

4.2. Coping Strategies of Dairy Farmers and their Potential Solution to Risks Associated with Dairy Farming

4.2.1. Prioritized risks associated with the dairy farming

The most important risks associated with dairy farming were prioritized based on the perception of the respondents as indicated in (Table 13 and Table 14). Both typical and entrepreneurial dairy farmers in Bishoftu ranked risks into 1st, 2nd, and 3rd. As the result feed shortage was ranked as key risks to dairy-farming followed by diseases, parasites and pests, and poor genetics and reproduction in areas.

The typical and entrepreneurial smallholder dairy farmers in Asella area mainly ranked diseases, parasites and pests as key risk followed by feed shortage, and difficulties with access to inputs & services in terms of price, quality or availability in (Table 13). Focus group discussion participants ranked by voting the main risks threatening their dairy farming. However, the output of rank of FGDs varied within groups to groups even dairy farmers categories, and more or less the rank was identical to survey results indicated in (Table 15). FGDs results also showed that the

entrepreneurial dairy farmers had interested to risk taker than risk aversion. However, some of the typical farmers in FGDs were reluctant to take risks; in case they want to avoid/prevent risks before it arose, and they were not effectively and efficiently applied all the components, capacity, and resources to recover it while the risks arose.

Table 13: Major risks of dairy farming ranked by dairy farmers in Asella areas

Risk	Asella							
	Typical (n=30)				Entrepreneurial (n=30)			
	R.1	R. 2	R. 3	Index	R.1	R. 2	R. 3	Index
Feed shortage	9	6	1	0.22	9	5	6	0.23
Diseases, parasites and pests	11	2	9	0.25	10	9	1	0.27
Difficulties with access to inputs & services in terms of price & quality	4	7	3	0.16	4	8	10	0.21
Market fluctuations in demand for/ price of milk	2	7	5	0.13	6	5	7	0.19
Issues of poor genetics & reproduction	3	7	3	0.14	1	2	3	0.06
Water shortage (on-going)	-	-	3	0.01	-	1	1	0.02
Environmental impact/Manure-waste disposal and management	1	1	6	0.06	-	-	2	0.01

Index = $(3 \times \text{Number of responses for 1st rank} + 2 \times \text{Number of responses for 2nd rank} + 1 \times \text{Number of responses for 3rd}) \div (3 \times \text{Total responses for 1}^{\text{st}} \text{ rank} + 2 \times \text{Total responses for 2}^{\text{nd}} \text{ rank} + 1 \times \text{Total responses for 3rd rank})$; n= number of respondents

4.2.2. Dairy farmers' coping strategies to deal with diseases, parasites and pests

Dairy farmers used different coping mechanisms to deal with disease, parasites, and pests as presented in (Table 16). Typical and entrepreneurial dairy farmers in Bishoftu area indicated that use of vaccination, treatment by a veterinarian, animal & barn hygiene, improve housing or sheds and deworming with commercial drugs were the major coping strategies to deal with diseases, parasites, and pests. Typical and entrepreneurial smallholder dairy farmers respondents in Asella

area exhibited in (Table 16), used of improving housing or sheds, proper animal & barn hygiene, treatment by a veterinarian or animal health worker, and vaccination was the main strategies to cope with diseases, parasites, and pests. Female typical FGDs dairy farmers in Asella pointed out that the use of the traditional medicine to deal with bloating of cattle by blending of oil, soap, and chill to solve the risks. Similarly, the female-typical FGDs dairy farmers in Bishoftu were indicated that use of the traditional medicine such as the leaf of Milia tree, drenching of coca cola and Beer (Kidus Gyorgis Beer) has been common in the community to deal with bloating of dairy cattle.

Table 14: Major risks of dairy farming ranked by dairy farmers in Bishoftu area

Risk	Bishoftu							
	Typical (n=30)				Entrepreneurial (n=30)			
	R.1	R. 2	R.3	Index	R.1	R.2	R.3	Index
Feed shortage	22	6	1	0.43	18	8	1	0.39
Diseases, parasites and pests	5	10	8	0.23	11	9	5	0.31
Difficulties with access to inputs & services in terms of price & quality	1	1	2	0.04	1	2	1	0.04
Market fluctuations in demand for/ price of milk	0	5	4	0.08	0	3	5	0.06
Issues of poor genetics & reproduction	2	2	8	0.1	0	4	11	0.11
Water shortage (on-going)	0	0	2	0.01	0	0	2	0.01
Labor scarcity	0	0	2	0.01	0	1	1	0.02
Environmental impact/Manure-waste disposal and management	0	6	3	0.08	0	3	4	0.05

Index = $(3 \times \text{Number of responses for 1st rank} + 2 \times \text{Number of responses for 2nd rank} + 1 \times \text{Number of responses for 3rd}) \div (3 \times \text{Total responses for 1st rank} + 2 \times \text{Total responses for 2nd rank} + 1 \times \text{Total responses for 3rd rank})$; n= number of respondents

4.2.3. Dairy farmers coping strategies to deal with feed shortage

Table 17 indicates dairy farmers coping mechanisms to deal with feed shortage. In Bishoftu area, both typical and entrepreneurial dairy farmers indicated that use of crop residues, feed supplements; haymaking and fodder were the potential solutions to deal with feed shortage. In Asella area, both typical and entrepreneurial dairy farmers showed that use of crop residues purchased supplementary feed and home processing of mixed rations were the major potential solutions to cope with feed shortage. FGDs in both study areas also indicated that the practice of feeding dairy cattle on crop residues and supplementary feed was found to be a very important strategy to deal with feed shortage. FGDs also pointed out the establishing of different legumes trees and fodder in fence was best strategies to deal with feed shortage.

4.2.4. Dairy farmers coping strategies to deal with the issues of poor genetics and reproduction

Dairy farmers coping mechanisms to deal with issues of poor genetics are presented in (Table 18). In study areas, both typical and entrepreneurial dairy farmers indicated that used of good supplementary feed, proper heat detection and use of AI by government and private technician were the major coping mechanisms to deal with the issues of poor genetics and reproduction. In Asella, 30% of typical dairy smallholders used improved bull service, while none did in Bishoftu. In both study areas, the major information source to deal with issue of poor genetics obtained from AI technicians and other farmer. Dairy farmers in FGDs pointed out the adopted different coping strategies to deal with risks associated with dairy farming depend on the availability and costs of strategies, financial resources, accurate of information source, extension worker, educational status, farming experience, technology, knowledge and skill, physical assets and livelihood strategies.

Table 15: Major risks-of dairy farming ranked by dairy farmers' focus group discussions of participation in study areas

Risks	Asella			
	Typical		Entrepreneurial	
	FTFGD.	MTFGD.	FEFDG.	MEFGD.
	1 rank	1 rank	2 rank	2 rank
Feed shortage	5	1	4	3
Diseases, parasites and pests	2	2	5	1
Market Fluctuation	1	3	2	5
Difficulties input supply	4	5	1	4
Issues of poor genetics	3	4	3	2

Risks	Bishoftu			
	Typical		Entrepreneurial	
	FTFGD.	MTFGD.	FEFDG.	MEFGD.
	1 rank	1 rank	2 rank	2 rank
Feed shortage	1	1	1	1
Diseases, parasites and pests	5	2	2	3
Market Fluctuation	4	5	5	2
Difficulties input supply	3	4	4	5
Issues of poor genetics	2	3	3	4

FTFGD.1= Female typical focus group discussion one; FEFDG2= Female entrepreneur focus group discussion two; MEFGD1= Male typical focus group discussion one; MEFGD2= Male entrepreneur focus group discussion two

Table 16: Frequency of dairy farmers per practices areas to deal with diseases, parasites and pests in study areas

Practices areas	Bishoftu				Asella			
	Typical (n=23)		Entrepreneurial (n=25)		Typical (n=22)		Entrepreneurial (n=29)	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Spraying of animals	0	0	6	24	1	4.55	3	10.34
Dipping of animals	0	0	1	4	0	0	1	3.44
Vaccination	21	91.30	24	96	18	81.82	19	65.52
Treatment by veterinarian or animal health worker	21	91.30	22	88	21	95.45	20	68.97
Self-administered drugs to cure diseases	0	0	3	12	6	27.27	12	41.38
Deworming with commercial drugs	12	52.17	19	76	8	36.36	14	48.28
Deworming with traditional medicine	1	4.35	2	8	0	0	1	3.44
Culling of affected animals	5	21.74	7	28	0	0	3	10.34
Improve housing or sheds	17	73.91	22	88	21	95.45	25	86.21
Proper animal & barn hygiene	20	86.96	25	100	21	95.45	22	75.86
Improve animal nutrition	1	4.35	18	80	16	72.73	16	55.17
Use of traditional medicines for disease prevention	2	8.69	2	8	2	9.09	1	3.44
Use of traditional medicines to cure diseases	0	0	1	4	1	4.55	0	0

Freq. = Frequency of dairy farmers per practices area; n= number of respondents selected risks

Table 17: Frequency of dairy farmers per practices areas to deal with feed shortage in study areas

Practices areas	Bishoftu				Asella			
	Typical (n=29)		Entrepreneurial (n=27)		Typical (n=16)		Entrepreneurial (n=13)	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Hay making	8	27.58	14	51.85	5	31.25	5	38.46
Silage making	0	0	3	11.11	0	0	0	0
Use of crop residues from purchasing or own farm	29	100	27	100	16	100	13	100
Fodder	22	75.86	22	81.48	6	37.5	10	76.92
Use commercial mineral supplements / premix	2	6.90	20	74.07	14	87.5	13	100
Use of supplement feed	29	100	27	100	15	93.75	13	100
Home processing of mixed ration	12	41.38	16	59.25	4	25	10	76.92

Freq. = Frequency of dairy farmers per practices area; n= number of respondents selected risks

4.2.5. Dairy farmers coping strategies to deal with the steady supply, affordability, and quality of external inputs and services

In both study areas, both typical and entrepreneurial dairy farmers reported that having good relationship with input suppliers, credit from input suppliers, buying inputs from authorized dealers and reduction in external input were the major coping strategies to deal with the issues of difficult inputs supply in (Table 19). FGDs pointed out that entrepreneurial dairy farmer had ability to deal with risks associated with dairy farming as compared to typical dairy farming. Because the entrepreneurial FGDs bought inputs for example feed when they are available at low price than typical dairy farmers. Some of the community of focus group discussions in Bishoftu also prepared home ration such as chicken manure, and mixed grains to deal with the difficulties of input supply in terms of price.

Table 18: Frequency of dairy farmers per practices areas to cope with issues of poor genetics and reproduction

Practices areas	Bishoftu				Asella			
	Typical (n=12)		Entrepreneurial (n=15)		Typical (n=13)		Entrepreneurial (n=8)	
	Freq	%	Freq.	%	Freq.	%	Freq.	%
Good feeding (supplements, quality fodder)	10	83.33	13	86.67	10	76.92	8	100
Keeping breeding and calving records	1	8.33	3	20	2	15.38	7	87.5
Proper heat detection	10	83.33	11	73.33	11	84.62	8	100
Use AI by government technician	8	66.67	11	73.33	10	76.92	8	100
Use AI by technician from cooperative	3	25	5	33.33	0	0	3	37.5
Use AI by private technician	10	83.33	9	60	7	53.84	5	62.5
Use bull service	0	0	0	0	4	30.75	1	12.5

Table 19: Frequency of dairy farmers per practices areas to deal with difficulties to inputs supply

Practices areas	Bishoftu		Asella	
	Typical (n=4)	Entrepreneurial (n=4)	Typical (n=14)	Entrepreneurial (n=22)
	Freq. (%)	Freq. (%)	Freq. (%)	Freq. (%)
Maintain good relationship with agro vet and other input suppliers	3(75)	3(75)	9(64.29)	10(45.45)
Took credit from stockist / delayed payment to service provider/input supplier	1(25)	2(50)	8(57.42)	6(27.27)
Contracting on input supply with processor	1(25)	1(25)	1(7.14)	2(9.09)
Keep records on incomes and expenditures	2(50)	1(25)	0	3(13.64)
Buy from authorized dealers	2(50)	4(100)	2(14.29)	5(22.73)
Reduce purchase of external inputs	1(25)	2(50)	4(28.57)	6(27.27)
Ask for advice	0	0	8(57.42)	3(13.64)

4.2.6. Dairy farmers coping strategies to deal with the risks of market milk demand or price fluctuation

The major coping strategies of entrepreneurial and typical dairy farmers in Bishoftu area indicated that sale to cooperative society, and sale to private processors to deal with market milk demand or price fluctuation “in Table 20”. However, both entrepreneurial and typical dairy farmer in Asella area were sale to informal trader/merchant, restaurant, cafe and hotel and home processing to deal with market milk demand or price fluctuation “in Table 20”.

Table 20: Frequency of dairy farmers per practices areas to deal with market fluctuations

Practices areas	Bishoftu				Asella			
	Typical (n=9)		Entrepreneurial (n=8)		Typical (n=14)		Entrepreneurial (n=18)	
	Freq.	%	Freq.	%	Freq	%	Freq.	%
Collective sale of milk (cooperative society)	4	44.44	3	37.5	0	0	0	0
Sell to private processor	6	66.66	4	50	0	0	0	0
Sell to merchant / trader / broker / hawker	0	0	0	0	12	85.71	16	88.89
Home processing milk for local marketing	4	44.44	3	37.5	4	28.57	6	33.33
Divide milk between different milk buyers / collectors	0	0	1	12.5	2	14.29	4	22.22
Contracting with buyer	1	11.11	2	25	3	21.43	6	33.33
Shift to buyer with better conditions (higher price	1	11.11	0	0	0	0	1	5.56
Recording of milk production and sales	3	33.33	2	25	3	21.43	5	27.78
Hygienic milking and milk handling	1	11.11	3	37.5	3	21.43	6	33.33
Adjust milking time to meet collection time	2	22.22	1	12.5	0	0	1	5.56

4.3. Resilience of dairy farming

The resilience score of smallholder dairy farmers' types to deal with the most important risks that they face in dairy farming is presented in (Figure 8 and Appendix Table 1). The radar graph (Figure 8) values indicated that the resilience score were increased from closer to farther away from the center of the radar graph (30 near the center of axis which indicates low resilience and 80 at the outer axis which indicates more resilience). The value indicated that those dairy farmers' types who mobilize the full components of resilience which means that the more combination of practices and resources to deal with risks related to dairy farming had the higher resilience score. The results indicated that the entrepreneurial dairy farmer in Bishoftu was more resilience than typical dairy farmer to deal with risks faced in dairy farming. Similarly, the entrepreneurial dairy farmers in Asella were more resilience than typical dairy farmer to deal with risks that affected dairy farming.

The typical dairy farmer respondents were not utilized all the practices and resources to deal with risks just like the entrepreneurial dairy farmers. FGDs results also indicated that all of the entire entrepreneurial participants were educated, and they were aware of knowledge and skill of strategically planning of dairy farming in long-term than gained through experience over typical dairy farmer participants.

The mean \pm SE resilience level of dairy farmer's types to deal with risks that faced in dairy farming also indicated in (Appendix Table 1). There was significant difference ($P < 0.05$) between the two dairy farmers types in Bishoftu to deal with risks such as diseases, parasites and pest, feed shortage and market fluctuation. Also, in Asella areas, there was significant difference ($P < 0.05$) between the entrepreneurial and typical dairy farmers to deal with risks such as: diseases, parasites and pests, manure management and issues of poor genetics and poor reproduction. The mean \pm SE value of entrepreneurial dairy farmers were higher than typical dairy farmers to deal with all risks associated with dairy farming except water shortage in Asella and manure managements in Bishoftu.

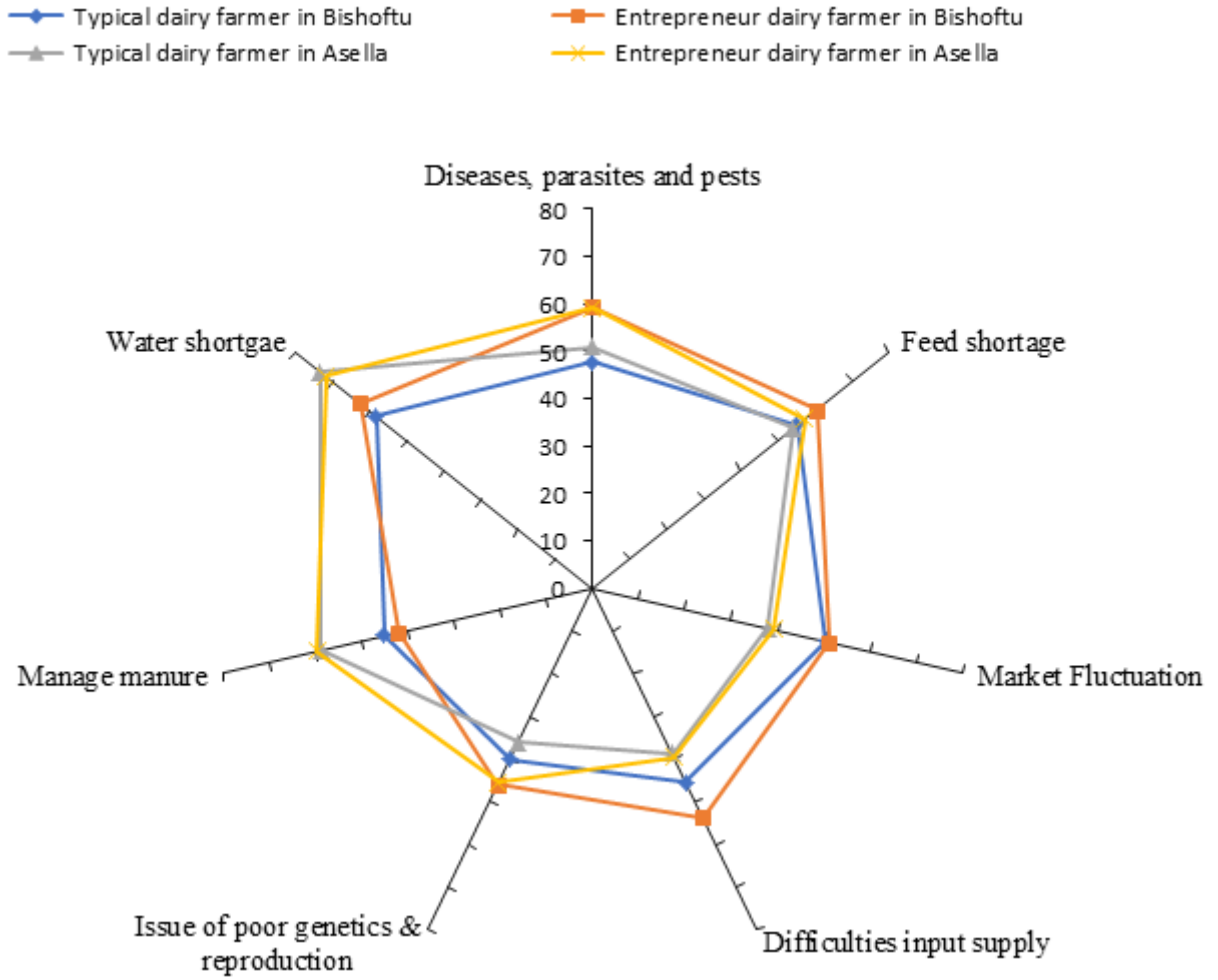


Figure 8: Radar graph comparing the resilience score of entrepreneurial and typical dairy farmers to deal with risks faced in dairy farming in Bishoftu and Asella areas

5. DISCUSSION

5.1. Farming Characteristics

The majority of the respondents were females in both study areas. The results were 53.33% in Bishoftu and 51.67% in Asella. This result was consistent with the report of (Katongole *et al.* (2012) and Aweke and Mekibib (2017) who reported that the majority of respondents were female 63.3% in Kambala (Uganda) and 53.8% in the small-scale dairy farming in Addis Ababa (Ethiopia), respectively. The result also agrees with the finding of an author who reported that the proportion of women dairy cattle respondents was higher compared to men owners in Bishoftu town (Tadesse.*et. al.*, 2014a). The result was inconsistent with the study of Tessema *et al.* (2013) who had reported that 78.87% of respondents were male. However, the ratios of male respondents were found in the entrepreneurial dairy farmer, and more ratios of female respondents were higher in the typical dairy farmer in both study areas. The associations of sex of respondents between dairy farmers in both study areas was significant ($P < 0.05$). The majority of the respondents in both study areas were farm owners, which agreed with the reports made by Moges (2015) and (Aweke and Mekibib, 2017).

The ages of majority dairy farmers in Bishoftu area ranged between 31-40 years which accounted 31.67%. This result was related to the finding of Hamza *et al.* (2015) who reported 30-40 years 45% in southern Sudan. This result showed that people in the most productive age are actively engaged in dairy farm activities which in turn have a capacity to build the resilience of dairy farming for long-term sustainability. In contrary, the ages of dairy farmers in Asella area ranged between 41-50 years 30%. This result agrees with the finding of Welearegay *et al.* (2012) reported that ranges of 40-45 years in the Hawasa city. The present study was consistent with the finding of Tessema *et al.* (2013) who reported that the average age of household heads was 45 years in Adama-Asella Milk shed. However, the ages of most entrepreneurial dairy farmer in both study areas ranged between 31-40 years. This indicated that those entrepreneurial dairy farmers were actively engaged in dairy farming management helps to achieve higher resilience as compared to typical dairy farming.

Education is an important entry point for empowerment of communities and an instrument to sustainable development. In this context, the majority of the respondents in both study areas were educated except the typical smallholder dairy farmers; a few respondents were illiterate or never went to school. About 30%, 38.33%, 18.33%, and 8.33% of the interviewed dairy farmers in Bishoftu area had the primary, secondary, college and university education, respectively. And also about 43.33%, 40%, 6.67%, and 3% of the interviewed dairy farmers in Asella area had the primary, secondary, college and University education, respectively. The finding was agreement with the study of Tadesse *et al.* (2014b) who had reported that 73% of households were the secondary school, 20% primary school, 5% diploma holder, and 3% were illiterate the case of in Ada'a Liben Woreda.

The proportion of dairy farmers who had college and university education in the current study was lower than the result of Mekasha *et al.* (2002) who reported that 24 % for Harar town (Ethiopia), and the result of Duguma and Janssens (2016) who reported that 35.5% and 7.4% in Jimma town. Majority of the respondents in the present study had formal education which is important to understand extension messages and to realize the importance of new technologies within a short time. These were because of evidence from FGDs results that revealed all of the entrepreneurial participants were educated, and they were aware of knowledge and skills for strategically planning dairy farming in long-term than typical dairy farmer participants. According to Ofuoku *et al.* (2009), farmers with high educational levels usually adopt new technologies more rapidly than lower educated farmers. Adebabay (2009) suggested that the role of education is obvious in affecting household income, adopting technologies, demography, health, and as a whole the socio-economic status of the family as well.

Water is the basic element for milk production. Even if all the necessary inputs are available for the milking cows, having sufficient water is important for the dairy farming. In this regard, the majority of typical and entrepreneurial dairy farmers in both study areas obtained water from tap water, although few dairy farmers obtained water from well/bores at times when tap water is not available. The majority (81.3 %) of the respondents use tap water and well water source of water and only 18.7% of respondents use a combination of river, well and tap water as source of water in Mekelle City (Solomon, 2014). This result was consistent with the reported of Birhanemeskel

et al. (2016) in an urban town of Adgirat (Ethiopia). In contrary, Abebe (2012) reported in the highlands of Blue Nile basin the rivers, ponds, and wells are major sources of drinking water for livestock.

Dairy farmers in the study areas allocated total land to different use and cover type. The overall averages of total land size possessed in Asella were 0.60 ± 0.12 ha, out of which 0.29 ± 0.06 ha and 0.02 ± 0.01 ha of land were allocated for annual crops and grazing land, respectively. In the Bishoftu town, the average landholding 0.48 ± 0.12 ha was slightly lower than Asella. About 0.34 ± 0.11 ha and 0.03 ± 0.01 ha of land was used for annual crops and grazing land. This result was lower than the study of Wondatir (2010) who reported that the overall average land holding per household in Debre Birhan was 1.8 ha, out of which 1.1 and 0.7 ha of land were allocated for crop production and grazing, respectively. In the present study area, annual crop production covers major holding areas while grazing land and other cover or shares lower. This could be due to most of the dairy farmers owning total land by rented in from other farmers was not comfortable for sown grass and fodder, and grazing land. They were enforced to sown annual crops and used crop residues for feeding cattle. This result was consistent with Afework (2011) who reported that the urban dairy farmers of Harar city had too small land holding per dairy farmers to serve for dairying.

Livelihood strategies are the combination of activities that people choose to undertake in order to achieve their life goals (UNCDF, 2005). Diversification of livelihoods both on the farm and non-farm activities are among the major policy areas for building resilience to the turbulent environment and reducing vulnerability (Yaro, 2013). In this context, both on-farm and off-farm livelihood strategies contributed to sustaining livelihood strategies in both study areas for typical and entrepreneurial dairy farmer to deal with risks further building resilience. The result was consistent with the finding of Addisu (2017) who reported that livelihood strategies of the farmer depended on the combination of on-farm and off-farm activities. The present study also revealed that the sources of income and food from on-farm activities were significantly greater than off-farm activities in both study areas ($P < 0.05$). The results were comparable with the finding of Terefe *et al.* (2014) who reported that the sources of income for livelihood strategies of Dale and Shebedino woreda of Southern Ethiopia mainly come from on-farm activities than off-farm.

However, the result was inconsistent with the finding of (Deresse *et al.*, 2008) that did that very small proportion of farmer in Ethiopia has access to off-farm income. Of the on-farm livelihood strategies the contribution of livestock production particularly dairy cattle/milk for livelihood goal was the most important activity for nearly (100%) contributed in both study areas even in both smallholder dairy farmers groups, which is not surprising as selected dairy farmers. This could be due to the fact that were in and around towns and the dairy farmers obtained food and income both from combination of on-farm and off-farm activities. This could be also due to the correlation between investment in dairy and outside income sources.

Getting high income from milk empowered farmers economically and triggered them to get more dairy technologies. Other livestock productions such as sheep, goats, poultry, and horses are the second contribution to livelihood strategies. This result agreed with the finding of Gizaw *et al.* (2016) who reported that livestock production contributes about 100% to livelihood in urban dairy farmers in the highland of Ethiopia. Among the off-farm activities, the own private business which was not related to agriculture was the major activity that contributed to livelihood in both study areas. The FGD results also showed that livestock outputs make the major part of daily food basket of the people. Selling of livestock and their products (like milk and egg) was the major source of income for the households. In addition, livestock especially dairy cattle have a great role in determining wealth status and social interactions of the community. Because wealth is an important factor in the recovery process of dairy farmer affected by shocks and stressors. The result was consistent with the theory of Pica-Ciamarra *et al.* (2011) who reported that livestock provide cash income or income in kind through the sale of animals and / or the sale and consumption of milk, meat, eggs and other animal products, and form of savings (capital growth through herd growth), insurance, and source of wealth.

The present study showed that the overall average milk production for all milking cows in both studies was highest during the rainy season than in the dry season. In Asella area, daily milk production during rainy season was 43.47 ± 4.14 liters/ herd and dry seasons 41.4 ± 3.97 liters/herd. While, in Bishoftu during rainy and dry seasons were accounted for 43.47 ± 4.14 liters/herd and 41.4 ± 3.97 liters/herd, respectively. They were statistically highly significant ($P < 0.01$) within the two types smallholder dairy farmers in both study areas. Welearegay *et al.*

(2012) reported that the milk production was higher during the wet season (53.9%) than dry season (0.9%) and depended on feed availability (45.6%) in the small-scale dairy farming system. The entrepreneurial smallholder dairy farmers in both study areas had a higher average milk production in both seasons as compared to typical smallholder dairy farmers which 38.97 ± 4.39 for the entrepreneurial dairy farmers during the rainy season and 16.77 ± 1.08 for the typical smallholder dairy farmer in Asella in the same season. Similarly, there was higher milk production for the entrepreneurial dairy farmers than the typical dairy farmers in Bishoftu. Because the entrepreneurial dairy farmers are those actively following their dairy cattle and consider farming as business and buy more inputs and services from outside than typical dairy farmers. This result is also consistent with the finding of Welearegay *et al.* (2012) who reported that higher milk production is accounted in medium and large dairy farmers than small-scale dairy farmers.

Comparable to most of urban and peri-urban dairy production systems in Ethiopia, dairy cattle in Bishoftu and Asella areas were mainly producing milk for market. Most urban dairy producers are engaged in the dairy business to generate income; a few households and some peri-urban keep dairy cow mainly local breeds to produce milk for household consumption. Accordingly, 93.17% and 87.97% of entrepreneurial and typical dairy farmers in Asella who sell their milk, respectively. Also, 94.12% and 92.13% of entrepreneurial and typical dairy farmers in Bishoftu sell their milk. The results were higher than the finding of Welearegay *et al.* (2012) and Sintayehu *et al.* (2008) who had reported that 78.8% and 74.2% of dairy producers in the urban area of Hawassa produce milk primarily for sale, respectively. Other authors, Megersa *et al.* (2011) reported 68.1% and 85.7% small scale and medium scale farming system in the Bishoftu areas, respectively. The reasons could be due to availability different dairy cooperatives and processors, and nearest to Addis in Bishoftu areas, and high number of consumers, more awareness of dairy farmer see as dairy cattle as income and business and nearest to Adama and Addis makes high percentages to sale milk in Asella areas.

The overall mean value of the number crossbred lactating cows per dairy farmer in Asella 2.61 ± 0.33 and Bishoftu 3.45 ± 0.36 observed in the present study was higher than what was indicated by Megersa *et al.* (2011) in central Ethiopia, Bishoftu town 1.29 ± 0.84 lactating crossbred cows

per smallholder dairy farmer). The result was much higher than the report of Mekonnen *et al.* (2010) who showed an average of (0.4) crossbred cattle per household at Dejen district, Ethiopia, but comparable to that reported by Getahun *et al.* (2008) who had indicated that an average of (4.5) per dairy farmer in Selalle area. The high average of crossbred lactating cows in the cattle herd indicated the importance of dairying for livelihood strategies of dairy farm at both Asella and Bishoftu town. Local oxen were mainly kept in the areas for ploughing purposes. The result comprised a significant number of the local cattle herd at both study area which is agreement with the reports of Desta (2002) at Selalle area and Abdinasir (2000) at Arsi area who indicated that a considerable proportion of the cattle herd was also composed of oxen. The high average of oxen in the local cattle herd is the reflection of the importance of cropping in the areas, and further the utilization of crop residue for dairy cattle, it is a mixed crop-livestock farming system.

5.2. Coping Strategies of Dairy Farmers and their Potential Solution to Risks Associated with Dairy Farming

Perceptions of risk are based on subjective believe about the occurrence of uncertain events and their subsequent outcomes. Accordingly, dairy farming in the study areas was affected by the number of risks. Dairy farmers were involved to prioritize the most important risks that threaten their dairy farming. As a result, the typical dairy farmers in Asella ranked risks based on the severity/impact on their farming as follows: diseases, parasites and pests (0.25), feed shortage (0.22), difficulties with access to inputs & services in terms of price, quality or availability (0.16), issues of poor genetics and reproduction and market fluctuation (0.13). While, the entrepreneurial dairy farmers prioritized much similar to typical dairy farmers who ranked as: diseases, parasites, and pests (0.27), feed shortage (0.23), difficulties input supply (0.21), market fluctuation (0.19) and issues of poor genetics and reproduction (0.06. Some of the participants of the entrepreneurial male FGDs in Asella area were reluctant to participate in the discussions because they were not getting immediate solutions to the outbreak of some diseases such as Lumpy skin diseases (Dhibee Gaalaa by Afan Oromo). This was because of the results from focus group showed that there was the unavailability of vaccination on regular time, especially; the outbreak of Lumpy skin disease (LSD) killed many cattle in the areas in this year The present finding was comparable with the report of Megersa *et al.* (2011) that diseases (57.1%) in medium farming of

Bishoftu was the major risks areas followed by feed shortage. Similarly, Tibeziinda *et al.* (2016) in southwestern Uganda reported that major constraints to livestock production were the disease (62%) followed by feed shortage.

Typical and entrepreneurial dairy farmers in Bishoftu prioritized feed shortage first followed by diseases, parasites and pests, issues of poor genetics, market fluctuation, and difficulties in input supply in terms of price and affordability. These results were consistent with the finding of various authors who found out feed shortage perceived as the first constraints to dairy farming followed by diseases (Katongole *et al.*, 2012; Belay *et al.*, 2013; Galmessa *et al.*, 2013; Kebede, 2015; Yetera *et al.*, 2018). The finding was comparable with the result reported at Gondar town Malede *et al.* (2015). The result was inconsistent with the finding of Megersa *et al.*, (2011) who reported diseases (57.1%) as first constraint in medium farming but similar with the reported in small-scale farming in which feed shortage (55.1%) was ranked first. Tegegne *et al.* (2006) reported that the major livestock production constraints in Ethiopia being malnutrition and under nutrition were first, followed by a high prevalence of diseases, poor genetic resource management, and poor market infrastructure. Terefe *et al.* (2014) also reported that feed shortage, access to improved breeds, market and credit services were major development constraints identified in Southern, Ethiopia.

Coping capacity refers to the ability of social system to manage and recover from adverse conditions using available skills and resources (Bahadur *et al.*, 2015). Among the major coping strategies of dairy farmers adopted to deal with the diseases, parasites, and pests in both study areas were: vaccination, treatment by veterinarian or animal health worker, deworming with commercial drugs, keeping animal and barn hygiene, culling affected animals, and improving animal nutrition. Both entrepreneurial and typical FGDs in Bishoftu area revealed that they had good opportunity to deal with diseases, parasites, and pests than in Asella area because they have accessed to many private clinics or mobile clinic, the presence of National Veterinary Institute (NVI), and Addis Ababa University College of Veterinary Medicine of Veterinary Teaching Hospital. This finding was consistent with the report of Jibat *et al.* (2015) in Ada'a district of Oromia Region of Ethiopia who reported that the public veterinary service was considered as the

preferred choice for livestock owners for its effectiveness and affordability compared to private veterinary services in their areas.

Dairy farmers in the study areas used different strategies (practices) to deal with the risk of feed shortage due to land scarcity. The entrepreneurial dairy farmers in Asella mainly used crop residues, dairy meal /industrial by products/ supplementary feeds, commercial salt premixes, home processed feeds, purchased fodders, and haymaking to overcome feed shortages. The typical dairy farmers of Asella were commonly used major coping strategies to deal with feed shortage: use of crop residues, dairy meal/industrial by products/ supplementary feeds, commercial salt premixes, and haymaking as coping strategies for feed shortage. The focus groups participants suggested that increased utilization of crop residues, cultivation of high yielding improved forages, and reducing the numbers of unproductive stock are strategies used to cope up with feed shortage. On the other hand, the FGDs pointed out that the use of non-conventional feed likes Atela and beverage of local katikala and wet brewery for dairy cows to deal with feed shortage, especially during dry season. These results are related with the finding of Belay *et al.* (2013) in Ginchi watershed (Ethiopia) who reported that increased the utilization of crop residues was ranked first for coping with feed shortage. Duguma and Janssens (2016) in Jimma town reported that the coping strategies during dry season feed scarcity were increased use of agro-industrial by-products and concentrate mix, increased use of conserved hay, increasing use of non-conventional feeds, purchasing green feeds when available and reducing herd size. Another study comparable with this study which was reported from in Jimma and Sebeta town indicated that almost all dairy farmers depend on purchased supplement feeds (Wondatir, 2010).

It was a common practice for typical and entrepreneurial dairy farmers in Bishoftu to deal with feed shortage by use of crop residues, supplementary feeds, purchase brewer's wastes, home processing ration and haymaking. The results were agreement with the study of Beyene *et al.* (2015) at Horo Guduru Wellaga while the coping strategies during dry season were using crop residue with little grazing and homemade feed like atela. Similarly, Belay *et al.* (2013) suggested that increased utilization of crop residue and production of improved forages were major coping strategies to deal with feed shortage in Ginchi watershed.

Besides, typical dairy farmers in Bishoftu mobilized the major coping strategies to deal with feed shortage indicated that use of crop residue, industrial by-products, and fodder. In contrast, to this study Katongole *et al.* (2012 and Malede *et al.* (2015) reported that the use of harvested natural forage was the primary coping strategies to deal with feed shortage in the areas. However, the male entrepreneurial focus group discussions had seriously suggested that establishing improved forage on specific land, establishing feed seed bank in the group, and improving and utilization of crop residue and hay were the recommended solution to mitigate with feed shortage. Coping strategies to deal with feed shortage of both dairy farmers in Asella and Bishoftu were almost identical except the dairy farmers in Asella area were applied some strategies of cut and carry grazing system that dairy farmers in Bishoftu. Because of land holding of per dairy farmers in Asella area was greater than in Bishoftu area. FGDs dairy farmers indicated that they adopted several strategies for coping with feed scarcity, by changing of feed resources based on availability and cost, purchasing of feed ingredients in bulk, using of crop residues, and reducing the number of unproductive cattle from the herd.

Good management can alleviate some of the stresses/risks associated with high production; producers are looking for genetic means to build a more efficient and robust cows for both current and future production environments. Genetic parameters for traits of economic importance need to be identified and validated, thus permitting the development of improved genetic evaluation systems for traits associated with cow profitability (Koeck *et al.*, 2012). In this regard, the smallholder dairy farmers in the study areas exploited different coping strategies to mitigate the issue of poor genetics and reproduction by using good feeding (quality of supplementary feed), follow up by both government and private AI technician, and a little use of bull service when a cow did not conceive by AI. Artificial insemination was the main coping strategies used by dairy farmers in both study areas to deal with issues of poor reproduction. Natural/bull service was used only when cows/heifers failed to become pregnant with AI service and when semen or AI technicians were not available.

The major inputs for livestock development include animal genetic resources, feeds and forages, veterinary drugs, vaccines, machinery equipment and utensils as well as knowledge (Tegegne *et*

al., 2006). The present study identified different coping strategies to deal with the issue of input supply, such as maintaining a good relationship with input suppliers, taking credit from stockiest/delayed payment, and reduce the purchase of external inputs. Generally, the focus group discussions result suggested that the contribution of the private sector and even the government sector in livestock/dairy input has been limited to supplies of veterinary drugs and services, roughage and concentrate feed, and processing equipment and utensils. This is especially the case in Asella areas higher than in Bishoftu. Moreover, FGDs results in Bishoftu revealed that both typical and entrepreneurial dairy farmers had an advantage over in Asella in terms of coping with difficulties of input supply. Because of the dairy farmers in Bishoftu have better access to information, better access to feed and veterinary service input (such as AKF feed supplier and varies inputs from private mobile clinics in town), AI service, and access of input credit services than the dairy farmers in Asella area.

The milk marketing system in Ethiopia is not well developed. About 98% of national milk production is marketed through informal marketing channel (Makoni *et al.*, 2014). The traditional processing and marketing of dairy products, especially traditional sour butter, dominate the Ethiopian dairy sector. Formal milk markets are particularly limited to urban and peri-urban areas of Ethiopian (SNV, 2008). However, in the present study farmers had many opportunities to sell their milk directly through the formal marketing system particularly in Bishoftu area, to deal with issues of market fluctuation. The FGDs in Bishoftu area pointed out stability or continuity of milk sales even during the fasting period. Because, the functional many dairy co-operatives and private processors such as Ada'a dairy cooperative, Genesis dairy farm, Sebeta Agro-Industry (MAMA), Holland dairy PLC and LEMA milk house has played a significant role in fostering their dairy development, primarily by providing a stable market environment and delivering services to them in the area. Oppositely, in Asella dairy farmers were forced to sell their milk through informal marketing channel and to bars, hotels, and restaurants to cope up with market challenges due to an absence of functional dairy cooperatives and milk processing in an area. Other strategies of FGDs in Asella areas mentioned that they sell their milk to Muslim followers

in bulk and change to local processing (butter and cheese) transported to Addis, Adama and Hawasa during the fasting period of time. Tessema *et al.* (2013) suggested that Asella town has a large number of Muslim inhabitants who do not have fasting culture that discourages consumption of milk and dairy products.

In general, FGDs farmers pointed out the adopted several coping strategies to deal with diseases, parasites and pests, feed shortage, issues of poor genetics and reproduction, market fluctuation, difficulties input supply, management of manure, and water shortage based on availability and cost of strategies, accurate information sources, their economic and financial situations, resources (likes physical assets), knowledge and skill, educational status, farming experience, extension worker, technology, and attitude towards risk. Hoogeveen *et al.* (2004) suggested that the best risk management strategies depend on the type of risk and on the costs, effectiveness of the available instruments, education status and infrastructure development. Risk coping strategies of farmer depend up on the attitude towards risk (risk avoider and risk taker), accurate and reliable information source and technology (Kahan, 2008).

5.3. Resilience of Dairy Farming

Change is always occurring, and if we ignore it or attempt to prevent it rigidly, we may miss opportunities or create new challenges to achieving long-term sustainability. Social-ecological systems can experience both gradual and rapid changes (Alliance, 2007). High resilient farmers perceived more opportunities in risk than low resilient farmers. They also made greater use of and gave more importance to, strategies that were associated with visualizing and positioning their business in the future, and with strategies associated with the prevention, mitigation, flexibility, and diversity to risks, compared to low resilience farmers (Shadbolt *et al.*, 2015).

In this context, the present study revealed that the entrepreneurial (positive deviant) dairy farmers were more resilient than the typical dairy farmers to deal with risks faced in dairy farming in both study areas. This was a fact because of the entrepreneurial dairy farmers applied full components of resilience (absorptive, adaptive and transformative) that used and placed more importance on strategies that coped with risk in a more proactive (ex-ante) way than ex- post risk management. This is due to a relatively better level of education among those surveyed, as well as relatively

better access to extension services, access to credit, engagement of alternative livelihoods (on-farm and off-farm), access to better technology, access to information sources, high milk production, market-oriented business, and long years of farming experience entrepreneurial dairy farmer as compared to typical dairy farmers. The study was in agreement with the finding of (Boka, 2017) who had reported that the household with better level of education, better access to extension service, better access to information, long farming experiences, alternative livelihood strategies and access to technology have the highest level of resilience in the highlands of Ethiopia.

Entrepreneurial dairy farmers were better in mobilizing resources and access the community's ability to mobilize different resources when responding to shocks or stresses than typical dairy farmers. Entrepreneurial dairy farmers placed relatively higher importance on strategies for coping with risks from strategic effective practices and resource utilization, and perspective compared to typical dairy farmers. Additionally, FGDs results indicated that all of the entrepreneurial participants were educated, and they had awareness of knowledge and skill of strategically planning dairy farming in the long-term than gained through experience over typical dairy farmer participants. This result also was consistent with the finding of Legese *et al.* (2017) who suggested that risk prevention is a part of ex-ante (buffering capacity) risk management strategy but coping with risk is a part of ex-post (adaptive capacity) risk management strategy.

The result was consistent with the literature (Shadbolt, 2016) that suggested that the entrepreneurial farmers had a positive attitude to change and an ability to successfully adapt to changing conditions. Because of resilience as moving beyond coping strategies towards achieving longer-term development (Bene *et al.*, 2012). McCarthy (2000) also suggested that the entrepreneurial farmers were typified by having a positive attitude to change and an ability to successfully adapt to changing conditions in the external environment. Comparable, these findings were consistent with Hooegeven *et al.* (2004)) who suggested that having a strategic purpose or implementing SWOT analysis were proxies for the capability of a farm business to recognize when strategic adjustments are necessary, and thus a reflection of their adaptive capacity.

Similarly, the high strategic focus may be related to recognizing that positioning the farm business for flexibility is important for coping with downside and upside risks (Darnhofer *et al.*, 2010). Shadbolt (2016) also suggested that the entrepreneurial farmer was more likely to be in a business growth stage, perceives mostly upside risk from uncertainties, produces to full capacity, does not prefer to keep debt low as a risk management strategy and was less likely to use practical planning steps. While the experienced but cautious (typical) farmer type was less likely to be in a business growth stage, was as likely to perceive the upside as the downside of risk and plays it safe by not producing to full capacity of resilience. The reason may be because of typical dairy farmer practices more on coping strategies out of components of resilience. Because coping mainly deals with the conservation and protection of the current system and institutional settings of risks associated with dairy farming. However, adaptation, by contrast, denotes a longer-term and constantly unfolding process of learning, experimentation and change that feeds into vulnerability (Pelling, 2010).

The entrepreneurial dairy farmers in Bishoftu seemed to be slightly more resilient than the entrepreneurial dairy farmers in Asella to deal with risks that faced in dairy farming. The reason why entrepreneurial dairy farmers in Bishoftu was better than in Asella as explained by FGDs results in Bishoftu that there was better access to information, somewhat better capacity (knowledge and skills, collection action, physical assets and other resources), willingness to get debt, have plan for long-term, better access to dairy cooperative society to sell their milk, business skill, bought in bulk and had access to get input supply in terms of veterinary service and feed supply. The result was consistent with the theory of coping risk management strategy that had to suggest that good risk management decisions depend on accurate and reliable information, which, in turn, help for the resilience of farmer (Kahan, 2008). FGDs in Asella showed that the available micro finance institutions in the area were not as such willing to advance loan during shocks/stresses. Consequently, dairy farmers resort to borrowing from local lenders at exorbitantly high-interest rates. These results were in agreement with (Shadbolt *et al.*, 2017) who had reported that the capacity to bounce back during and after different risks/constraints induced shocks or stresses depends on a number of households' characteristics, institutional arrangements (coping strategies), social networks, economic capacity (resources and assets) and natural setting.

6. CONCLUSION AND RECOMMENDATIONS

The result indicated that livelihood strategies of the dairy farmers were dependent on both combinations of on-farm and off-farm activities to cope with the risks which associated with dairy farming. Dairy farmers have adopted several coping strategies to deal with diseases, parasites and pests, feed shortage, issues of poor genetics and reproduction, market fluctuation, difficulties input supply, management of manure, and water shortage based on availability and cost of strategies, accurate information sources, their economic and financial situations, resources (likes physical assets), knowledge and skill, educational status, extension worker, farming experience, technology, livelihood strategies and attitude towards risk. But, these coping strategies in which dairy farmers employed to deal with risk were greatly different even within the same geographical location of the interviewed dairy farmers.

As result, the entrepreneurial dairy farmers in both study areas were relatively more resilience than the typical dairy farmers to deal with risks that faced in dairy farming. Therefore, in order to develop the resilience of dairy farmers further to ensure the sustainability of dairy farming and cope with the risks that associated with dairy farming, the dairy farmers should be aware of the capacities of resilience such as absorptive, adaptive and transformative capacity in an efficient and effective manner to deal with varies risks.

Based on the results of this study, the following recommendations are forwarded on resilience and coping with shocks/stresses of smallholder dairy farming activities in the study areas:

- To build resilience to shocks and stresses within the turbulent environment, smallholder dairy farmer must have access to appropriate resources and apply risk-mitigating strategies that support their ability to maintain progress towards development goals. Because resilience is a prerequisite for achieving sustainability in the turbulent environment;
- To achieve resilience goal different activities might be undertaken could be to encourage participation of farmers in discussion groups, encouraging farmer networking, frequently assess resilience, encourage farmers to interact with other actors from inside and outside

the industry, promote opportunities for learning, and encourage dairy farmers to consider a range of choices to address a problem;

- Government and NGO sector should increase the access of appropriate innovative financial products and services (e.g., loans) in order to invest in adaptive strategies and savings structures that allow for debt-free recovery, which further helps to reduce risks to shocks/stresses from dairy farming;
- Increase the access of information service and early warning systems to smallholder dairy farmers. Because the provision of timely information allows the households of smallholder dairy farmers exposed to hazards to take action to avoid or reduce their risk and prepare for effective response;
- Interventions should be specific to individual HHs, community, and geographic areas. This is because even dairy farmers interviewed in the same location are greatly different in their level of resilience;

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LISTS APPENDICES IN TABLES

Appendix Table 1: Mean±SE value of resilience level of the entrepreneurial and typical dairy farmers to deal with risks faced in dairy farming

Study areas	Type of dairy farmers	Risk													
		Diseases, parasites and pests		Feed shortage		Market fluctuation		Difficulties input supply		Manure management		Issue of poor genetic		Water shortage	
		N	Mean (SE)	N	Mean (SE)	N	Mean (SE)	N	Mean (SE)	N	Mean (SE)	N	Mean (SE)	N	Mean (SE)
Asella	Entrepreneur	20	59.2 ±1.84	20	56.61±3.18	18	39.16+2.19	22	39.57+2.00	2	59.45+1.00	8	52.33+2.85	2	71.96+6.96
	Typical	22	50.93 ±1.56	16	54.04±2.70	14	38.10+2.07	14	38.74+1.22	6	48.45+1.01	13	42.82+2.09	3	73.33+4.39
	Overall	42	54.87 ±1.35	36	55.47±2.12	32	38.69+1.51	36	39.25+1.30	10	50.65+1.71	21	46.44+1.94	5	72.79+3.28
	P-value	***		NS		NS		NS		***		**		NS	
Bishoftu	Entrepreneur	25	59.33±1.81	27	60.40±1.52	8	50.31±4.05	4	53.74±5.96	7	45.75±5.69	15	45.73+2.99	2	62.68+11.25
	Typical	23	47.75±2.01	29	55.04±1.20	9	40.45+1.78	4	45.50+2.15	9	42.34+2.69	12	40.84+2.78	2	58.21+0.36
	Overall	48	53.78±1.58	56	57.63±1.02	17	45.09+2.39	8	49.62+3.32	16	43.84+2.92	27	43.55+2.08	4	60.46
	P-value	***		**		**		NS		NS		NS		NS	

***= Highly significant (p<0.01); **= Significant (p<0.05); NS= Not significant (p>0.05); SE= Standard error

Appendix Table 2: Major information sources as ranked by dairy farmers to deal with feed shortage in study areas

Information Sources	Asella								Bishoftu							
	Typical (n=16)				Entrepreneurial (n=13)				Typical (n=29)				Entrepreneurial (n=27)			
	1 st	2 nd	3 rd	Index	1 st	2 nd	3 rd	Index	1 st	2 nd	3 rd	Index	1 st	2 nd	3 rd	Index
Own knowledge	6	2	5	0.28	0	2	3	0.07	12	11	3	0.35	9	13	5	0.36
Other farmers	0	8	6	0.23	0	7	6	0.21	2	9	12	0.21	1	8	11	0.19
Agro -input shop	10	4	1	0.41	11	1	0	0.03	15	6	8	0.37	17	4	4	0.39
Development agent	0	0	1	0.01	1	1	1	0.05	0	0	0	0	0	0	0	0
Extension worker	0	2	3	0.07	1	2	3	0.10	0	3	6	0.07	0	2	5	0.06
Private advisor	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0.04

Appendix Table 3: The most important information sources as ranked by dairy farmers to deal with issues of poor genetics and reproduction in study areas

Information Sources	Asella								Bishoftu							
	Typical (n=13)				Entrepreneurial (n=8)				Typical (n=12)				Entrepreneurial (n=15)			
	1 st	2 nd	3 rd	Index	1 st	2 nd	3 rd	Index	1 st	2 nd	3 rd	Index	1 st	2 nd	3 rd	Index
Own knowledge	0	1	7	0.12	0	1	3	0.10	0	5	6	0.22	0	10	4	0.27
Other farmers	0	7	4	0.23	0	5	2	0.25	1	2	3	0.14	1	2	7	0.16
AI technician	11	0	2	0.45	8	0	0	0.5	11	2	0	0.51	14	1	0	0.49
Development agent	0	2	0	0.05	0	1	1	0.04	0	0	0	0	0	0	0	0
Extension	2	3	0	0.15	0	1	2	0.08	0	2	3	0.09	0	2	1	0.06
Private advisor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0.03

Appendix Table 4: The most important information sources ranked by dairy farmers to deal with difficulties input supply in study areas

Information Sources	Asella				Bishoftu											
	Typical (n=15)				Entrepreneurial (n=14)				Typical (n=3)				Entrepreneurial(n=3)			
	1 st	2 nd	3 rd	Index	1 st	2 nd	3 rd	Index	1 st	2 nd	3 rd	Index	1 st	2 nd	3 rd	Index
Own knowledge	4	0	1	0.14	4	1	3	0.20	2	1	1	0.5	1	1	1	0.33
Other farmers	1	8	7	0.29	0	8	5	0.25	1	2	2	0.61	2	2	2	0.67
Agro -input shop	6	5	4	0.36	7	2	3	0.33	0	0	0	0	0	0	0	0
Animal health worker	1	0	0	0.03	1	0	0	0.04	0	0	0	0	0	0	0	0
Development agent	3	1	0	0.12	1	2	0	0.08	0	0	0	0	0	0	0	0
Extension worker	0	1	3	0.06	1	1	3	0.09	0	0	0	0	0	0	0	0

Index = $(3 \times \text{Number of responses for 1st rank} + 2 \times \text{Number of responses for 2nd rank} + 1 \times \text{Number of responses for 3rd}) \div (3 \times \text{Total responses for 1st rank} + 2 \times \text{Total responses for 2nd rank} + 1 \times \text{Total responses for 3rd rank})$; n= number of respondents

Appendix Table 5: Proportion of TLU possession and species except cattle

Livestock Species	Bishoftu						Asella					
	Typical			Entrepreneurial			Typical			Entrepreneurial		
	Tot	Mean \pm SE	Species (%TLU)	Tot.	Mean \pm SE	Species (%TLU)	Tot	Mean \pm SE	Species (%TLU)	Tot	Mean \pm SE	Species (%TLU)
Horses	1	0.03 \pm 0.03	1.98	0	0	0	3	0.1 \pm 0.07	6.49	11	0.37 \pm 0.16	43.36
Donkeys	17	0.57 \pm 0.21	16.79	6	0.2 \pm 0.10	1.41	14	0.47 \pm 0.40	15.16	6	0.2 \pm 0.11	12.37
Sheep	73	2.43 \pm 0.83	18.03	72	2.4 \pm 1.1	4.24	64	2.13 \pm 1.08	17.33	54	1.8 \pm 0.78	27.84
Goats	3	0.1 \pm 0.1	0.74	0	0	0	1	0.03 \pm 0.03	0.27	3	0.1 \pm 0.07	1.55
Chickens	2529	84.3 \pm 46.69	62.46	16035	534.5 \pm 467.03	94.35	2243	74.77 \pm 66.45	60.74	250	8.33 \pm 3.48	12.89
Overall	2629		100	16123		100	2336		100	342		100

Tot. = Total number of livestock per smallholder dairy farmers; SE= Standard error; %TLU= Percentage of tropical livestock unit, ns= not significant at p-value <0.05; Conversion factors were: 0.7 for cattle, 0.1 for sheep and goats, 08 for horses, 0.4 for donkeys, and 0.01 for chicken

Appendix Table 6: Overall average of VAS resilience score for each risk area per types dairy farmers

Risks	Bishoftu (n=60)		Asella (n=60)	
	Typical	Entrepreneurial	Typical	Entrepreneurial
Feed shortage	55.04926	60.40123	54.04266	57.2879
Diseases, Parasites and pests	47.74948	59.33333	50.92641	59.2
Issues of poor genetics	40.83999	45.72633	42.81836	52.32668
Market fluctuation	50.57672	51.08466	38.10204	39.16402
Difficulties input supply	45.50341	53.73912	38.7372	39.57153
Manure management	42.34432	45.75353	58.71291	59.45
Water shortage	58.21429	62.67857	73.33333	71.96429

Appendix Table 7: Questionnaires for the survey part

Outline of the questionnaires (assessment tool)

Part I	Basic data
Part II	Risk selection
Part III	Practices
Part IV	Resources

Part I

1	Survey number	
A	Sample (1 = typical smallholder 2 = entrepreneurial smallholder)	
B	Survey date	
C	Time started	
D	Interviewer	
2	Country	
A	Woreda of respondent	
B	Village/Kebele of respondent	
3	Name of respondent	
A	Gender of respondent	
B	Year of birth	
C	Position in farm(1=owner, 2=spouse, 3=son/daughter, 4=manager)	

5	Livelihood strategies
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4.1	What activities on your farm (on-farm) contribute to your livelihood? Labour & Skills	Tick if yes
A	dairy cattle / milk How many years ago were dairy farming started on this farm?	
B	fattening cattle less than 5 year	
C	breeding heifers for sale 5-10 years	
D	other livestock farming, including sheep, goats, pigs, poultry, rabbits, t 10-15 years	
	horses, donkeys, camels 16-20 years	
E	backyard garden greater than 20 years	
4.2	food crops for household consumption Educational status of respondents	
G a	cash crops 0= Never went to school	
H b	greenhouse 1= Primary education	
I c	tree planting 2= Secondary education	
J d	fishing, hunting, gathering of forest products 3= College	
e	4= University	

5.2	What activities outside your farm (off-farm) contribute to your family's livelihood?	Tick if yes
a	casual labour on other farms	
b	casual labour outside agriculture	
c	employed by government/private sector/NGO	
d	own agri-business	
e	own private business, not agriculture-related	
F	remittances from relatives (overseas or in-country)	
G	pension	
H	Rental properties	
5.3	What proportion of your food & income comes from on-farm? (%)	
5.4	What proportion of your food & income comes from off-farm? (%)	
5.5	If you look at just the milk produced on this farm, what proportion do you sell	
5.6	What proportion do you consume milk at home? (%)	

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6	How many animals do you own?	Number
a	Horses	
b	Mules	
c	Donkeys	
d	Sheep	
e	Goats	
f	Chickens	

7	How many cattle do you own, of which type (local, exotic, crossbreed)	local breed	Crossbred	exotic breed
a	Milking cows - in milk right now			
b	Milking cows - dry right now			
c	Heifers			
d	Calves (male & female			
f	Beef cows that you don't milk			
g	Bulls			
h	Oxen			
8	What is your minimum and maximum daily milk production for all cows together over the past rainy season? (Litres)			
a	Minimum			
b	Maximum-			
c	Average over the rainy season			
9	What is your minimum and maximum daily milk production for all cows together over the past dry season? (Litres)			
a	Minimum			
b	Maximum			
c	Average over the dry season			

10	Land holding (hectare)						
10.1	How much land do you: own / lease / borrow? How much of that land do you rent out, use for perennial crops, annual crops. Sown & planted fodder, natural grass, under buildings? (hectare)						
Total land	Land rented out	Perennial crops trees	Annual crops	Sown grass planted fodder	Grazing land	Land under buildings	
11	What are sources of water for your dairy farm? (tick if yes)						
Rivers / lakes	boreholes / wells	natural springs	rainwater (stored)	gravity-fed water system	irrigation system	Tap water	Other

Part II - Risk selection

12	How would you rate the following risks in terms of being a pressing threat to your dairy farming?	Tick if yes	VAS: no threat – extreme threat
12.1	Feed shortage as result of insufficient land for grazing and feed/fodder crops		
12.2	Diseases, parasites and pests		
12.3	Difficulties with access to inputs & services in terms of price, quality or availability		
12.4	Market fluctuations in demand for / price of milk		
13	Do you consider the following issues to be a risk/threat to your dairy farming? If so, How would you rate them in terms of being a pressing threat to your dairy farming?	Tick if yes	VAS: no threat – extreme threat
13.1	Insecurity (such as theft)		

13.2	Unfavourable policies, regulations, taxes		
13.3	Poor infrastructure limiting access to market at certain times of the year		
13.4	Issues of poor genetics & reproduction		
13.5	Water shortage (ongoing)		
13.6	Labour scarcity		
13.7	Environmental impact/Manure-waste disposal and management		
13.8	Working capital shortage / high interest rates		
13.9	Relocation due to urbanization, infrastructure development or external investments		
14	From the above risks, Tell me the three (3) most severe risks threatening or impact your farm.	Priority 1	
		Priority 2	
		Priority 3	

Notes: The interviews were carried out based on the perception of dairy farmers on risks prioritized above three top most impacts on his/her farms.

15	Risk: diseases, parasites & pests		
Part III - Practices			
15.1	Did you use the following practices over the past 5 years to maintain animal health? If ticked: To what extent is this practice effective?	<i>Tick if yes</i>	<i>Q1 VAS: (not eff. - most eff.)</i>
a	spraying of animals		
b	dipping of animals		
c	vaccination		
d	treatment by veterinarian or animal health worker		
e	self-administered drugs to cure diseases		
f	deworming with commercial drugs		
g	deworming with traditional medicines		

h	culling of affected animals		
i	improve housing or sheds		
j	proper animal & barn hygiene		
k	crossbreed with more resistant animals		
l	improve animal nutrition		
m	use of traditional medicines for disease prevention		
n	use of traditional medicines to cure diseases		

15	Risk: diseases, parasites & pests			
Part IV – Resources				
15.2	Which of the following resources do you consider to be important to deal with diseases, parasites and pests? To what extent do you use your own resources, to what extent does your outside sources? To what extent do you have enough of that resource to deal with diseases, etc.? (VAS: Not enough – enough)			
		Own (%)	Outside (%)	VAS(VAS: Not enough – enough)
a	Financial resources			
b	Knowledge & skills			
c	Labour			
d	Collective action			
e	Plant varieties			
f	Animal genetics			
g	Physical assets like equipment, machinery, tools, buildings, means of transportation, etc.			
15.3	Over the past 5 years, which financial resources did you use to deal with the diseases, parasites, & pests?		Tick if yes	
a	paid from farm-income			
b	paid from savings			
c	paid from off-farm income or remittances			

e	borrowed from friends, relatives		
f	Took loan from informal micro-finance group (like table banking, merry-go-round etc.)		
g	took credit from SACCO		
h	took credit from bank		
i	took loan from private money lender		
j	sold animals other than cattle		
k	sold cattle		
15.4	Did you use the following information sources to deal with diseases, parasites and pests?		Tick if yes
a	my own knowledge		
b	other farmers		
c	agro vet/agro-input shop/feed shop/fodder shop		
d	Veterinarian or animal health worker		
e	AI technician		
f	milk transporter/broker/trader		
g	Development agent /		
h	extension worker		
i	trainer/advisor from processor		
j	private advisor		
k	NGO/project		
l	research or education institute		
m	media like TV, radio, newspapers, magazine, internet		
20.5	Which three information sources did you find most useful to deal with diseases, parasites and pests?	Information 1	
		Information 2	
		Information 3	

16	Risks: Feed shortage		
Part III - Practices -			
16.1	Which of the following practices did you use over the past 5	Tick	VAS:

.	years to maintain feed supply, and to what extent are they effective?	If yes	(Not eff.- most eff.)
a	hay making		
b	silage making		
c	use of crop residues from own farm and purchase		
d	purchasing fodder		
e	started using new fodder crop types or varieties		
f	started using new legume crop types or varieties		
g	use local salts as mineral supplements		
h	use commercial mineral supplements / premix		
i	use of dairy meal/purchased supplements		
j	home processing of mixed ration		
k	fodder testing		
l	calculate feed rations		

16	Risks: Feed shortage			
Part IV – Resources				
16.2	Which of the following resources do you consider to be important to deal with feed shortages? To what extent do you use your own resources, to what extent do you use outside sources? To what extent do you have enough of that resource to deal with feed shortages? (VAS: Not enough. – enough)			
		Own (%)	Outside (%)	VAS
<i>a</i>	Financial resources			
<i>b</i>	Knowledge & skills			
<i>c</i>	Labour			
<i>d</i>	Collective action			
<i>e</i>	Plant varieties			
<i>f</i>	Animal genetics			
<i>g</i>	Physical assets like equipment, machinery, tools,			

	buildings, means of transportation			
16.3	Over the past 5 years, which financial resources did you use to deal with the feed shortages?			
a	paid from farm-income	Tick if yes		
b	paid from savings			
c	paid from off-farm income or remittances			
d	borrowed from friends, relatives			
e	Took loan from informal micro-finance group (like table banking, merry-go-round etc.)			
f	took credit from SACCO			
g	took credit from bank			
h	took loan from private money lender			
i	sold animals other than cattle			
j	sold cattle			
16.4	Did you use the following information sources to deal with Feed shortage due to land scarcity?	Tick if yes		
a	my own knowledge			
b	other farmers			
c	agro vet/agro-input shop/feed shop/fodder shop			
d	Veterinarian or animal health worker			
e	AI technician			
f	milk transporter/broker/trader			
g	Development agent			
h	extension worker			
i	trainer/advisor from processor			
j	private advisor			
k	NGO/project			
l	research or education institute			
m	media like TV, radio, newspapers, magazine, internet			
16.5	Which three information sources did	Information 1		

	you find most useful to deal with feed shortage?	Information 2
		Information 3

17	Manage manure and waste		
Part III - Practices			
17.1	Did you use the following practices over the past 5 years to manage manure & waste? If ticked: To what extent is this practice effective?	Tick if yes	VAS (not eff.-most effective)
a	apply manure to annual crops		
b	apply manure to perennial crops		
c	apply manure to fodder crops		
d	dry manure for use as fuel		
e	sell dry manure		
f	sell wet manure		
g	feed chicken manure to cattle		
h	make biogas		
j	apply biogas slurry to annual crops		
k	apply biogas slurry to fodder crops		
l	sell biogas slurry		

17	Manage manure and waste		
Part IV – Resources			
17.1	Which of the following resources do you consider to be important to deal with negative environmental impact? To what extent do you use your own resources, to what extent do you use outside sources? To what extent do you have enough of that resource to deal with environmental impact? (VAS: Not enough. – enough)		
		Own (%)	Outside (%)
a	Financial resources		
b	Knowledge & skills		
c	Labour		

d	Collective action			
e	Plant varieties			
f	Animal genetics			
g	Physical assets like equipment, machinery, tools, buildings, means of transportation			
17.2	Over the past 5 years, which financial resources did you use to deal with environmental impact?			Tick if yes
a	paid from farm-income			
b	paid from savings			
c	paid from off-farm income & remittances			
d	borrowed from friends, relatives			
f	Took micro-finance loan (like table banking, merry-go-round etc.)			
g	took credit from SACCO			
h	took credit from bank			
i	took loan from private money lender			
j	sold animals other than cattle			
k	sold cattle			
17.3	Did you use the following information sources to deal with environmental impact?			Tick if yes
a	my own knowledge			
b	other farmers			
c	agro vet/agro-input shop/feed shop/fodder shop			
d	Veterinarian or animal health worker			
e	AI technician			
f	milk transporter/broker/trader			
g	Ethiopia: Development agent			
h	extension worker			
i	trainer			
j	private advisor			
k	NGO/project			

l	research or education institute		
m	media like TV, radio, newspapers, magazine, internet		
17.4	Which three information sources did you find most useful to deal with manage manure?	Information 1	
		Information 2	
		Information 3	

18	Ensure steady supply, affordability, and quality of external inputs & services		
Part III - Practices			
18.1	Which of the following practices did you use over the past 5 years to ensure proper supply of input and services, and to what extent are they effective?	Tick if yes	VAS (not eff. - most effect.)
a	maintain good relationship with agro vet and other input suppliers		
b	took credit from stockist / delayed payment to service provider/input supplier		
c	took credit from milk trader (selling tomorrow's milk today)		
d	make use of check-off system		
e	collective purchasing of inputs through farmer organization		
f	use subsidized inputs from county/district government		
g	contracting on input supply with processor		
h	keep records on incomes and expenditures		
i	buy from authorized dealers		
j	reduce purchase of external inputs		
k	ask for advice		

18	Ensure steady supply, affordability, and quality of external inputs & services		
Part IV – Resources			

18.2	Which of the following resources do you consider to be important to deal with extreme weather events? To what extent do you use your own resources, to what extent do you use outside sources? To what extent do you have enough of that resource to deal with extreme weather events? (VAS: Not enough. – enough)			
		Own (%)	Outside (%)	VAS
A	Financial resources			
B	Knowledge & skills			
C	Labour			
D	Collective action			
E	Plant varieties			
F	Animal genetics			
G	Physical assets like equipment, machinery, tools, buildings, means of transportation			
18.3	Over the past 5 years, which financial resources did you use to deal with Extreme weather events?			Tick if yes
A	paid from farm-income / produce sales			
B	paid from savings			
C	paid from off-farm income & remittances			
D	borrowed from friends, relative			
E	Took micro-finance loan (like table banking, merry-go-round etc.)			
F	took credit from SACCO			
G	took credit from bank			
H	took loan from private money lender			
I	sold animals other than cattle			
J	sold cattle			
18.4	Did you use the following information sources did you use to deal with Extreme weather events?			Tick if yes
A	my own knowledge			
B	other farmers			
C	agro vet/agro-input shop/feed shop/fodder shop			

D	Veterinarian or animal health worker		
E	AI technician		
F	milk transporter/broker/trader		
G	Ethiopia: Development agent		
H	extension worker		
I	trainer/advisor from processor		
J	private advisor		
K	NGO/project		
L	research or education institute		
M	media like TV, radio, newspapers, magazine, internet		
18.5	Which three information sources did you find most useful to deal with input supply?	Information 1	
		Information 2	
		Information 3	

19	Market your milk profitably		
Part III - Practices			
19.1	Which of the following practices did you use over the past 5 years to market your milk profitably, and to what extent are they effective?	Tick if yes	VAS: (not eff. - most eff.)
a	Collective sale of milk (on-farm bulking of milk neighbours, farmer group, cooperative society etc.)		
b	sell to private processor		
c	sell to merchant / trader / broker / hawker		
d	home processing milk for local marketing		
e	sell evening milk locally		
f	divide milk between different milk buyers / collectors		
g	contracting with buyer		
h	Shift to buyer with better conditions (higher price etc.)		

i	recording of milk production and sales		
j	producing products that keep a long time, such as mature (lactic) butter		
k	hygienic milking and milk handling		
l	adjust milking time to meet collection time		
m	on-farm cooling of milk		

19	Market your milk profitably			
Part IV – Resources				
19.1	Which of the following resources do you consider to be important to deal with market fluctuations in demand for / price of milk? To what extent do you use your own resources, to what extent do you use outside sources? To what extent do you have enough of that resource to deal with extreme weather events? (VAS: Not enough. – enough)			
		Own (%)	Outside (%)	VAS
A	Financial resources			
B	Knowledge & skills			
C	Labour			
D	Collective action			
E	Plant varieties			
F	Animal genetics			
G	Physical assets like equipment, machinery, tools, buildings, means of transportation			
19.2	Over the past 5 years, which financial resources did you use to deal with market fluctuations in demand for / price of milk?			Tick if yes
A	paid from farm-income / produce sales			
B	paid from savings			
C	paid from off-farm income & remittances			
D	borrowed from friends, relative			
E	Took micro-finance loan (like table banking, merry-go-round etc.)			

F	took credit from SACCO	
G	took credit from bank	
H	took loan from private money lender	
I	sold animals other than cattle	
J	sold cattle	
19.3	Did you use the following information sources to deal with market fluctuations in demand for / price of milk?	Tick if yes
A	my own knowledge	
B	other farmers	
C	agro vet/agro-input shop/feed shop/fodder shop	
D	Veterinarian or animal health worker	
E	AI technician	
F	milk transporter/broker/trader	
G	Development agent	
H	extension worker	
I	trainer/advisor from processor	
J	private advisor	
K	NGO/project	
L	research or education institute	
M	media like TV, radio, newspapers, magazine, internet	

19.4	Which three information sources did you find most useful to deal with market fluctuations?	Information 1	
		Information 2	
		Information 3	

20	Maintain good genetics & reproduction		
Part III - Practices			
20.1	Which of the following practices did you use over the past 5 years to maintain good genetics & reproduction, and to what extent are they effective?	Tick if yes	VAS: (Not eff. - most eff.)
a	Good feeding (supplements, quality fodder etc.)		
b	keeping breeding and calving records		

c	proper heat detection			
D	use AI by government technician			
E	Use AI by technician from cooperative			
F	use AI by private technician			
G	administer AI ourselves			
H	use bull service			
I	careful bull selection			
J	use sexed semen			
K	synchronized heat			
L	crossbreeding with exotic breeds			
M	replaced cows by purchased exotic breeds			
N	embryo transplantation			
O	management of calving process			
20	Maintain good genetics & reproduction			
Part IV – Resources				
20.2	Which of the following resources do you consider to be important to deal with issues of poor genetics & reproduction? To what extent do you use your own resources, to what extent do you use outside sources? To what extent do you have enough of that resource to deal with extreme weather events? (VAS: Not enough. – enough)			
		Own (%)	Outside (%)	VAS
A	Financial resources			
B	Knowledge & skills			
C	Labour			
D	Collective action			
E	Plant varieties			
F	Animal genetics			
G	Physical assets like equipment, machinery, tools, buildings, means of transportation			
20.3	Over the past 5 years, which financial resources did you use to deal issues			Tick

	of poor genetics & reproduction?	if yes
A	paid from farm-income	
B	paid from savings	
C	paid from off-farm income & remittances	
D	borrowed from friends, relative	
E	Took micro-finance loan (like table banking, merry-go-round etc.)	
F	took credit from SACCO	
G	took credit from bank	
H	took loan from private money lender	
I	sold animals other than cattle	
J	sold cattle	
20.4	Did you use the following information sources did you use to deal with issues of poor genetics & reproduction?	Tick if yes
A	my own knowledge	
B	other farmers	
C	agro vet/agro-input shop/feed shop/fodder shop	
D	Veterinarian or animal health worker	
E	AI technician	
F	milk transporter/broker/trader	
G	Development agent	
H	extension worker	
I	trainer/advisor from processor	
J	private advisor	
K	NGO/project	
L	research or education institute	
M	media like TV, radio, newspapers, magazine, internet	
20.5	Which three information sources did you find most useful to deal with	Information 1
		Information 2

issues of poor genetics and reproduction?	Information 3	
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21	Manage water availability
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Part III - Practices

21.1	Which of the following practices did you use over the past 5 years to manage water availability, and to what extent are they effective?	Tick if yes	VAS: (not eff. - most eff.)
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a	On-farm rain water harvesting		
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b	Wastage reduction measures		
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c	Drill more wells		
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d	Other sources		
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21	Manage water availability
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Part IV – Resources

21.2	Which of the following resources do you consider to be important to deal with water scarcity? To what extent do you use your own resources, to what extent do you use outside sources? To what extent do you have enough of that resource to deal with water scarcity? (VAS: Not enough. – enough)
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		Own (%)	Outside (%)	VAS
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a	Financial resources			
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b	Knowledge & skills			
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c	Labour			
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d	Collective action			
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e	Plant varieties			
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f	Animal genetics			
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g	Physical assets like equipment, machinery, tools, buildings, means of transportation			
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21.3	Over the past 5 years, which financial resources did you use to deal with	Tick
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	water scarcity?	if yes
A	paid from farm-income	
B	paid from savings	
C	paid from off-farm income & remittances	
D	borrowed from friends, relative	
E	Took micro-finance loan (like table banking, merry-go-round etc.)	
F	took credit from SACCO	
G	took credit from bank	
H	took loan from private money lender	
I	sold animals other than cattle	
J	sold cattle	
21.4	Did you use the following information sources did you use to deal with water scarcity?	Tick if yes
A	my own knowledge	
B	other farmers	
C	agro vet/agro-input shop/feed shop/fodder shop	
D	Veterinarian or animal health worker	
E	AI technician	
F	milk transporter/broker/trader	
G	Development agent	
H	extension worker	
I	trainer/advisor from processor	
J	private advisor	
K	NGO/project	
L	research or education institute	
M	media like TV, radio, newspapers, magazine, internet	
21.5	<i>Which three information sources did you find most useful to deal with water scarcity?</i>	Information 1
		Information 2
		Information 3

Closure

Time Ended	
Comments	

Phone number: _____

Thank you very much!

Appendix Table 1 : Guideline for focus group discussions on resilience with dairy farmers

Introduction:

- Self-introduction of researcher and facilitators to participants, and objectives of discussion
- Self-introduction of participants

Objectives:

To gain understanding on how farmers as a community are able to deal with the most important risks that affect dairy farming.

- To collect additional input from farmers and to validate farm level resilience assessments

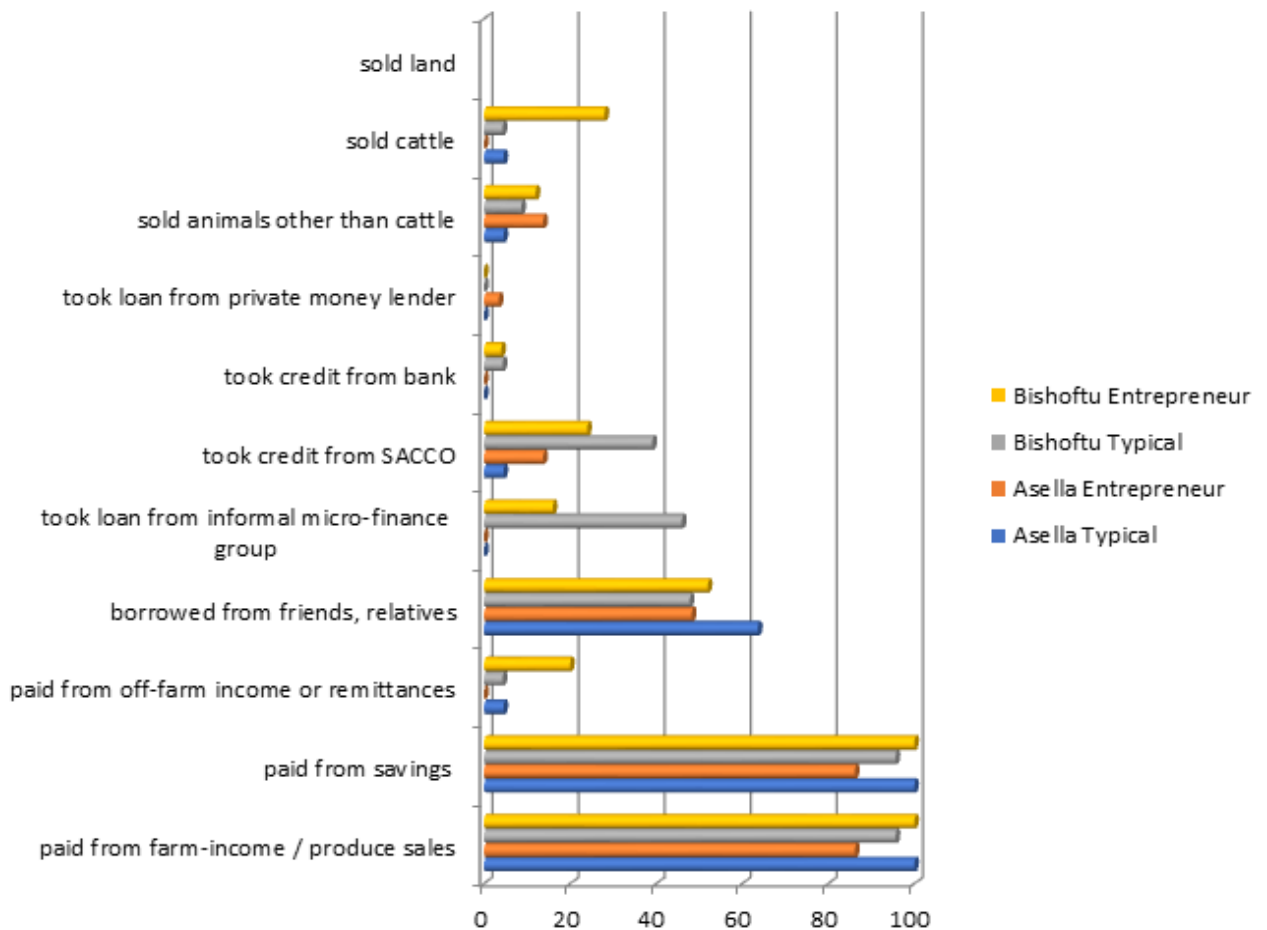
Major risk selection

- Present 5 main risks selected in individual farm assessments (according to frequency in top-3 risks identified) on individual cards or distributed across flip chart; check understanding of risks (namely: Feed shortage due to land scarcity, Diseases, parasites and pests, Issues of poor genetics and reproduction, Difficulties in access of input supply, and Market fluctuation).
- Ask 3 farmers to rank these risks, using 45 candies each, explaining their ranking
- Calculate scores per risk, adding up all candies per risk
- Discuss with group as needed to lead to agreement from all participants
- Select two highest ranking risks for next step.

Questions on major risks (start from highest ranking)

1. What have your farming communities been doing at community level to deal with this risk? (Practices, group actions, etc.) Possible follow up question: So, what enables your farming communities to deal with this risk?
2. Sometimes your purpose to manage this risk may conflict with your purpose to make a living (for example, when spending much money on vaccinations, drugs, supplements). How do you balance between these two purposes?
3. What should be done by you as farmers and by outside actors to address this risk more effectively? (possibly write in two lists on flip charts)
4. If some of these actors would not contribute their actions, how would you as farmers react in order to deal with this risk?

APPENDICES IN FIGURES



Appendix Figure 1: Financial sources to deal with risks associated with dairy farming in study areas



Appendix Figure 2: Male and female FGDs in Asella



Appendix Figure 3: Male and female FGDs in Bishoftu