

Article

Local Institutions and Climate Change Adaptation: Appraising Dysfunctional and Functional Roles of Local Institutions from the Bilate Basin Agropastoral Livelihood Zone of Sidama, Southern Ethiopia

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Abstract: This study aimed to appraise the role of local institutions in adaptation to changing climate at the local level in the Bilate Basin Agropastoral Livelihood Zone of Ethiopia. Thirty-one years of climate data were analyzed by employing the Mann–Kendall trend and Sen’s slope test techniques. The survey was conducted on 400 households that were systematically randomized from 7066 households, while community-level data were collected through the participatory rural appraisal (PRA) technique. The entire analysis was framed by a tetragonal model. The results of the analysis indicated that temperature exhibited a significantly increasing trend, while rainfall, which is statistically related to temperature, showed a decreasing trend, resulting in lingering droughts and human and animal diseases. Major livestock declined by 69%. As a response, while Sidama indigenous institutions were well-functioning and nurtured through local knowledge, and the governmental and civic ones were entrenched with various limitations. Contextual fitness and compatibility, interplay, inclusiveness, and sustainability of their operations in temporal and spatial scales were some of their limitations. Therefore, federal and local governments should focus on monitoring, evaluating, and learning aspects of their grand strategies, review general education, farmers’ credit, and civic institutions’ governance policies and strengthen the synergy of civic, government, and indigenous institutions.

Keywords: Bilate Basin Agropastoral Livelihood Zone; participatory rural appraisal; local institutions; local-level adaptation; Sidama indigenous knowledge; tetragonal

1. Introduction

1.1. Global Climate Change and Institutional Roles of Adaptation

Climate change has become a global reality [1], and it will render large parts of the planet unfit for agriculture unless people manage it to mitigate its effects and adapt at the right time [1,2]. This change has a demanding impact on the lives and livelihoods of all human systems [3,4], involving several million firms and calling for trillions of decisions [5,6] in the form of responses at various levels from individuals to communities across the world [3,5,7–9]. At a theoretical level, institutions are important in many ways in the relationship between human beings and the environment, including causing climate change itself [10] and addressing its negative impacts [1,7,8,11,12]. Local institutions [2,13]

play different positive roles in climate change adaptation. They (a) initiate, influence, and mediate the flow of external interventions in the contexts of coping, adapting, mitigating, and they (b) initiate, shape, and reshape the actions and abilities of households and communities to respond to climate impacts and to pursue different adaptation practices. At a practical level, local institutions play a multitude of adaptation roles, which exhibit interchained and integrated features. Some of them supply climate-related information (informative role), while others disseminate it (broadcasting role). Still, others do work on preventing climate crises (protecting role) [3], promoting resilience [5], and smoothening crises [6,7]. In addition, although political and policy instruments affect their natural behavior, civic organizations' strategic and careful interventions can contribute to the successful adaptation practices [1,5,8].

Similarly, various environmental anthropology literature [6,8,9] advocates for the use of community-based institutions for climate change adaptation at a local level as a point of entry while recognizing the leading role of public institutions [1,4]. The more these institutions are synergetic and harmonized in terms of the roles and culture they share among and between them, the better their outcome becomes. This mode of functioning is commonly referred to as functionality [9,11], and its absence is called dysfunctionality. Institutional arrangements are known [1,2,7,8] to account for people's success or failure to adapt to their planning and to adapt to their vulnerable state.

1.2. Local Impacts of Climate Change and Institutional Roles of Adaptation in Ethiopia

As is true for other sub-Saharan countries [6], Ethiopia has been facing recurrent and severe climate-change-driven droughts that have subsequently resulted in chronic food insecurity and mass hunger [12,14]. In particular, climate change is becoming one of the major development challenges in the Bilate Basin Agropastoral Livelihood Zone of Sidama [12,13,15]. The high poverty rate and fragile ecologies, as well as bad governance, have created [1,3,5,15] a situation where farmers and pastoralists are highly sensitive to even a relatively small rainfall decrease. These factors combine to create high vulnerability to drought and associated food insecurity [4,6,10].

This situation appears to have been exacerbated over the last half-century with the addition of the changing climate [1,7]. As a response, Ethiopia's national government has been striving to address the observed impacts of climate change through policy instruments based on assessments conducted at a national level. The level, types, and associated risks of climate change and variability vary across times and space, as does its derivative impact. Therefore, at a local level, there is a critical need for information about climate change and trends, change-driven impacts, and local institutions' roles concerning local-level adaptation. Some of a few studies [10,12,16,17] conducted so far have entirely excluded local institutions' role in a climate change adaptation at a local level [16,17], while others [10,12,15] have oversimplified Sidama's indigenous institutions' most prominent roles, as well as those of civic ones.

Overall, there is insufficient scientific information at a local level about (1) whether or not pro-environmental and pro-natural resource institutions exist in the study area where there is observed climate change; (2) if they are compatible, competent, and practical; (3) if there are systems, structures, and interactions between and among them; (4) perhaps equally important, if there are accessibility and sustainability of these institutions with the roles they are expected to play or not. Such gaps remain inherent in solution initiatives, resulting in worse outcomes. This study attempts to fill this information gap, which is paramount for designing, implementing and controlling climate change management bylaws, laws, and policies from the micro to macro level in the country.

2. Materials and Methods

2.1. Materials

2.1.1. Description of the Study Area

This study was conducted within the area of 6.36°–7.14° N Latitude and 38.01°–38.56° E Longitude in Ethiopia, which the Ministry of Agriculture of Ethiopia categorizes as the Bilate Basin Agropastoral Livelihood Zone (BAP LZ) [18].

The study area is located in the Sidama administrative zone (now Sidama National Regional State—SNRS—since 4 July 2020) in Ethiopia (Figure 1; Table 1).

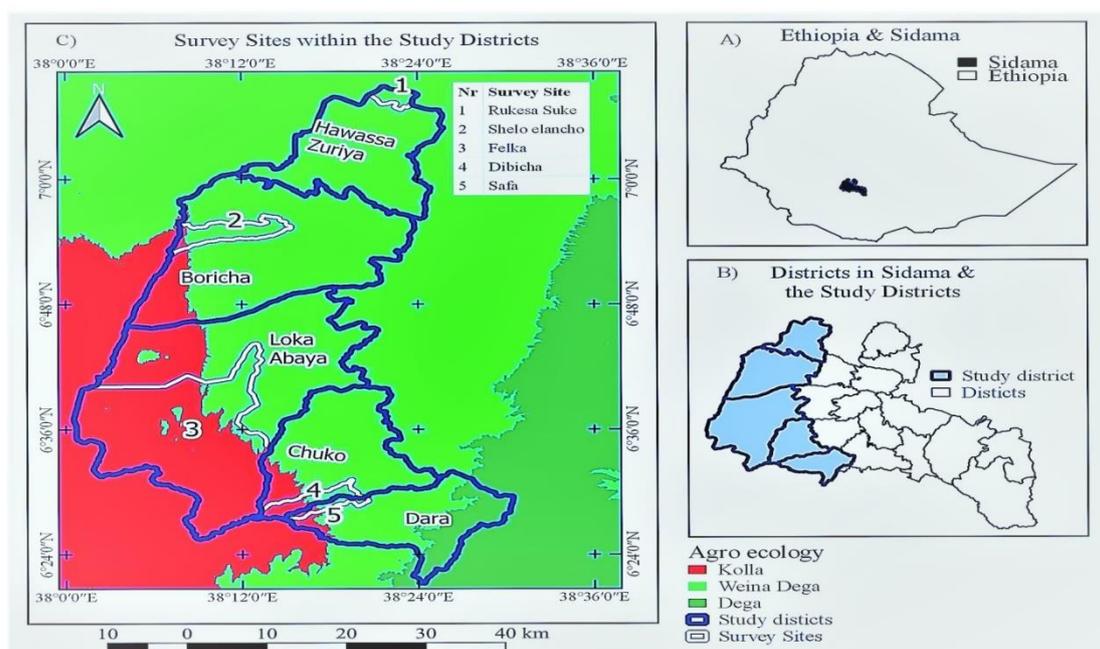


Figure 1. Map of the study area. Source: authors’ work.

Table 1. Geophysical characteristics of the study area.

No	Study District	Total HHs (N)	Sampled Farmers’ Association	Total HHs of The Sample Site	Sample Size (N)
1.	Hawassa Zuria	30,841	Rukessa Suke	1095	62
2.	Boricha	65,957	Shello Elancho	1657	94
3.	Loka Abaya	27,085	Falka	1287	73
4.	Aleta Chuko	44,888	Dibbicha	1942	110
5.	Dara	46,453	Safa	1085	61
	Total	215,224	5	7066	400

Source: Bureau of Finance and Economic Development.

The focus of the study was both formal and informal (indigenous) local institutions. In this study, formal local institutions are contextualized as institutions with well-defined missions, goals, and objectives and predetermined lines of operation and communication from national to local levels. Furthermore, they can be owned by the public (peri-public) or private or civic society. In contrast, informal institutions are contextualized as a set of commonly shared and accepted norms, values, and practices of the community practices. Food security and risk management, farmers’ training (FTC) services, cooperative enhancement, environmental protection, education, and credit are governmental institutions with a mission of assisting local level adaptation.

2.1.2. Data: Source and Type

This study employed data from secondary and primary sources. Secondary source data included data on climate and those pertinent to institutions of concern. Furthermore, primary source data included cross-sectional household survey and participatory rural appraisal (PRA) (key informant, focused group discussion, and participant observation) data.

This study's climate data encompassed the geographic area of 6.360°–7.140° N Latitude and 38.010°–38.56° 0E Longitude. They were generated from the national meteorological agency (NMA) on both monthly rainfall and temperature for 1987–2017.

Household survey: This tool was employed to collect data from 400 respondent households drawn through a systematic sampling technique (Table 1).

The sample size was determined based on [19]. Accordingly, the sample size was identified as:

$$n = N/1 + N * e^2 \quad (1)$$

where n stands for sample size, N stands for population, e stands for the error term. Thus, $n = 7066/1 + 7066(0.05)^2 \Rightarrow 7066/17.665 \Rightarrow 400$.

As data collection tools, structured and semi-structured questions were employed to randomized households to collect data on major themes of this study: climate change and its impacts on the livelihood of households; responses in the form of adaptation to such changes and change born impacts; whether or not there were supporting institutions to households' endeavors to adapt; whether or not there are idiosyncratic vertical and horizontal systems and the interplay between and among these institutions; whether or not the receivers of supporting services of these institutions were satisfied with the roles played by the latter and whether or not there the institutions and their ideal roles are sustainable.

While a cross-sectional household survey enables an understanding of a phenomenon's quantifiable reality through randomization, PRA enables a more in-depth understanding of its qualitative dimensions. Various scientific literature supports similar designs for the context of this study. In addition to this [20], employing a participatory approach to assess climate change impacts in African rural communities facilitates better understanding. PRA [7,21,22] of climate change in rural settings helps to evaluate characteristically hidden inter- and intrarelations between people, on one hand, and functionality, fitness, and sustainability of institutions that exist and are assumed to exist for and in the community, on the other hand [4,21,23].

Focus group discussion (FGD): To collect data in the range of the household to the community, as an augmentation to key informant interview (KII) data, a focus group discussion (FGD) was designed for each of five administrative districts (i.e., five FGDs) in the study. Each of the five groups had 9–12 members of the community, including elders, senior government representatives, household-heading women, senior rural development agents, the youth league leader in the youth organization in the local political arrangement, senior academics, a religious society leader, a senior health extension, and civic societies' representatives. They were expected to observe and/or understand climate change and variability within the society and thus had become part of the solution to impact-driven constraints in society.

The key informant interview (KII) and participant observation (PO): This tool was employed to gain in-depth information about themes from a community level.

2.2. Techniques of Data Analysis

(a) Climate data analysis: Climate data were analyzed based on time series. They are applicable for several purposes, including studying the past behavior of the phenomena under consideration, comparing current trends with past or expected trends, and comparing the performance of two different series of a different type for the same time duration.

Mann–Kendall test and Sen’s slope estimates (MAKESENS) was employed to test the trends [24] of rainfall and temperature of the study area over the past thirty-one years from 1987 to 2017. The Mann–Kendall (MK) trend test tool [25,26] is commonly used, among other alternative models of trend analysis, to determine if a trend exists and to handle seasonal patterns’ data. Unlike a parametric analysis, regardless of the normal distribution of the population (N) of the study, the nonparametric regression (Mann–Kendall’s (MK) test) fits temporal scale changes of the units corresponding to each time. It was therefore employed to test the rainfall and temperature trends of all thirty-one years (372 months) of Western Sidama’s drought-prone districts. Under the context of changing climate defined by the varying trends of rainfall and temperature, survey-based data were analyzed using descriptive (univariate) statistics under the STATA 16 version. On the other hand, PRA and other source-based data were analyzed issue-by-issue and theme-by-theme in such a way to ensure triangulation.

(b) Appraising the role of a local institution on climate change adaptation.

As an approach to appraising the role of local institutions in climate change adaptation, the overall analysis was framed through a tetragonal model (Figure 2). Each of the sides represents one of the four abovementioned themes the study sought to address. Through this model, we attempted to appraise four components, including the following: institutional existence; institutional fitness in the contexts and systems (software dimension) these institutions work through and structures (hardware dimension) they operate on; institutional interrelationships; and temporal (sustainability) and spatial (areal distribution) scales.

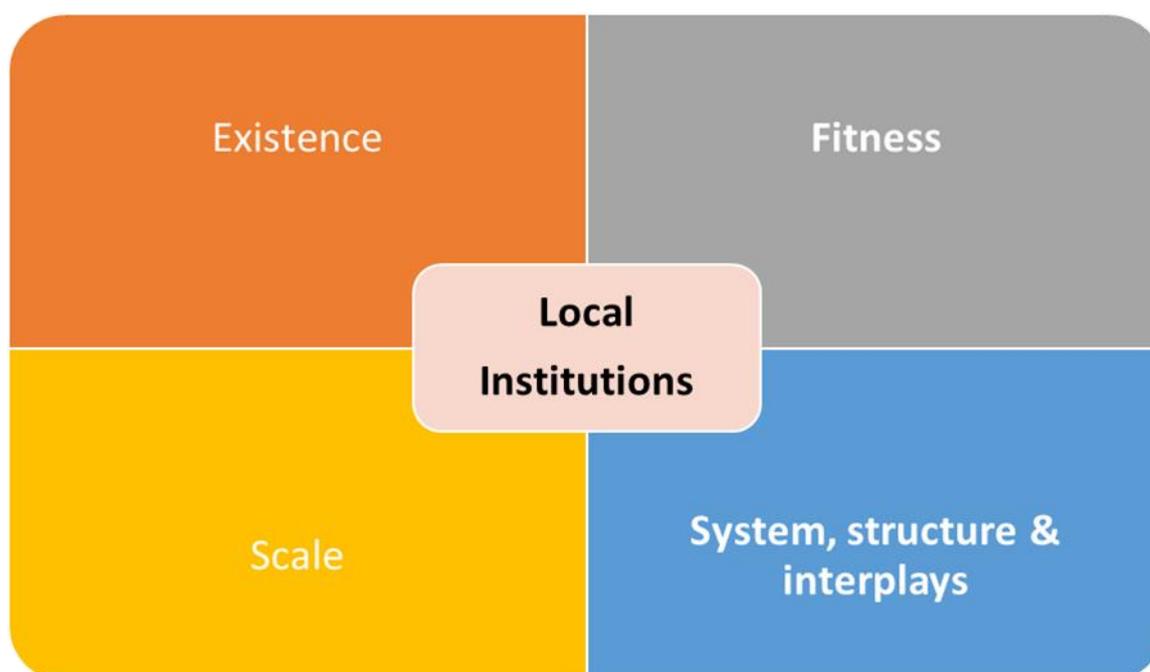


Figure 2. A framework to assess local institutions’ role in adaptation to climate change. Source: modified from [10].

This analytical framework was a modified form of the Young Oran R’s [27] framework applied by [10] that used a “triangular” concept to deconstruct the institutional roles in adaptation to climate change by considering institutional fitness, their interplay, and their operational scales.

This study differentiated itself from its precursors and has novelty in terms of two main issues: its inclusion of both indigenous and civic institutions for the focus of analysis, and its inclusion of the interrogation of institutional existence as the fourth dimension of the institutional analysis, which changed the shape of the model from triangle to tetragonal (Figure 2).

3. Result and Discussion

3.1. Rainfall and Temperature Trends

In terms of volume, as can be seen in Figure 3a, annual rainfall decreased with a magnitude of 3.6 mm/year, which is not statistically significant. However, it varied from 1194.5 mm to 1776 mm in terms of temporal distribution, as recorded in 2016 and 2006.

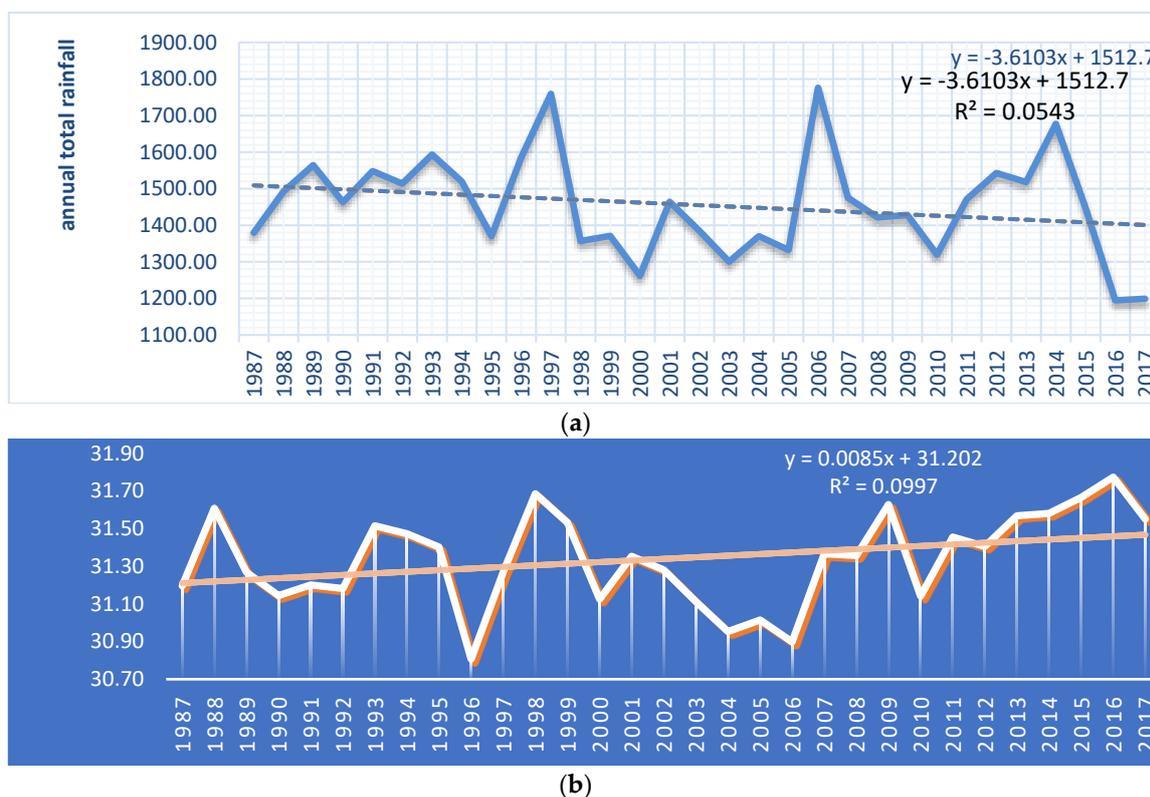


Figure 3. (a) Annual rainfall trend, source: researcher's computation from meteorological data; (b) annual maximum temperature trend, source: researcher's computation from meteorological data.

The average annual maximum temperature is 31.2 °C, and it showed a statistically significant increasing trend (at $\alpha = 0.05$; $p = 0.012$). Figure 3b shows that the annual average maximum temperature increased from 30.81 °C to 31.77 °C over the last 31 years, which implies an increase of 0.96 °C (Figure 3b). Similarly, a randomized household survey indicated that 94% (N = 400) and 98% (N = 400) of households believed that both rainfall and temperature showed an annual decrease and increase, respectively. This finding corresponds with [3,9,28] and specifically with [15,16,29].

3.2. Observed Climate Change Impact on Agriculture of the Study Area

Many reports and relevant models point out that changing averages of temperature and precipitation affect general economic productivity. The more variable, unpredictable, or extreme climate has altered today's economic yields, earnings, health, and physical safety, and, ultimately, the paths and levels of future development [3,7,30]. Household data revealed that Oxen and cattle (which are both 1 tropical livestock unit (TLU = 1) of conversion) declined from 3.1 units per head of the family before twenty years to 1.2 units, currently implying a 61% decline. Calves declined by 47% (Figure 4).

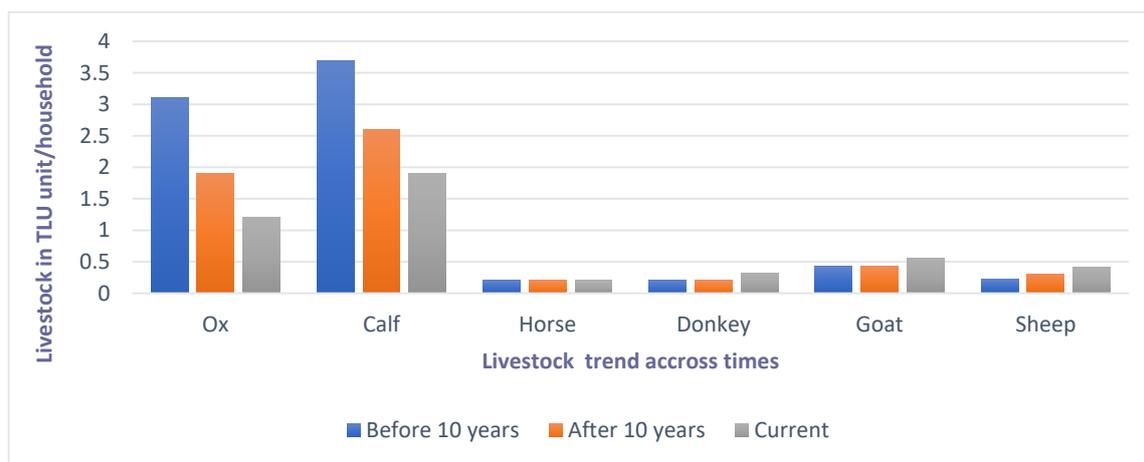


Figure 4. Impact of climate change on livestock population. Source: survey (March–May 2020).

Populations of pack animals such as donkeys increased by 37%, while populations of small ruminant goats (*Capra*) and sheep (*Ovis*) showed increases of 30% and 78%, respectively (Figure 4). Ninety-eight percent of households perceived households that climate change harms their farm output. Remarks from focus group discussions and information from experts revealed that droughts and cattle diseases were responsible for declines in cattle population and diminished agricultural yields by exposing households to hunger and severe poverty. These incidents were repeatedly mentioned in Borricha and Lokka Abbaayya in “Qolla” (dry and hot tropical climatic zone) in most of Western Sidama (Figure 1). On the other hand, by adding poultry to the list, the same sources indicated that to adapt to the impacts of climate change, households switched from relatively higher-risk and more drought- and disease-sensitive larger cattle husbandry to pack animals, small ruminant animals, and poultry. This practice was mentioned as a reason for the increase in the populations of the latter three.

This finding was consistent with other findings [10,15,16,31] conducted in Ethiopia, both in general and in the Central Rift Valley. Similar studies in the area reported increasing temperature and unwarrantable droughts that have been attributed to steep slopes, according to 82% of farmers, who believed that livestock numbers had decreased [10]. Similar reports have been released for adjacent areas. Average numbers of livestock owned by pastoralist households were found to have declined from 10 to 3 oxen (a 70% decline), 35 to 7 cows (an 80% decline), and 33 to 6 goats (an 83% decline) [32]. Moreover, there are reports that climate change has reduced livestock assets by 80% in southern pastoralist and nomadic communities for the last three decades [32]. This study’s finding that the increase in small ruminants and pack animals diverges from prior studies [33], which reported a decrease in small ruminants and other livestock. This divergence could be related to household-level decisions to adapt to climate change. When farmers make such decisions, they consider the economic cost/benefit ratio [15,34,35]. When households affected by climate change opt to retain their livestock as part of their livelihood, they are more likely to switch to small ruminants and non-ruminants as an adaptation strategy by considering their relative advantages compared to larger ruminants. This adaptation strategy results in an increase in animal populations observed compared to the population size before climate change.

In contrast, if these households opt to shift from the livestock-based livelihood to other forms of livelihood or do not respond to the changing climate, then, obviously, the livestock size tends to decline sharply [34,36]. This observation supports the finding that the numbers of livestock owned by households in the study area have fallen drastically over the past two decades as animals died from disease induced by climate change and the severe drought it brings.

3.3. Appraising the Role of Local Institutions on Local-Level Adaptation to Climate Change

3.3.1. Existence of the Relevant Institutions Facilitating Local Level Adaptation

Adaptation to climate change comprises the transition from awareness to practicing viable strategies and plans in society [2,7,21,36,37].

The existence, strengths, and effective coordination of all types (governmental, civic, political, and private) and all levels of institutions play a crucial role in climate change adaptation in local settings [22,35,37]. In addition, a review of the related literature showed that government institutions had been established to support the practices of climate change adaptation and mitigation nationally: Ethiopian Environment and Forest Research Institute (EEFRI) established in 2014 [38]; Ministry of Environment, Forest, and Climate Change (currently restructured as a commission); National Disaster Risk Management Commission; Commission of Environment, Forest, and Climate Change; Colleges of Agriculture and Vocational Trainings; Ministry of Education (MoE); Ministry of Science and Higher Education; Ministry of Finance; and the Ministry of Water, Irrigation, and Energy [39]. Although their equivalents exist at regional and subregional levels, this study identified some vital national programs for climate change adaptation and mitigation that did not exist at local levels. For example, forestry is among the four pillars of the Climate-Resilient Green Economic Strategy, which aims to reduce national emissions by 50% by 2030. The government has recognized the national REDD+ program as one of the four fast-track programs to realize the vision of a green economy [40]. However, the REDD+ program was not applied to the districts of this study area affected by climate change, nor was there a national adaptation plan (PAP-ETH). The PAP-ETH develops drought index-based crop insurance in response to drought escalations, enhancing renewable power in such a way that it increases a sink-base by reducing biofuel demands and improving portable water sources. Correspondingly, seventeen of the eighty-six civic organizations registered in Sidama have engaged in various projects specific to agriculture, water and sanitation, education, livelihood and food security, and cooperation and marketing. It was observed that these philanthropic organizations contributed to climate change adaptation through life-saving schemes, creating awareness, and reducing vulnerabilities. However, no project-specific civic organization was observed to have engaged directly in climate change adaptation at a local level of the study area (Annual Report of SZAFED, 2017). Most of them had no office base in their primary mission area. Most of them were pooled in the Bureau of Finance of the region, where they signed a memorandum of understanding and were coordinated. Except at this level, there were no rooms where they were coordinated below the regional level. On the other hand, a cross-sectional household survey analysis indicated that 51% (N = 400) of the households confirmed the importance of institutions for food security and risk-management service delivery. In comparison, 47% and 52% of households agreed to the establishment of capacity-building (farmer training centers (FTCs)) and cooperative enhancement offices, respectively. Similarly, 73%, 73%, and 53% of the respondents confirmed the importance of environmental protection, educational, and credit services institutions, respectively.

Data from PRA further enriched these figures. The farmer training centers were not easily accessible to the farmers, nor were they currently functional, as they remained either run-down or demolished, mainly due to poor initial construction and a lack of focus on maintaining them. Districts such as Dibbicha and Miridicha (Aletta Chuko), Rukkeessa Sukke (Haawassa Zuria), and Falka (Lokka Abbaayya) were examples of this. One of the purposes of establishing farmer training centers was to enhance farmers' capacity for good agricultural practices in such a way that improves farm productivity and compensates for the loss by climate variabilities and other constraints. However, as data showed, they were neither easily accessible nor existent at a local level, despite the existence of relevant government organizations (Ministry and bureau of agriculture) at national and regional levels. There were also traditional indigenous institutions: Olluu Songo, the lowest unit of elders' council; Ayiiddu Songo, a medium level council; and Garote Songo, the highest council (and a counterpart of the Parliament) of elders operating at different levels of the settlement patterns [13,41].

Specifically, Cimeeyye (ascribed elders), who were key informants, shared that these settlement patterns are distinguished by Qa'es (which include some 2–5 households), Qachaas (which are composed of as many as 7–10 Qa'es together), Ollaas (which consist of 4–7 Qachas and are equivalent to a single farmers' association), and Qamattes (which consist of different Ollaas and are equivalent to a district administration). This arrangement shows the existence of well-defined, delineated, and value-oriented indigenous institutions at a local level with potential knowledge, experience, and, remarkably, local resources such as workforce to easily adopt strategies that the government identifies to employ.

3.3.2. Fitness of Local Institution to Existing Contexts

The fitness of the local institutions regarding adaptation to climate change [8,10,27] is related to these institutions' functionality in addressing environmental issues, including their policy provisions, implementations, and implementation challenges [10].

Adaptation is a response to climate change and its impacts that occurs at the local level, and it requires predominantly centering local governments and local indigenous knowledge [37].

A survey (N = 400; Table 2) revealed that the percentages of households who received relevant service from functioning local government institutions were 35% (SD = 48), 29% (SD = 45), and 37% (SD = 48) in the form of the Productive Safety Net Program (PSNP), the Household Asset Building Program (HABP), and receiving climate information, respectively (Table 2). Similarly, those households who received training on good agricultural practices, marketing and market networking (supply of selected seed varieties and better animal breeds), and natural resource (soil water and ecosystem) conservation were, respectively, 38% (SD = 49), 28% (SD = 45), and 89% (SD = 31). Further, about 84% (SD = 37) and 25% (SD = 44) of households, respectively, responded that they had received educational and credit services (Table 2). Given that four out of ten Ethiopians are chronically food insecure [17,42,43], it is fair that 35% (with less dispersion of the responses) of the community receives the social protection services of the PSNP (Table 2). As the Federal Democratic Republic of Ethiopia (FDRE) has been working aggressively to ensure increased access to primary education [10,14,16], it is expected that 84% of the community reports having access to educational services. Similarly, the macro-policy level of FDRE vows to ensure the green economic revolution as manifested in Climate-Resilient Green Economy Strategy (CRGE) [18,40,44]. As part of this strategy, 89% of households reported receiving natural resource (soil, water, ecosystem) management services. Nevertheless, as pointed out above, the households' access to HABP, climate information, training on good agricultural practices, market (improved agricultural inputs), and credit (financial) services was seen far from average with less deviation of the responses. Local institutions' competitiveness is reflected by their effectiveness of service delivery [21,23,35,43], which could be determined by its receivers' level of satisfaction. Household survey data indicated that from the receivers of the services from above said governmental institutions, 26%, 40%, and 16% of households were satisfied with the services they received from PSNP, HABP, and climate information, respectively (Table 2). On the other hand, 50%, 51%, and 53% of households (Table 2), respectively, said that they were satisfied with training on good agricultural practices, market and market networking (access to agricultural inputs such as selected seeds, better animal breeds, fertilizer, pesticides, and farm outputs), and natural resource conservation (soil, water, and ecosystem). From the receivers of educational and credit services, 24% and 21% reported their satisfaction, respectively. These statistics show that households had the least satisfaction with climate information, credit services, education services, PSNP, and HABP. The maximum number of satisfied households was only 53 out of 100 households that received services on natural resource conservation (Table 2). A household's access to climate information helps farmers to adapt to a crisis and enables them to act proactively about the risks of shocks [7,9,16].

Table 2. Institutional service delivery and level of community satisfaction.

Variables	Service Delivered (1 = yes; 0 = no)		Delivered Service Satisfaction Status (1 = Satisfied; 0 = not Satisfied)	
	Mean	SD	Mean	SD
PSNP	35	48	26	44
HABP	29	45	21	53
Climate information	37	48	16	37
Training on good agricultural practices	38	49	50	50
Marketing services	28	45	50	50
Natural resource Conservation	89	31	53	50
Education	84	37	24	42
Credit	36	44	40	41

Source: a household survey (March–May 2020).

On top of this, one of the key informants, a rural development agent of the study area, pointed out that the rural development agents and agricultural extension workers had no access to official links with meteorological organizations. Thus, they could not disseminate timely weather information to the farmers with no access to nationally disseminated information via mass media. Further, they explained a severe gap regarding access to local level meteorological observation centers in the study area. A few were found in the distance beyond the 50 km radius, and most were broken due to poor management, as similar agents noted. Moreover, participant observation (OB) showed that centers of ground weather observation were located as far as some 62 km from each other, but some were found to no longer exist, challenging the reliability of using data from these centers. Education is a way to develop human capital. For a monotonic livelihood community like Sidama, although it is also the most effective tool to open avenues of alternative income besides rain-dependent agriculture, data showed that households were not satisfied with educational services institutions given to them. Participants in the focus group discussion echoed similar voices to the data of the household survey (Box 1).

Box 1. Notes of one of the FGDs Source: survey (March–May 2020).

We sent our decent boys to the school by selling out our cows, calves, oxen, trees, and other most valuable assets to afford for their education, hoping that we will be paid back later upon their employment after graduation. Currently, however, we found our boys at the same home in recurrent delinquency. We lost both our financial and obedient human resources at the school. 'It was not common to be unemployed after school at our age (40 years ago), and it is common to be unemployed after school nowadays, another added.

Other KII participants also expressed their evaluation that the educational institutions were ineffective in producing competitive labor power that could attain a non-agricultural livelihood. They mentioned a variety of factors, which were related to heat stress, droughts, winter frost in the morning, food shortage during drought season, frequent illnesses such as malaria and waterborne diseases, temporary migration during drought season leading to absenteeism, poor motivation and attention, dropouts. These factors led to common later effects on standard test performance on one hand, and on the other hand, inherent educational policies such as a “direct pass” policy (in which no child repeats the same grade despite failing the classroom test for that grade) at lower grade levels; a self-content policy (in which one teacher teaches all subjects in a classroom regardless of his/her competency in any of the subjects); a lack of entrepreneurship, in which theories about being an entrepreneur rather than being employed are presented to lower and upper grades, either in the form of content or subjects, and lack of vocational content and/or subjects, such as electricity, crafting, designing, and artisanship, which would allow students to be introduced to such opportunities and try

these skills with the potential to choose any of them as their later livelihood. As can be learned from the Education Sector development strategy of the MoE, Ethiopia's previous educational policy is 4:4:2:2, which is defined as follows: The first four levels are the first cycle of primary school (grades 1–4). The second four are the second cycle of primary school (5–8). The remainder refers to secondary school (grade 9–12), where the first two levels are the first cycle of secondary school (9–10), followed by the second cycle of secondary school (11–12), which is a preparatory school to join higher learning institutions [45]. It was observed from the educational sector development strategy of the MoE [45] that no vocational disciplines are found in any school grades. Instead, vocational training is only found at technical and vocational education training colleges. Students, therefore, only have access to such disciplines after completing grade ten and joining the technical and vocational education and training (TVET) colleges based on their score on the Ethiopian secondary school exit examination. Generally, with other things being equal, the lack of education policy concurrence and compatibility with the study area contexts lead to the education system's ineffectiveness in enabling learners to engage in non-agricultural livelihood opportunities. Thus, rural community households are not satisfied with the educational institutions' services, which reflects institutional unfitness.

Easier access to credit opportunities [2,3] assists farmers' adaptation to the impacts of climate change by improving the productivity of on-farm adaptation and by encouraging them to engage in off-farm activities. Nonetheless, in the National Bank proclamation of 592/2008, there is no way for farmers to access credit services from financial institutions. Only two microfinance institutions were observed, supplying a minimum number of loans under collateral terms that the poor people in rural settings could hardly fulfill. As was observed in their operational manual, loan services' interest ranged from 16 to 18% for the first year and doubles thereafter. The FGD participants unanimously described similar situations, referring to how the situation prevents their participation in such credit services and applauding their Liqoo-indigenous practice of borrowing and lending in the Sidama community. This finding agrees with the reports by [10,12,41] and the inscription [13]. Therefore, despite the existence of climate adaptation assistance from governmental institutions at the local level of the study area, data revealed that they were not accessible, nor were their services satisfactory enough if accessible, which reflects their lack of fitness in the context of this study.

3.3.3. Structure, Systems and Interplays of Local Institutions

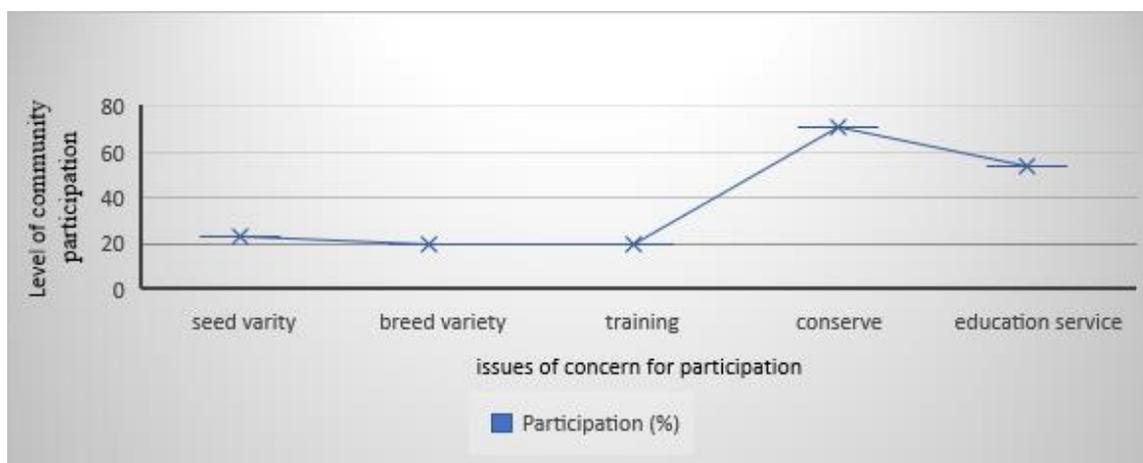
Structurally, it was observed that there were relevant governmental and institutional offices, including the Environmental Climate Change Commission, from regional to local districts of administration levels. Nevertheless, there was no single civic organization at a local level.

All multilateral and bilateral NGOs had their offices at a regional level with almost no structures at a local level, as learned through all PRA sources and other secondhand data reviews.

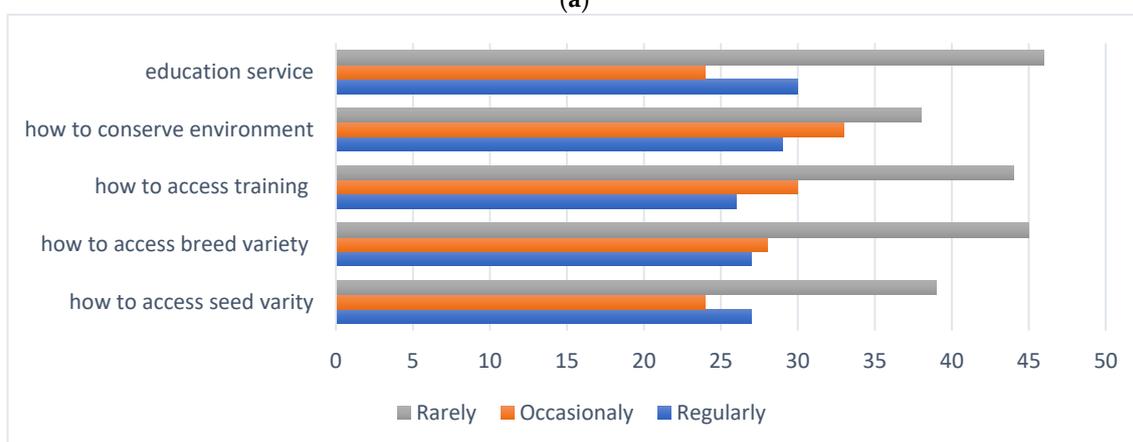
The 1981 African Charter on Human and People's Rights under Article 24 included environmental rights as part of human rights, and Africa as a whole thus became the first continent to introduce environmental rights [46]. In 1995, the Federal Constitution of Ethiopia recognized the environmental rights and the citizens' right to enjoy a conserved and managed environment, which was endorsed for implementation by the government's executive organs. In line with this, it was observed that governmental institutions in this study's focus, each have their respective systems of operations (regulations and guiding manuals). In addition, many scientific reports [11,22,43,46] commended that such initiatives need to be people-centered. Unless such governmental climate adaptation programs and civic organizations are operationalized by the maximum participation at the local-level community of concern, they are unlikely to meet the needs of local vulnerable groups, as is the case of the Global Environmental Facility-managed coastal adaptation project in Tanzania [47], Uganda [48], and East Africa [49].

The level of community participation in the regulation and guidance systems was low, and in particular, regulation and guidance related to improving seed variety, breeding a variety of cattle, and training on other good agricultural practices was below 25% (N = 400) for all three, while it was

54% and 70% for education and natural resource conservation, respectively (Figure 5a). The frequency of participation levels was rare, occasional, or regular for all analyses (Figure 5b).



(a)



(b)

Figure 5. Level and frequency of community participation in the making of procedures for local-level climate adaptation. (a) Level of participation. Source: a household survey (March–May 2020). (b) The frequency of participation. Source: a household survey (March–May 2020).

According to notes collected through FGD and KII on this issue, there was no evidence that community members participated in market practices (e.g., how to access improved seed variety, cattle breeds, and training on good agricultural practices). However, three rural development agents from Daarra, Aleta Chuko, and Borricha districts disagreed with FGD and KII notes. Previous studies on institutional matters in Ethiopia aligned, supporting local adaptation [43] in general, and [13,50] highlighted how awkwardness of local government’s systems impaired endeavors to reduce poverty in Sidama.

Furthermore, [10,14] reported institutional maladaptation in the area. Based on these scientific insights, it can be concluded that the findings of both the survey and the PRA are more acceptable than those of the rural development agents whom the government employs. Nevertheless, there were community participation practices in the school governance system at intermittent times through various platforms such as parent–teacher associations (PaTA), school governing boards (SGB), and general parents’ assemblies (GPA). Moreover, rural development agents and experts from the district offices facilitated community participation to carry out various environmental conservations. Specifically, the FGSs data from Daarra and Lokka–Abbaayya districts show that the sanctuary initiative in

earmarked areas (e.g., hot springs and Lokka–Abbaayya National Park) was the participatory one where inhabitants took various discussions continuously.

Environmental concern has been included and systemized into the curricula of grades 1–4 and those of social science subjects up to grade ten [45], which were observed in different students' texts. These curricula enabled the schools to impart environmental lessons to the pupils of the abovementioned grades, as the school directors of all five districts shared in one-on-one interview sessions. These directors also added that different extracurricular clubs had been established since 2000. Recently, the schools have been working on climate change and environmental management activities through awareness creation at the schools and afforestation in and around the schools. As a result, green schools and bushy plantations in and around the schools have contributed to shade from heat stress, which was severe some fifteen years ago.

Civic organizations [6,23] play a significant role in addressing latent demands and needs not addressed through public institutions' existing efforts by favoring the most vulnerable parts of a community. In this way, the success of philanthropic services depends on various factors, and the level of stakeholders' participation stands out as one of the key factors [10,22,35,37,51]. PRA source data indicated that the level of community participation in all phases of the projects of civic organizations, which were few in number and similar in their operations, was said to be the lowest.

The stories of KII and remarks from all FGDs indicated that indigenous institutions played vital roles in the environment and natural resource use and management, including using and conserving in terms of "the tragedy of commons". Other notable good practices of the Sidama community concerning the usage and management of their natural resources are the Seera principles, which work through the "Affini?" dialog. The Affini? dialog as a pillar in the making of Sidama indigenous institutions is described by [13,41]. Songo (session of elders) decides on many community matters. Some of the roles of Songo include (a) deciding who, when, and how to use a given commons' resources such as grazing fields (Dannawa); (b) deciding on the sanctuary of sacred places from which members of the community are exclusively prohibited from using and remains conserved for the practice of Sacrosanct ceremonies; (c) punishment decisions (e.g., for criminal acts, homicides, prohibited deforestation, and insubordinations); and (d) compensation to the offended ones through the Affini? dialog. Fortunately, Sidama's elders convoke their structures (songos) of all settlement patterns at the place known as Gudumaale, where big podocarps and leafy trees are accompanied by younger trees. As the elders' Songo convokes in every settlement stratum, in principle, there is a need to have Gudumale's for every stratum that it is highly likely to have numerous carbon sequestration bases in Sidama. Specifically, Sidama communities have well-recognized and organic endogenous knowledge of envisaging weather conditions of a day, a week, a month, a season, and even beyond that. For example, [41] wrote that Sidama's traditional astrologists (Ayyaanto) read the stomach of a slaughtered sheep for that purpose at the eve of the Sidama's new year (Fichee–Cambalaalla) and predict the likelihood of fortunes (rain, agricultural productivity, and economic prosperity and peace and security) in the following year. If their reading shows misfortunes (e.g., drought) for the following year [13], they warn the society to prepare appropriately.

This practice of the rural community was complemented by FGD and KII data. Accordingly, Sidama communities depend more on weather conditions of a given time through what they foresee: (a) temperature heat stress they observe, (b) wind direction and intensity, (c) cloud cover, (d) air moisture, (e) rainfall on holidays (raining on the day of Asterio-Mariam—Ethiopian Epiphany—hints at rainy seasons (Aletta Chuko), (f) seasonal thunder (roaring thunder; the more frequent the roaring is, the higher the likelihood of observing heavier rainfall), (g) a rainbow in the sky (observance of the rainbow at the sky is attached with end of the rainfall), (h) sounds of birdcalls named Giggishsho and Qo'laante—the signal for the rain that will fall later on—and the flocking of insects known as Okkoshama from the earth, which signals water and moisture sufficiency in the soil, after which perennial crops (e.g., enset and coffee) are to be planted. Different works in the literature [12,41,50] have also described similar points. This analysis shows that there are contextually well-fitted

endogenous institutions and knowledge in Sidama that support local-level climate adaptation practices. These institutions also have their structures (songos) and systems (Halaale and Affini?) that enable the pervasiveness of smooth functioning between and among them.

In short, data from the survey and PRA showed that though there were defined systems through which local government institutions are assumed to support local-level adaptation function, most institutions' systems showed less participation; the frequency of participation identified was rare. Moreover, despite their similar operations at the local level, civic organizations have no parallel structures (offices) with local public institutions' structures working on adaptation plans. This subsequently has created gaps in horizontal and vertical interplays. On the other hand, indigenous institutions have locally recognized traditional systems that enable rural communities to apply indigenous knowledge to local-level adaptation practices (Figure 6).



Figure 6. Endogenous knowledge-based adaptation practices at rural Sidama. Source: from Lokka Abaya district during field observation.

Institutional interplay (i.e., regular interaction) is one of the vital factors determining the success of individual and joint purposes for which each of them was established [1,4,6]. However, there are too many global instances to mention [11,23] of local indigenous institutions in which local governments played a remarkable role in climate change adaptation, including those in Ghana [21], Kenya, Tanzania, Malawi, Zimbabwe, southern Zambia [23], Fuji [21], and Bolivia [52]. At the macro-policy level, the NAP-ETH envisaged building a platform that assists local knowledge management in Ethiopia. Nevertheless, it was observed that there was no single point at which these indigenous organizations convene together with local government or civic organizations working on climate change adaptation. This finding accords with reports by [10,12,43,50,53] that there is a lack of horizontal and vertical interplay between and among the institutions working on the local-level adaptation role attributed to the failure of adaptation practices in Sidama's drought-prone areas.

3.3.4. Scales of Local Institution's Operation

There are several ways through which the sustainable effectiveness of institutions assisting with adaptation are constrained at a local level, including (i) their inability to scale up their operations for longer time periods (temporal scale-up); (ii) their incomprehensiveness, which is explained by their inability to include the most vulnerable groups who were victimized by formal institutional impropriety (e.g., abuse of rights by police, war and conflict regimes, and market failure) and harmful traditional practices (e.g., exclusion of women from the right to inherit property, early marriage, polygamy); and (iii) their inability to expand areas of operation (spatial scale-up) [8,37,52,54].

It was observed from rural Sidama that endogenous-knowledge-based practices of local-level adaptation are sustained over time on a broader basis (Figure 6). It is uncommon to observe the storage of crop residuals, especially of maize, on wet trunks and leaves of trees in Sidama's drought-prone

districts, which is a habitual practice of farmers in these districts throughout the years. The farmers consider the weather condition of the upcoming season based on their long-lasting experiences and store residuals during harvesting and good days to use them as animal fodder when drought occurs later on.

According to [40,44,55], Ethiopia predicts a 50% reduction in carbon emissions and its equivalents by 2030 through its Climate-Resilient Green Economic Strategy (CRGE) while reducing vulnerability to climatic shock and enhancing resilience. Nonetheless, the focus given to their effective implementation was observed to be intermittent. According to information from rural development agents of all districts, afforestation activity focused only on planting seedlings, while stewardship of plants is neglected. Afforestation was also campaign-based and seasonal, whereas less attention was given to monitoring and evaluating the real stock grown. Undeniably, billion of seedlings were being planted annually according to the “Green Legacy” motto to achieve CRGE efficiently and effectively. Still, there is a need for a kind of institutional apparatus to follow-up and take care of the planted seedlings. In addition, government institutions started a campaign of water harvesting schemes at a local level ten years ago. The objective was to supply water for drought-prone areas, mainly for agricultural uses. However, there are no such initiatives at present, and even former establishments have presently disappeared while the community is under severe water shortage.

There have been some initiatives since 2012 by civic organizations (e.g., the Abenezer Rehabilitation and Development Association (ARDA) and the Water, Sanitation and Hygiene program (WASH)) intervening through “school feeding” programs in Daarra, Aletta Chukko, and Borricha (Figure 7) where food insecurity caused by drought was commonly reported [31].



Figure 7. School feeding at Borricha district in 2016. Source: archive from Abenezer Rehabilitation and Development Association (ARDA).

However, such interventions have been withdrawn. It should be noted that a given civic organization could withdraw for any reason, including the project’s phase-out.

Since formerly intervention programs positively contribute to addressing socio-economic problems a community faces, similar interventions should be scaled-up and sustained until the problem is no longer a challenge for socio-economic development and human wellbeing. These interventions’ discontinuities implied a temporal scale-up limitation on both public and civic institutions. This limits the sustainability of adaptation practices, which then constrains transformative adaptation.

A household data analysis revealed that 89% of women, children, youth, and people with physical disabilities did not participate in all stages of projects that engaged in intervening and supporting local-level adaptation. According to various recommendations from the literature [33,37,54,56], when working with empowering the most vulnerable groups, mainstream and integrated programs could yield better outcomes than those that operate discretely. A review of progressive, summative, and scientific reports on integration identified two major inherent limitations of civic organizations. First, there was redundancy, which is explained through three or more civic organizations operating in

the humid and highland district of Hawassa Zuria (within 25 km of Hawassa). In contrast, only one was operating in dry and lowland districts of Lokka Abaya and Daarra (90 km from Hawassa). This could be attributed to the governance of civic organizations, which usually sign their agreement with federal and regional governments and operate on the local level by commuting from the regional city of Hawassa with no formal interplays with institutions at the local level. The other limitation is related to their inclusiveness. Their interventions to support the vulnerable groups had flimsy operations. Theoretically, children, women, the elderly, and peoples with impairments were collectively defined to be vulnerable groups [3,7,52], and economic, political, and social empowerment of women was said to most important one to scale-up the outcomes of interventionist investment [6,34,46]. However, the evaluation mentioned above observed that most civic organizations' intervention was in terms of agriculture, education at school, and integrated health. Only two out of seventeen civic organizations were observed as providing education to disabled people in Aletta Chukko and Borricha, whereas no similar organization was observed in the other three districts. It was only in Darra districts that civic organizations were observed working on girls' and women's empowerment through education. No civic organization was observed to be working on programs for the elderly. Overall, limitations were observed to be linked with continuity in terms of interventions (temporal scale-up), the scope of operations (spatial scale-up), inclusiveness, and intensification of interventions of civic organizations in supporting vulnerable groups. Data indicated that, with a particular focus on the most vulnerable groups of the community to which the support's transfer was direct, the productive safety net program (PSNP) intervention was scaled up across all districts analyzed. This intervention worked well the last time it was implemented, which shows its better position vis-à-vis civic organizations in terms of the three abovementioned types of scales. It was reported by [43] that the social protection program was constrained by the government, which feared social dependency to proliferate among beneficiaries. Notwithstanding misappropriations and improper implementations at local levels [10,20], the social protection program (PSNP) played a significant role in lifting up chronically food insecure beneficiaries from hunger and further death.

Conversely, similar sources indicated that there was temporal scale-up, inclusiveness, and spatial scale-up limitations due to the access to and use of credit services, meteorological information, water supply (e.g., schemes of irrigation including water accumulation and use of schemes that were later abandoned), market, and market networking, veterinary services, and drought-index insurance, all of which were parts of government institutions. This finding was relevant according to [13] and reports by [10,14,16,17,43]. Further, in addition to household survey data, data from PRA indicated that notwithstanding temporal limitations showing a continuous follow-up of their growth, seedlings that had been planted across districts previously mentioned were widely scaled up and intensified. Therefore, in addition to its policy provision and cascading its policies to its relevant structures downwards, the government should focus on monitoring, evaluating, and learning.

4. Discussion and Policy Implication

4.1. Discussion

The study explored the existence, functionality, dysfunctionality, fitness, and sustainability of institutions supporting adaptation to climate change at a local level of the Bilate Basin Agropastoral Livelihood Zone in Ethiopia. The study traced the change in climate variables indicated by decreasing annual rainfall and statistically increasing temperature, which antecedent studies [10,12,15,16,29] have also reported. This change brought about multifaceted impacts perceived and estimated by farmers experiencing them at a local level. The household survey indicated that the reduction of major livestock by 69% was attributed to climate change. In addition, prior studies [14,16,31,32] reported that there were prolonged droughts, animal diseases, and crop failure [32] attributed to climate change and variability over the area, and these incidents collectively led to a decline in livestock and farm

production by exposing farmers to food and livelihood insecurity. For instance, [32] reported this figure to be 80% without adaptation.

Though the types, depth, and scope of adaptation practices vary across districts and even within districts, all farmers practice adaptation to climate change. This finding corresponds with various previous scientific studies, including [14,16]. In the form of livestock-based adaptation, most farmers preferred to continue to reduce the size of major livestock and even destock the remaining ones and switch to non-ruminant livestock and poultry, whose climate change-driven risks were believed to be less than for ruminants. Specifically, [33] highlighted the pathways of the impact of climate change on livestock production and productivity and listed adaptation strategies, including livestock diversification, destocking, switching, abandoning, and migration that pastoralists practiced in the Borena community of Ethiopia.

Whether they are formal or informal, institutions are believed to be one of the determining factors for success or failure of adaptation to climate change at the local level. Through four methods that this study employed to appraise institutions' role in assisting farmers' efforts to adapt to the changing climate, it was concluded that indigenous institutions were well functioning and better supported local-level adaptation with high sustainability than governmental and civic institutions. While this is the reality on the ground, indigenous institutions have gained little attention from academic literature [10,16,17], policymakers, and promoters of climate change adaptation at a local level.

4.2. Policy Implication

The practice, breadth, depth, and sustainability of the adaptation to changing policy at a local level are a function of the government's political will and its macrolevel policy instruments. The result of this study indicated the following policy implications.

4.2.1. The Existence of Institutional Apparatus and their Setups

The Ethiopian government has vowed to ensure environmental wellbeing as a third-generation right and as a citizenry right, as defined in the FDRE's constitution of 1995. Including its multifaceted overall strategy, the Climate-Resilient Green Economic Strategy (CRGE), various large-scale programs have been designed for prevention, adaptation, and mitigation, with a particular focus on reducing vulnerability, household asset building, and public work for environmental rehabilitation and generation of livelihoods. However, some vital national programs such as REED+ and NAP-ETH (drought-indexed crop insurances, alternative energy development, and irrigation schemes) that were assumed to operationalize the CRGE were not implemented in the study area. Further, although a few civic organizations were registered to support overall socio-economic development in the study area, they had no structures in the areas where they were supposed to work. Thus, the federal government should strengthen its monitoring, evaluation, and learning activities to ensure whether or not its national-level strategies were appropriately implemented.

4.2.2. Institutional Fitness and Compatibility

Some policies through which both public and civic institutions were operating were found not to be context-relevant (e.g., civic organization governance policy, general education policy, and credit policy). Therefore, the government should consider reviewing its civic organization governance policy, education policy, and farmers' credit service policy.

4.2.3. Institutional System, Structure, and Interplay

The institutions that this study considered to operationalize the CRGE have not been regularly participating in the local community. Nor were they satisfactory or effective (except for the practice of natural resource conservation and PSNP) with the services they delivered in relation to local-level climate adaptation. The data showed that both the beneficiary satisfaction and better outcome of the programs were linked with community participation, so local governments should promote community

participation. As they have no institutional apparatus at the local level, civic organizations were operating in a way that involved commuting from the regional center, which is likely to create a gap in the horizontal and vertical interplay between them and other like-minded institutions. The governance model of the civic institutions with the government institutions is top-to-bottom. In this approach, the project contract was being signed at the level of a civic organization and the federal or regional government without the participation of lower-level community structures for whom the project is expected to work. As data indicated, there were fitness, interplay, and sustainability gaps under this form of governance. Therefore, the current form of governance should be changed to a bottom-to-top approach. Under this model, the role agreement would be signed at the local level, where both the problems to address and the primary stakeholders are; the strategic agreement would then be signed at the government's top-level structures (e.g., regional government and federal government). This approach could help to increase civic organizations' accountability, which later could improve their effectiveness and efficiency. In addition, due to their climate change adaptation endeavors, public, civic, and indigenous institutions were operating in a flimsy and intermittent manner. Thus, their roles were redundant, self-completing, wasteful, and non-predictable, implying a lack of synergy, interplay, and sustainability. Therefore, the local government should revitalize how they promote synergy, interplay, and operation scales at local levels.

4.2.4. Institutional Operation Scales and Sustainability

There were various programs of public and civic institutions designated to support local-level adaptation to climate change. Although some of the programs were well functioning (e.g., PSNP and integrated natural resource conservation), others, such as the green legacy, the seedling conservation program, the school feeding program, and the rainwater harvesting program, lacked continuity and remained limited in helping the most vulnerable strata (children at home and school, women and impaired people) of the community. Therefore, the government should plan to scale up the adaptation programs with a promising effect towards other parts of the community in need and should ensure a sustainable adaptation.

5. Conclusions

Data revealed a significantly increasing temperature trend while the rainfall showed a decreasing trend that was not statistically significant. This variability of both climate variables resulted in droughts and diseases that collectively attributed to a decline in 60% of major livestock and farm yields, thereby affecting the rural community's livelihoods and lives. There were various endeavors by governmental, civic, and indigenous institutions to manage risks caused by the impacts of climate change.

There were numerous indigenous institutions of Sidama with functioning structures and systems that were well nurtured through indigenous knowledge with high relevancy to community-based climate change adaptation. Nevertheless, it has been learned that neither governmental nor civic institutions' programs had recognized or empowered these institutions to yield better outcomes in line with community-based climate change adaptation. Similarly, no formal platform converged the consortium of indigenous–governmental–civic institutions, together with their common goal (achieving local-level adaptation). Therefore, in addition to reviewing its climate change adaptation policies stipulated above, the government should appreciate the vital role of indigenous institutions and establish the common platform of civic–government–indigenous (CGI) institutions and intertwine indigenous knowledge with the scientific ones for better outcomes of local-level adaptation.

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