

Building Resilience of Rural Livelihoods to Climate Variability through Informal Microfinance Institutions in Tharaka South Subcounty, Tharaka Nithi County, Kenya

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Abstract: Informal microfinance institutions are member based community organizations through which members collectively undertake various mutual support initiatives. They enable members to fill their adaptation deficits by contributing towards access to livelihoods assets hence enhancing livelihood strategies through which they build resilience. However, despite the critical role informal microfinance institutions play in building resilience, no studies have been done to undertake a detailed analysis of their role in building resilience of rural livelihoods to climate variability. More so, no studies have analyzed the influence of informal microfinance institutions towards resilience of rural livelihoods to climate variability based on their contribution towards access to capital assets hence enhancement of livelihood strategies. This therefore necessitated a study to analyze the role of informal microfinance institutions towards resilience of rural livelihoods to climate variability. The study was based on the sustainable livelihoods framework and used a descriptive study design. It uses multistage sampling design with data being collected from secondary and primary sources. Data analysis was done using thematic analysis, descriptive analysis and linear regression analysis. The study finds out that the social networks created by informal microfinance institutions enable collective action through which members undertake mutual actions that build their resilience to climate variability. Through these mutual actions, members are able to effectively and efficiently mobilize capital resources, undertake production and income generating activities, participate in governance and development processes and support each other through various reciprocity mechanisms. They are also avenues for emotional support and access to knowledge and skills through shared learning and trainings.

Key words: Climate variability, informal microfinance institutions, livelihood assets, livelihood strategies, resilience building, resilience, social capital, sustainable livelihoods framework

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I. INTRODUCTION

Informal microfinance refers to all financial transactions that occur outside the regulation and control of the monetary authority (Owusu et al, 2013). Informal microfinance institutions are in effect coping strategies and mutual support mechanisms that poor people have evolved in response to their financial marginalization (Tilakaratna, 1996). Microfinance help build resilience by filling the adaptation deficit i.e. the gap in adaptive capacity that a household has due its lack of capital in various forms hence enabling access to adaptation technologies (Scheyvens, 2015).

Microfinance services contribute towards asset accumulation through microcredit, micro insurance or micro savings (Hammil et al, 2008). The social networks created through membership to informal microfinance institutions improves social capital (Mersland and Eggen, 2007). Access to capital assets determines the resilience level of a household or community (Uy et al, 2011; Oft, 2009; Verner, 2010; Saxena et al, 2016). Microfinance institutions also provide networks that enable access to people who are most vulnerable to climate risks (Agrawala and Carraro, 2010). Moser and Faria (2014). In addition, they engage in other non-financial activities aimed at fostering resilience including environmental conservation and training.

Based on the fact that microfinance institutions contribute towards adaptation and mitigation of climate change and variability (Hammil et al, 2008; Ritchie, 2007; Bhattamishra and Barret, 2008; Oft, 2009; Okibo and Makanga, 2014; Komba and Muchopondwa, 2015). Informal microfinance institutions could thus also have a significant influence on climate variability resilience in rural areas of developing countries where the informal finance sector is three times bigger than the formal one (Haworth et al, 2016). However, although studies have been undertaken to analyze factors influencing resilience to climate change and variability including (Perez et al, 2015; Agyir et al, 2015; Cheb, 2015; Mondal et al, 2016; Bryan et al, 2011, Lyimo and Kangelawe, 2015). None has considered the contribution of informal microfinance institutions as a factor in their analysis.

More so, studies undertaken to analyze the role of microfinance institutions in resilience of rural livelihoods to climate variability (Gash and Gray, 2016; Moser and Faria, 2014; Schyvens et al, 2012; Mushuku and Mayisha 2014; Okibo and Makanga, 2014) did not do a detailed analysis of the role of informal microfinance institutions towards building resilience to climate variability. This means that no studies have analyzed the influence of informal microfinance institutions towards resilience of rural livelihoods to climate variability. This is the contribution of informal microfinance institutions towards access to capital assets and livelihood strategies based on the sustainable livelihoods framework. According to Kabede and Adane (2011) livelihood assets determine how livelihoods work and are the basis of livelihood strategies. Livelihood strategies constitute how people convert assets into desired outcomes which include resilience to climate variability (Nayak and Maharun, 2013). Studies on response to climate change and variability in Tharaka (Mugi, 2011; Recha, 2009) do not analyze the role of informal microfinance institutions in resilience to climate variability.

II. THEORETICAL FRAMEWORK

The sustainable livelihoods framework was developed by DFID based on Chambers and Conway (1992) definition of livelihoods. i.e. ‘‘A livelihood comprises the capabilities, assets and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and maintain or enhance its capabilities and assets both now and in the future while not undermining the natural resource base’’. The framework underlies a couple of core principles i.e. its people centered, holistic, dynamic, builds on strengths, micro-macro links and sustainability. The sustainable livelihoods framework is the core of the sustainable livelihoods approach and provides an organizing structure for analysis (GLOPP, 2008).

The sustainable livelihoods framework is an analytical framework used to understand the various factors that affect the livelihoods of the poor and to examine how these factors interact amongst themselves (UNDP, 2015; Petersen and Pedersen, 2010). It conceptualizes and enables a comprehensive understanding of the livelihood processes through which people make a living in an area (Tarekegne et al, 2014). The sustainable livelihoods framework views people as operating in a vulnerability context.

The vulnerability context frames the external environment in which people exist and highlights their susceptibility to its negative effects and how they respond (Aniah et al, 2016). It is shaped by different factors including shocks, trends and seasonality (Nayak and Maharun, 2013). The vulnerability context varies across spatial and temporal scales including between and within communities, social groups, sectors, regions and nations as determined by socioeconomic and structural inequalities (United Nations, 2016; IPCC, 2001; Bohle et al, 1994). These variables also influence people’s perceptions of the vulnerability context, the understanding of which is pertinent in developing appropriate resilience building strategies (IUCN et al, 2004).

The core aim of the sustainable livelihoods framework seeks to reduce vulnerability to shocks, trends and seasonality by building the livelihood assets of households (AIACC, 2003; DFID, 2000; Agyir et al, 2015; Piya et al, 2012; Badjeck, 2009). The sustainable livelihoods framework therefore conceptualizes rural livelihoods as a process of transforming and substituting between human, social, financial, physical and natural capital (Jacobs et al, 2015). It seeks to understand people’s livelihood assets and how they convert them through livelihood strategies to achieve positive livelihood outcomes (Moser et al, 2011). The viability and effectiveness of livelihood strategies thus depends on access to assets as influenced by ecological, socioeconomic and institutional factors (Kabede and Adana, 2011; Majale, 2002).

The choice of livelihood strategies is mediated by structures and processes, an important element of the sustainable livelihoods framework (Chambers and Conway, 1992; Daw et al, 2009; Ellis, 2000). Structures include private and public organizations such as households, members groups and the community (FAO, 2008). Structures are important because they form the basis for establishment and implementation of processes. Processes include social norms, culture, and legislations, policies, agreements, rights of individuals and power relations (DFID, 2000).

Structures and processes operate at all levels from the household to the international level and in all spheres including the private and public (DFID, 2000). They determine how, where, when and by whom assets are accessed, used, controlled and decided upon hence influencing livelihood strategies (Moser et al, 2011; Carney, 2003). Structures and processes also form the link between the individuals and households at the micro level and the macro level contexts (Scoones, 1998).

Structures and processes define the way in which institutions and individuals behave, operate and interact in a community (Lowe and Schilderman, 2001). By doing this, structures and processes can determine resilience of the socioecological system (Adger, 2000; Lo, 2013; Raymond and Robinson, 2013, Chen et al, 2014; Fernandez-Gimenez et al, 2012). Local institutions thus play a critical role in shaping climate variability resilience building. They do this by shaping the impacts, shaping response through different incentive structures and acting as intermediaries for external interventions and support (Agrawal, 2010).

III. MATERIALS AND METHODS

Study Area

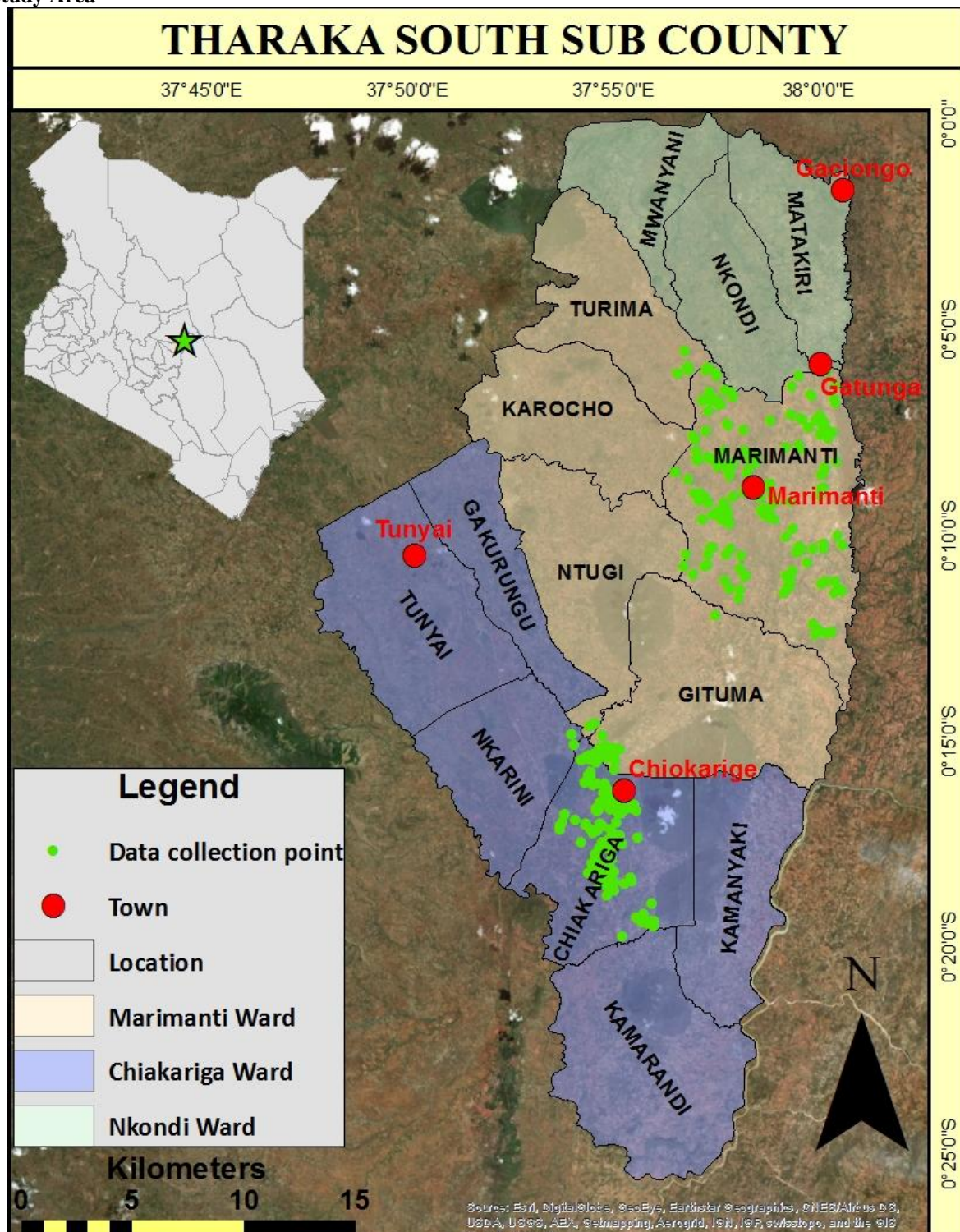


Figure 1: Map of Tharaka South Sub County

Tharaka South Sub County is part of Tharaka Nithi County and lies to the East of Mount Kenya. It covers a surface area of 689 KM² (GoK, 2010). Tharaka South Sub County is subdivided into three wards namely: Nkondi, Chiakariga and Marimanti (GoK 2012b). Tharaka South Sub County has a total population of 80,122 people of whom 38,653 are male while 41,464 are female. The sub county has 17,111 households and a population density of 116 people per KM² (GoK 2010b). The sub county has three main livelihood zones namely the mixed farming zone, marginal mixed farming zone and the rain fed farming zone (Government of

Kenya, 2008). The people are largely agro pastoralists with farming and animal husbandry accounting for over 70% of their income (Kirrairie *et al*, 2012).

The sub county is marked by high numbers of registered community based groups most of which are engaged in informal microfinance activities. The area is characterized by inadequate access to formal financial institutions with the main source of credit therefore being informal microfinance institutions.

Tharaka South Subcounty experiences unusual climate variability due to climate change (GoK, 2012b) and also due to the fact that it is semi-arid. The sub county mainly receives low, unreliable and poorly distributed rainfall (GoK, 2016). Rainfall has a bimodal pattern and fluctuates between 500 to 800 mm per annum (GoK, n.d.). Temperatures range between 24 to 37 degrees centigrade (GoK, n.d.) but at times rise up to 40 degrees centigrade (Kabui, 2012). The sub county falls in the dry/savannah climatic zone according to the Koppen-Geiger climate classification. Proximity of the area to Mount Kenya means that the local climate is influenced by the *El Nino* southern oscillation, inter tropical convergence zone, latitude, and altitude and sea surface temperatures among other factors (Odingo *et al*, 2012).

IV. DATA COLLECTION

The study used a descriptive study design. It employed multi stage sampling design. Two Locations i.e. Marimanti and Chiakariga were first selected randomly for the study. An inventory of informal microfinance groups was then created indicating the sub locations where they are based. 18 groups proportionately spread across sub locations in each of the locations were then selected. 11 respondents were then chosen systematically from the lists of the selected informal microfinance groups to form the study sample. The study's sample size was determined using Cochran's (1963) Equation 1 and a sample size of 385 respondents arrived at.

Secondary data was obtained through review of existing literature. Primary data was collected through: focused group discussions, key informant interviews, observation and household questionnaire survey. Data collection was done with the assistance of a mobile based georeferenced data management system called kMACHO. Methodological triangulation was used to cross verify, validate and harmonize data from different data collection methods. This helped increase the credibility and validity of the results.

Pilot testing of the data collection instruments was done to check for weaknesses in design and instrumentation. The data collection instruments were evaluated for validity through expert consultation. The research instruments were tested for reliability using the Cronbach Alpha method to test the degree of internal consistency between the items. A Cronbach alpha of 0.774 was arrived indicating good reliability.

V. DATA ANALYSIS

Analysis of the role of informal microfinance institutions in building resilience of rural livelihoods to climate variability was done using thematic and descriptive analysis. Household's resilience to climate variability was measured based on the sustainable livelihoods framework. The sustainable livelihoods framework is concerned with how people use a range of assets to devise livelihood strategies with an aim of achieving positive livelihood outcomes i.e. resilience to climate variability (Connoley-Boutin and Smit, 2016).

In doing this a household's access to capital assets was measured in terms of the total expenditure incurred in accessing them. This included household expenditure on access to education and health care, and expenditure on access to inputs i.e. assets for crop and livestock production. The amount and proportion of money sourced from informal microfinance institutions and used as part of a household's total expenditure towards accessing these assets was used as an indicator of the contribution of informal microfinance institutions towards resilience to climate variability. The total values of a household's crop production and livestock production was also used as a measure of resilience to climate variability.

In order to ascertain if informal microfinance institutions contribute towards resilience of rural livelihoods to climate variability. Linear regression analysis was used to find the relationship between the contribution of informal microfinance institutions and a household's total expenditure in accessing these capital assets and production activities i.e. resilience to climate variability. This was also ascertained by using the linear regression analysis to find the relationship between the contribution of informal microfinance institutions and the total values of a household's crop production and livestock production i.e. resilience to climate variability.

VI. RESULTS

How informal microfinance institutions help in building resilience to climate variability

When asked whether informal microfinance institutions helped in addressing the impacts of climate variability, using rainfall as an indicator, 80.8% of the respondents said that they help. This is enabled in various ways including through financial and social functions of the informal microfinance institutions.

Informal microfinance institutions enable members to mobilize and access financial capital through savings, loans, dividends and financial assistance which they use to access assets which are converted through livelihood strategies whose outcome is resilience to climate variability. 53.6% of the respondents who said that

informal microfinance institutions help in addressing the impacts of climate variability said that they do so by helping them to access loans. 11.7% cited access to loans as being the reason why they joined informal microfinance institutions with another 0.6% said they joined to benefit from the easily accessible and affordable loans they give to members. Moreover, 20.5% cited access to loans as being one of the benefits they gained from being members of informal microfinance institutions with 1.7% observing the better repayment rates of these loans as being a benefit. 0.3% of the respondents who had borrowed money from informal microfinance institutions in the last one year said they had borrowed to sustain informal microfinance activities while another 0.1% said they had borrowed to make their contributions to an informal microfinance institution.

3.9% of the respondents noted informal microfinance institutions help them to address impacts of climate variability by providing financial capital through the dividends shared on the auction date. 2.1% of the respondents cited these dividends as being among the benefits they get from informal microfinance institutions. More so, informal microfinance institutions encourage members to save money by providing an avenue for making savings and instilling self-control hence financial discipline which is achieved through peer pressure and groups by laws. 8.6% of the respondents who said informal microfinance institutions help them in addressing impacts of climate variability said this happens by helping them to make savings. 8.6% of the respondents said they joined informal microfinance institutions in order to be able to make savings with 3.4% saying this is one of the benefits of being a member of an informal microfinance group.

6.9% of the respondents said they had joined informal microfinance institutions in order to access financial assistance from the group while 1.6% cited this as being one of the benefits they gain by being members in an informal microfinance institution. 3.0% of the respondents said they joined the informal microfinance institution so as to get money to cater for their family financial needs with 7.4% of the respondents citing this as being one of the benefits that they get from being members. These institutions thus enable members to mobilize adequate financial capital much easily than they can mobilize individually.

Informal microfinance institutions also enable members to access insurance either through drought index insurance for crop and livestock production and human health insurance schemes. This is because they enable members to access financial resources to pay for required premiums. Some groups enroll members collectively. Agencies offering insurance services also enter communities through such groups hence enabling members to access the services. More so, 0.3% said they had joined so as to be able to raise money to respond to emergencies. 0.8% of the respondents who borrowed money in the last one year did so to respond to emergencies.

Informal microfinance institutions also help in climate variability resilience by enabling livelihoods and income sources diversification. This is attained by giving members the financial capacity to invest in alternative income sources, enhancing member's skills and knowledge through trainings and greater access to livelihood opportunities.

Informal microfinance institutions enable member's to invest in entrepreneurship activities either individually or jointly. When asked the benefits they get from informal microfinance institutions, 2.2% of the respondents said that they offer opportunities for investment with 1.4% saying they enable them to start and run business activities. The informal microfinance institutions do this by helping member's access financial capital. 6.6% of the respondents who had borrowed loans in the last one year said they wanted to boost their existing businesses while 5.2% said they wanted to start a new business. The informal microfinance institutions also support members to build their entrepreneurship skills by enabling access to trainings and shared learning.

Informal microfinance institutions enable members to invest, produce and market collectively thus enhancing their bargaining power and efficiency through produce bulking and economies of scale. Informal microfinance institutions have organized structures that allow access to better production and marketing arrangements such as contract farming and tenderpreneurship. They also enable members undertake investments whose resource requirements they can't mobilize individually including initiating big business enterprises, initiating projects or purchase of expensive assets.

12.2% of the respondents said acquisition of property and household items is one of the benefits they get from informal microfinance institutions. 0.8% of the respondents who had borrowed loans in the last one year said they had borrowed in order to buy a piece of land while 0.8% had borrowed to buy household items. In addition, 1.7% of the respondents who had borrowed loans in the last one year said they had borrowed to build a house whereas 0.1% had borrowed to do fencing.

Informal microfinance institutions support members in crop and livestock production by supporting purchase and access to inputs and improved crop and livestock varieties. This is enabled through loans borrowed and dividends earned from the groups and external funding accessed through the group. They also enable to access trainings and extension services hence improved knowledge and skills e.g. on climate smart agricultural practices. 0.8% of those who said informal microfinance institutions help in addressing impacts of climate variability said they help them to access resistant seeds through support from external agencies. 3.5% of the respondents had borrowed loans in the last one year to purchase livestock while 3.0% borrowed to purchase

farm inputs. 1.4% of the respondents borrowed to pay for water connection while another 0.4% said they borrowed to pay their water expenses.

Informal microfinance institutions help improve food and nutritional security by supporting agricultural production and enabling more access to financial capital which members could use to purchase foodstuff. 7.4% of the respondents who borrowed money in the last one year said they had borrowed to buy food. By supporting improvement in crop and livestock production informal microfinance institutions contribute towards increased production and income levels hence also food and nutrition security.

Informal microfinance institutions enable members to access trainings and extension services. These include trainings and extension services on microfinance including on other knowledge and skills meant to increase production and investment capacity and improve their livelihoods. 0.8% of the respondents said informal microfinance institutions support them in addressing climate variability said this is because they enable them access trainings on saving. 0.1% of the respondents said they joined informal microfinance institutions to access training opportunities e.g. seminars. Informal microfinance institutions also provide platforms for shared learning and exchange initiatives through which members share information on best practices and lessons learnt. They also serve as conduits for dissemination of information and knowledge to the larger community. 1.9% of the respondents said they had joined informal microfinance institutions due to the opportunity of learning through sharing of ideas and information with fellow members while 2.6% referred to shared learning as being one of the benefits.

Informal microfinance institutions empower marginalized people in the community enabling them to participate in development decision making process and influence institutional frameworks, legal and policy frameworks and strategic frameworks to address their interests. Informal microfinance institutions also lead to women empowerment especially as they become economically empowered and knowledgeable hence greater involvement in decision making, financial freedom and access to assets.

Informal microfinance institutions help build social capital through social networks. This enables members to support each other through various reciprocity mechanisms. In doing this members support each other through monetary contributions or in kind. Some groups set aside a special welfare fund which is used to help a member who is in need e.g. in case of an emergency. Others have rotational shared labour arrangements between their members. When asked how informal microfinance institutions helped them address impacts of climate variability, 7.6% observed that members of their group's collectively contribute money to help a member who is faced with an emergency situation. 2.1% noted that members support each other through merry go round schemes whereby they contribute to each other on a rotational basis.

Informal microfinance institutions are sources of emotional support whenever a member has a stressing issue. This is attained by sharing issues with fellow members and mutual support. 3.9% of the respondents who said that informal microfinance institutions help them in addressing impacts of climate variability said this is because fellow members give them emotional support whenever they have a problem. 7.9% of the respondents said they had joined informal microfinance institutions due to the emotional support group members give to each other while 1.6% of the respondents alluded to this as being one of the benefits they get from the informal microfinance institutions. 0.3% of the respondents said one of the benefits they get from informal microfinance is that they help relieve stress by sharing their problems with fellow members.

Informal microfinance institutions through positive peer pressure, social norms, group's bylaws and providing livelihood opportunities that keep people positively engaged promotes good discipline which cumulatively trickles down to the larger community creating the right conditions for livelihoods improvement. Informal microfinance institutions create social harmony between community members. They also create social harmony between members from different communities through as they engage in joint events, support programs and exchange activities. Creation of social harmony provides an enabling environment for conflicts and disputes management within and between households and communities.

Informal microfinance institutions help improve members health through increased access to healthcare services. This is attained by enabling access to financial resources to meet health care costs, access to health trainings and enabling access to health insurance. There are some informal microfinance institutions who address health care activities as their primary activity i.e. health support groups while others address health care issues as a secondary activity. 4.0% of the respondents who borrowed money in the last one year said they had borrowed to pay for health care services.

Informal microfinance institutions help members to access education. This is as a source of financial resources to meet educational costs. Some informal microfinance institutions are formed with primary objective of paying educational expenses. When asked why they had joined informal microfinance institutions, 4.5% of the respondents said they had joined in order to raise money for paying school fees with 10.3% of the respondents mentioning this as one of the benefits they gained by being members of informal microfinance institutions. 30.4% of those respondents who had borrowed loans in the last one year said the purpose of borrowing was to pay school fees.

Some informal microfinance institutions are involved in environmental conservation and management as an activity. Such groups contribute towards resilience building through the ecosystem based approach. This could be through seedling production and tree growing, participation in environmental conservation and sensitization and as natural resource users groups. 6.5% of the respondents who said that informal microfinance institutions help them in addressing impacts of climate variability said this is through engagement in tree planting activities. 1.3% said informal microfinance institutions help build their capacity for environmental conservation through trainings. Moreover, 0.8% of the respondents had joined informal microfinance institutions so as to participate environmental conservation efforts.

Informal microfinance institutions also enable members to access alternative energy and energy saving technologies e.g. kuni mbili jiko's. Some groups have been trained on how to make the energy saving jiko's using local raw materials hence greater availability and affordability. Use of alternative energy sources and energy saving cook stoves is pertinent to forests conservation.

Informal microfinance institutions serve as entry points for development programs by government or non-government agencies. By having better knowledge of the community and representation of its characteristics, these groups' help in better planning and targeting of interventions especially by enabling access to the most vulnerable people. 0.3% of the respondents said they joined informal microfinance institutions because the group's offer support to vulnerable people in the community. 6.8% said they joined informal microfinance institutions because they wanted to access the development benefits members are able to access with 9.2% joining because the groups provide opportunities for member's personal development.

Informal microfinance institutions also help in community projects planning and implementation hence sustainability. This is by providing in kind human resources support through participation, providing community based implementation structures, promoting community ownership, enabling easier access to needed information, and enabling mobilization of matching funds in programs where it's a requirement.

Resilience to climate variability based on access to capital assets and livelihood strategies

Household resilience to climate variability was measured based on access to capital assets i.e. education and health livelihood strategies i.e. access to inputs of crop and livestock production. This involved using expenditure on access to education and health care and expenditure on inputs of crop and livestock production as indicators for household's resilience to climate variability according to the sustainable livelihoods framework. The value of animal and crop production per household was also used to measure resilience of households to climate variability.

The total amount of money spent on access to education in the last one year across the respondent's households was KShs 27,918,510 with the average expenditure per household being KShs 72,516. The household's expenditure on education ranged between KShs 400 to KShs 2,000,000. Household's expenditure on education involved spending on various expenses including 22.8% spent on books while 22.5% was spent on school uniforms. 23.7% was spent on school fees and 16.2% on transport costs. Other expenses on education by the respondents included 5.2% who had spent money on school trips, 3.6% on co-curriculum activities, 9.6% on pocket money, 3.1% on house rent for students and 9.6% on shopping for school utilities.

Informal microfinance institutions were also observed to contribute towards access to trainings and extension services. This is because 74.1% of those who had attended/accessed trainings and extension services in the last one year said that informal microfinance groups contributed towards the attendance/access while 25.9% said they didn't. The informal microfinance institutions had enabled 80.0% of all the trainings/extension services attended/accessed

The total amount of money spent on healthcare in the last one year across the respondent's households was KShs 6,960,340 with an average of KShs 18079 per household. Household's expenditure on health care lay within a range of KShs 200 to KShs 200,000. The spending on health care by the households was on various expenses including 29% spent on transportation of patients to the hospital while 22.1% said the money was spent on drugs purchase from the chemist. 20.7% said their health care expenses were inform of paying for medical services at a health centre while 8.6% said their expenses came from paying premiums for health insurance services. Other health expenses mentioned included 8.6% on meals, 4.9% laboratory services, 0.3% purchase of herbal medicine and 0.8% purchase of wheel chairs.

The total amount of money spent across the respondent's households in the last one year on inputs of crop production was KShs 5,504,925 with an average of KShs 14,299 per household. This expenditure lay within a range of KShs 250 to KShs 160,500. The spending on inputs of crop production by the households was as shown in table 1.

Table 1: Total expenditure on crop production

Total expenditure on crop production			
Input	% who purchased /paid for input	% who didn't purchased /paid for input	Total expenditure on input (KShs)
Fertilizer	9.4	90.6	68,720
Manure	4.9	96.1	49,600
Planting seeds/materials	76.6	23.4	941,105
Pesticides/ herbicides	84.9	15.1	1,089,820
Irrigation water	15.6	84.4	88,560
Granary/store	9.1	99.9	487,700
Farming land	22.6	77.4	643,800
Labour	44.2	55.8	1,517,000
Tools	40.5	59.5	386,900
Marketing costs	48.6	51.4	304,360
Total expenditure			5,504,925

The total value of crop production was KShs 7,748,985 with an average of KShs. 20,127 per household. This value fell within a range of KShs 40 to KShs 136,200. The breakdown in value of crop production for the various types of crops is as shown in table 2.

Table 2: Total value of crop production

Total value of crop production					
#	Crop	% who grew the crop	% who didn't grow the crop	Total amount of crop produced (KGs)	Total value of crops produced (KShs)
1	Maize	29.4	70.6	13,868	416,040
2	Beans	3.9	90.6	250	17,500
3	Sorghum	64.4	35.3	2408.5	753,225
4	Millet	83.6	16.4	40744	1,231,080
5	Finger millet	2.3	97.7	863	120,820
6	Cow peas	80.5	19.2	25521	762,900
7	Pigeon peas	30.4	69.6	9936	596,160
8	Green grams	92.5	7.5	55986.5	3,494,880
9	Dolichos	1.3	98.7	80	5,600
10	Fruits	15.6	84.4	14338	286,760
11	Vegetables	12.7	87.3	3244	72,080
	Total Production				7,748,986

The total amount of money spent across the respondent's households on inputs of livestock production in the last one year was found to be KShs 4,576,450 with an average expenditure of KShs 11,887 per household. The range of expenditure on livestock production was KShs 100 to KShs 280,000. The breakdown of household's spending on inputs of livestock production by the households was as shown in table 3.

Table 3: Total expenditure on livestock production

Total expenditure on livestock production			
Input	% who purchased /paid for input	% who didn't purchased /paid for input	Total expenditure on input (KShs)
Fodder	13.5	86.5	482,450
Supplementary feeds	12.7	87.3	65,320
Lease of grazing land	41.0	59.0	1,012,550
Medicine/pesticides	75.6	24.4	506,060
Insemination/breeding services	2.3	97.7	3,950
Water	37.7	62.3	761,160
Livestock shelter	32.2	67.8	282,610
Tools	16.4	83.6	169,100

Labour	14.0	86,0	1,070,690
Marketing costs	38.4	61.6	168,930
Total expenditure			5,504,925

The total value of livestock production was KShs 42,229,650 with an average of KShs 109,687 per household. This total value fell within a range of KShs 500 to KShs 740,000. The breakdown in value of livestock production for the various types of livestock is as shown in table 4.

Table 4: Total value of livestock production

Total value of livestock production					
#	Livestock	% who produced the livestock	% who didn't produce the livestock	Total amount of livestock produced (Head count/KGs)	Total value of livestock produced (Head count/KGs)
1	Cattle	66.5	33.5	791	23,730,000
2	Goats	87.3	12.7	3,365	13,454,000
3	Sheep	35.3	64.4	616	1,848,000
4	Chicken	90.4	9.6	3,553	2,389,000
5	Donkeys	9.1	90.9	43	430,000
6	Pigs	1.3	98.7	12	180,000
7	Bee keeping/Honey (KGs)	16.6	83.4	1062.5	314,550
	Total Production				7,748,986

Contribution of informal microfinance institutions to resilience to climate variability based on their contribution to access to capital assets and livelihood strategies.

The contribution of informal microfinance institutions to household's resilience was measured based on the amount of money they had contributed towards access to capital assets i.e. health care and education and livelihood strategies i.e. inputs of crop and animal production. This was measured based on the proportion of informal microfinance institutions contribution to a household's expenditure in accessing education and health care and inputs of crop and livestock production.

When asked if informal microfinance institutions had any contribution on households educational expenses, 79% said that they made a contribution in the last one year while 21% said that the informal microfinance institutions made no contribution on household's expenses on education. Informal microfinance institutions contributed a total of KShs 8,492,200 with an average contribution of KShs 22,115 per household ranging between KShs 400 to KShs 1,500,000. This contribution constituted 30.4% of the total expenditure on education in the last one year across the households.

In order to find the relationship between the contribution of informal microfinance institutions and household's total expenditure on access to education. A simple linear regression was calculated predicting a household's expenditure on education based on the amount of money contributed by the informal microfinance institutions towards the cost of education. A significant regression equation was found ($F(1,382) = 352.756, P < 0.05$) with an R^2 of 0.479. The amount of money contributed by informal microfinance institutions predicted a household's expenditure on education is equal to $43630.654 + 0.693$ (the amount of money contributed by informal microfinance institutions) KShs when household's expenditure on education is measured in KShs.

As appertains to health care, 51.4% of the respondents said that informal microfinance institutions had contributed to health care expenses in the last one year while 48.6% said they didn't contribute. Informal microfinance institutions contributed a total of KShs 2,047,600 with an average contribution of KShs 5332 per household ranging between KShs 300 to KShs 90,000. This contribution constituted 29.5% of the total expenditure on health care across the households.

In order to find the relationship between the contribution of informal microfinance institutions and household's total expenditure on health care. A simple linear regression was calculated predicting a household's expenditure on health care based on the amount of money contributed by informal microfinance institutions towards the cost of health care. A significant regression equation was found ($F(1,383) = 65.078, P < 0.05$) with an R^2 of 0.143. The amount of money contributed by informal microfinance institutions predicted a household's expenditure on health care is equal to $15189.609 + 0.48$ (the amount of money contributed by informal microfinance institutions) KShs when a household's expenditure on health care is measured in KShs.

Informal microfinance institutions also contributed substantially towards crop production in the last one year. 62.6% of the respondents said informal microfinance groups contributed towards their crop production in the last one year while 37.4% said they did not contribute. Informal microfinance institutions contributed a

total of KShs 1,617,070 with an average of KShs 4200 per household ranging between KShs 100 to KShs 74,400. This contribution constituted 21.2% of the total cost of inputs of crop production across the households in the last one year. The contribution was on various inputs of crop production is as broken down in table 5.

Table 5: Total contribution of informal microfinance institutions to crop production

Total contribution of informal microfinance institutions to crop production					
Input	Total expenditure on input (KShs)	% of those paying/purchasing input whom informal microfinance institutions contributed to the cost	% of those paying/purchasing input whom informal microfinance institutions didn't contribute to the cost	Total contribution of informal microfinance institution to the purchase	% contribution of informal microfinance institution to the payment/purchase
Fertilizer	68,720	33.3	66.7	30,940	45.0
Manure	49,600	52.6	47.4	14,350	28.9
Planting seeds/materials	941,105	44.1	55.9	322,520	34.3
Pesticides/herbicides	1,089,820	40.3	59.7	338,200	31.0
Irrigation water	88,560	16.7	83.3	5,050	5.7
Granary/store	487,700	65.7	34.3	220,000	45.1
Farming land	643,800	57.5	42.5	203,700	31.6
Labour	1,517,000	44.2	55.8	340,300	22.4
Tools	386,900	36.1	63.9	100,900	26.1
Marketing costs	304,360	9.1	90.9	26,900	8.8
Total expenditure	5,504,925			1,617,070	21.2

In order to find the relationship between the contribution of informal microfinance institutions and household's total expenditure on crop production. A simple linear regression was calculated predicting a household's expenditure on crop production based on the amount of money contributed by informal microfinance institutions towards the cost of crop production. A significant regression equation was found ($F(1,383) = 351.820, P < 0.05$) with an R^2 of 0.477. The amount of money contributed by informal microfinance institutions predicted a household's expenditure on crop production is equal to $7374.63 + 0.692$ (the amount of money contributed by informal microfinance institutions) KShs when a household's expenditure on crop production is measured in KShs.

The relationship between the contribution of informal microfinance institutions and household's total value of crop production was also determined. In doing this, a simple linear regression was calculated predicting a household's value of crop production based on the amount of money contributed by informal microfinance institutions towards the cost of crop production. A significant regression equation was found ($F(1,383) = 19.052, P < 0.05$) with an R^2 of 0.45. The amount of money contributed by informal microfinance institutions predicted a household's value of crop production is equal to $17367.898 + 0.657$ (the amount of money contributed by informal microfinance institutions) KShs when a household's value of crop production is measured in KShs.

Informal microfinance institutions contributed substantially towards access to inputs of livestock production with 51.2% of the respondents saying informal microfinance groups contributed towards their livestock production in the last one year while 48.8% said they did not contribute. Informal microfinance institutions contributed a total amount of KShs 1,106,850 across the households with an average contribution of KShs 2,875 per household ranging between KShs 800 to KShs 34,800. This contribution constituted 24.2% of the total cost of inputs of livestock production across the households in the last one year. The contribution was on various inputs of livestock production as broken down in table 6.

Table 6: Total contribution of informal microfinance institutions to livestock production

Total contribution of informal microfinance institutions to livestock production					
Input	Total expenditure on input (KShs)	% of those paying/purchasing input whom informal microfinance institution contributed to the cost	% of those paying/purchasing input whom informal microfinance institution didn't contribute to the cost	Total contribution of informal microfinance institution to the purchase	% contribution of informal microfinance institution to the payment/purchase
Fodder	482,450	42.3	57.7	90,900	18.8
Supplementary feeds	65,320	30.6	69.4	7,780	11.9
Lease of grazing land	1,012,550	51.3	48.7	282,600	27.9
Medicine/pesticides	506,060	33.9	66.1	145,130	28.7
Insemination/breeding services	3,950	100.0	0	300	7.6
Water	761,160	61.8	38.2	281,840	37.0
Livestock shelter	282,610	32.3	67.7	67,800	24.0
Tools	169,100	50.8	49.2	60,500	35.8
Labour	1,070,690	50.9	49.1	264,800	15.4
Marketing costs	168,930	10.8	99.2	16,100	9.5
Total expenditure	5,504,925			1,106,850	24.2

In order to find the relationship between the contribution of informal microfinance institutions and household's total expenditure on livestock production. A simple linear regression was calculated predicting a household's expenditure on livestock production based on the amount of money contributed by informal microfinance institutions towards the cost of livestock production. A significant regression equation was found ($F(1,383) = 104.762, P < 0.05$) with an R^2 of 0.213. The amount of money contributed by informal microfinance institutions predicted a household's expenditure on livestock production is equal to $6448.893 + 1.892$ (the amount of money contributed by informal microfinance institutions) KShs when a household's expenditure on livestock production is measured in KShs.

The relationship between the contribution of informal microfinance institutions and household's total value of livestock production was also determined. In doing this, a simple linear regression was calculated predicting a household's value of livestock production based on the amount of money contributed by informal microfinance institutions towards the cost of livestock production. A significant regression equation was found ($F(1,383) = 40.923, P < 0.05$) with an R^2 of 0.094. The amount of money contributed by informal microfinance institutions predicted a household's value of livestock production is equal to $90663.606 + 6.617$ (the amount of money contributed by informal microfinance institutions in KShs) when a household's value of livestock production is measured in KShs.

VII. DISCUSSION

Informal microfinance institutions help in building resilience to climate variability as confirmed by 80.8% of the respondents who said they do so. They do this by enabling members to have better access to capital assets. This enhances member's capacity to undertake livelihood strategies since they involve conversion of assets into livelihood outcomes i.e. resilience to climate variability.

Informal microfinance institutions provide financial capital to members either through loans, savings, dividends or support from external sources. This financial capital enables members to access capital assets which they invest in livelihood strategies including production activities such as crop and livestock production and entrepreneurship activities. Informal microfinance institutions also help members to increase their capacity to engage in livelihood strategies by being avenues of access to knowledge and skills either through trainings or shared learning of best practices and lessons learnt. Better access to assets and knowledge and skills enables diversification of production and entrepreneurship activities hence creating safety nets to cushion members against climate variability risks.

Members of informal microfinance institutions also leverage on their organizational structures and collective actions to invest in expensive assets or bigger income generating activities which would be difficult to undertake individually. This enables investment in collective production and marketing initiatives which lead to

greater bargaining power and increase efficiency through economies of scale. Savings in informal microfinance institutions and the easy access to financial capital also creates a form insurance against climate risks by improving the capacity of member's to respond.

Informal microfinance institutions help member's to build resilience to climate variability by improving access to services thus capital assets. This includes providing financial capital to invest in education hence improved access. They also provide financial capital to access health care services and enable members to participate in health insurance schemes. By improving crop and animal production and helping increase income levels hence capacity to purchase food in case of scarcity, informal microfinance institutions help improve food and nutritional security which is vital for health and performance in livelihood activities including education.

Informal microfinance institutions create social capital through their social networks which increases member's resilience as they support each other in times of need through various reciprocity mechanisms. Members also support each other emotionally which helps them to cope better with harsh climate conditions. These social networks also help improve discipline and social harmony among member's which trickles down to the larger community thus creating the right conditions for livelihoods improvement and addressing issues such as the conflicts brought about by impacts of climate variability.

Informal microfinance institutions also serve to empower members, including women, to participate better in decision making processes. This enables them to overcome their marginalization by being in a better position to influence structures and processes towards addressing their interests. Informal microfinance institutions are the main entry points for development programs that help build climate variability resilience. They are also often used as implementation structures for such development programs or assist in their implementation processes. By doing, they enable development programs to target the most vulnerable people in the community hence supporting them in climate variability resilience building.

Informal microfinance institutions contribute substantially towards access to capital assets and assets that also form the basis of livelihood strategies. This is confirmed by the respondents who said that informal microfinance institutions contributed towards access to education, health care and inputs for crop and livestock production in the last one year i.e. education (79%), health care (51.4%), crop production (62.6%) and livestock production (48.8%). The informal microfinance institutions also provided substantially to household's expenditure on capital assets that also form the basis of livelihood strategies i.e. education (30.4%), health care (29.5%), crop production (21.2%) and livestock production (24.2%).

Therefore, on using linear regression analysis to analyze the relationship between household's total expenditures on accessing education, health care and inputs for crop and livestock production and the contribution of informal microfinance institutions towards the expenditures. Positive significant relationships were found i.e. education (0.693, $P < 0.05$), health care (0.48, $P < 0.05$), crop production (0.692, $P < 0.05$) and livestock production (1.892, $P < 0.05$). A significant positive relationship was also found between the contribution of informal microfinance institutions towards expenditure on crop and livestock production and total value of production i.e. crop production (0.657, $P < 0.05$) and livestock production (6.617, $P < 0.05$).

This therefore confirms that informal microfinance institutions have a significant contribution to the resilience of rural livelihoods. This is because they have a significant contribution on access to capital assets that form the basis for livelihood strategies. This access to capital assets and livelihood strategies occur through structures including households and informal microfinance institutions and the prevailing processes leading to resilience to climate variability as a livelihood income. According to the sustainable livelihood framework, how people use a range of assets to devise livelihood strategies leads to achievement of positive livelihood outcomes such as resilience to climate variability.

VIII. CONCLUSION

The social networks that characterize informal microfinance institutions create the right conditions for collective action. Through this collective action members of informal microfinance institutions are able to influence markets, development processes, and governance structures and processes which enhance resilience building activities. Informal microfinance institutions also have a significant contribution to member's access to capital assets, knowledge and skills based on which livelihood strategies including entrepreneurship and production activities are enhanced and diversified. Informal microfinance institutions therefore have a significant influence on resilience of rural livelihoods to climate variability. The role of informal microfinance institutions in building resilience of rural livelihoods to climate variability thus needs to be intensified through actions that enhance their performance. This should involve taking drastic actions to address challenges facing informal microfinance institutions and creating an enabling environment for their activities.

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