



# Non- Farm Activity Participation and Implications on Farmers' Climate Change Adaptation in Kathonzwani Sub-County, Kenya

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**Abstract:** Agriculture is the mainstay of many economies in the developing world. The sector, however, is facing a myriad of challenges, most notably, climate change and its associated risks. Unreliable and unpredictable rainfall patterns have continuously decimated agricultural productivity and overall household welfare. Therefore, many households are increasingly diversifying into the non-farm sector to supplement their agricultural income and thus adapt to climate change. With projections pointing to more frequent and severe climate change conditions, there is urgent need to develop and/or strengthen existing adaptation mechanisms. To this end, the current study focused on non-farm activities and climate change adaptation in Kathonzwani sub-county, an ASAL region in Kenya. Specifically, the study assessed the nature, characteristics and significance of non-farm activities pursued by farmers in the study area in an effort to circumvent the effects of climate change. A descriptive survey design was employed while multistage sampling was used to determine the sample size of 313 from a population of 41878 households. Data collection was effected using a semi-structured questionnaire. Based on the study findings, non-farm activities play an important role in household adaptability to climate change impacts. A Pearson correlation between various income and total household income established a strong positive correlation for non-farm income ( $r=0.873$ ,  $p=0.000$ ), a moderately positive correlation for farm income ( $r=0.474$ ,  $p=0.00$ ) and a weak positive correlation for 'other' sources of income ( $r=0.171$ ,  $p=0.024$ ). The study recommends increased government efforts in capacity building of rural populations as well as in the establishment of sustainable non-farm enterprises.

**Key words:** Non-Farm Activities, Income, Climate Change, Adaptation, Arid and Semi-Arid Lands

## 1. Introduction

Most rural economies in Africa are predominantly agrarian, with a vast majority of households largely relying on small scale subsistence rain-fed farming for survival (Komba & Muchapondwa, 2015). Despite the enormous contribution the agricultural sector plays in maintaining rural household welfare, gains from the sector are continuously getting decimated by the impacts of climate change. Whereas climate change impacts are being experienced world over, it has been noted that developing countries will be more vulnerable to the looming catastrophe due to their high climate sensitivity as well as limited adaptive capacities (Arndt & Tarp,

2017). According to the Intergovernmental Panel on Climate Change (IPCC, 2014), increasing temperatures and decreasing levels of precipitation as a result of climate change will reduce agricultural production in Sub-Saharan Africa up to 50% by 2020. Worse still, more recent climate change projections point to more disturbing revelations as extreme climatic conditions are expected to be on the rise during the forthcoming decades (IPCC, 2017). Komba and Muchapondwa (2015) note that at loss will be the Arid and Semi-Arid Lands (ASALs) in the developing world where most livelihoods directly depend on climate-sensitive activities. Climate change is expected to not only affect rural incomes but also complicate food security and poverty as well as the sustainable development aspirations of many in sub-

Saharan Africa, where the aforementioned challenges are already at intolerable levels.

Given the prevailing climatic conditions, the need to develop and enhance climate change adaptation mechanisms especially within the non-farm sector cannot be overemphasized (Taruvinga, Viersier & Zhou, 2016). Non-farm activities are all income generating ventures associated with waged labour or self-employment but not agricultural in nature, including such activities as processing, marketing, manufacturing, wage and casual local employment in the rural villages (Odoh & Nwibo, 2017). Literature has appreciated the positive role played by non-farm activities in enhancing household welfare. The UNCTAD (2015) for instance estimates that the rural non-farm sector accounts for about 40-60 per cent of household income in developing countries. Non-farm activities play a vital role in enhancing household nutrition (Barbatude & Quim, 2010; Mertz et al. 2010). Moreover, rural non-farm activities can cushion farming households from the vagaries of climate change as well as providing complementary income following drought episodes (UNDP, 2015; Muchapondwa, 2015). In South Africa and Ethiopia for instance, Bryan *et al.* (2008) found that non-farm income had the most positive effect on climate change adaptation after age and education.

Despite the increasing recognition of the non-farm sector in various parts of the world, climate change adaptation studies in Kenya have given the non-farm sector a wide berth and have instead paid attention to adaptation within agriculture (Mariara & Karanja, 2007; 2013; Ochieng et al, 2015; Mutunga, et al, 2017). Moreover, even in cases where non-farm activities have been identified as possible climate change adaptation mechanisms for farming households (Mutunga et al, 2017), attempts have not been made to explore the nature and contribution of this sector. Bryan et al (2008) note that some non-farm activities have the capacity to exacerbate peoples' vulnerability to climate change. Similarly, some non-farm activities are environmentally degrading while others are unsustainable owing to their dependence on climate-sensitive farm activities (ibid). Moreover, survivalist and lowly remunerated activities pursued out of distress as opposed to those undertaken in pursuit of available opportunities cannot render a sustainable adaptation to climate change (UNCTAD, 2015). Based on the foregoing, there is a serious need to establish the nature of non-farm activities in an attempt to enhance adaptability in the face of increasing climate change events.

The need to adapt to climate change in Kenya is further reinforced by the prevailing ecological and demographic characteristics, which in turn increase the country's vulnerability to extreme weather events. Bulk of the country's total land mass (84%) is classified as either arid or semi-arid (Republic of Kenya, 2011). Moreover, close to one third of the country's total population reside in these ASALs (UNDP, 2015) making the number livelihoods at risk enormous. Poverty incidence is high,

estimated at 46% nationally (UNICEF 2014) and as high as 64.1% in Makueni County (Republic of Kenya, 2012), where the current study was conducted. Thus, the current study sought to unearth the nature as well the contribution of non-farm activities pursued by farmers in Kathonzwani sub-county in Makueni County, Kenya with a view to assessing their potential for climate change adaptation.

## 2. Literature Review

The need to address the climate change challenge has been a subject of constant debate in the policy arena and the academia as well, with more emphasis on climate change adaptation (UNFCCC, 2010). Climate change adaptation has been defined as the 'adjustment of a system to moderate the impacts of climate change to take advantage of new opportunities to cope up with the consequences of climate change' (ibid).

Research on farmers' climate change adaption has identified several strategies: on-farm activity adjustments and non-farm activity diversification (Akinagbe & Ironhibe, 2015; Jorstad & Webersk, 2016; Demeke & Zeller, 2012; Komba & Mchaponwa, 2015; Iiyama, 2006). On-farm activities include the different types of undertakings that a farmer would pursue within his/her farm in order to adapt to climate variations. These activities include, among others, the use of hybrid varieties as well as pesticides (Mutunga et al, 2017) and adjustments on planting time (Komba & Mchaponwa, 2015). Non-farm activities, on the other hand, represent all activities undertaken out of the farm and include among others: trading, services, handicraft making, charcoal burning, gathering wild fruits, brick making, and sand harvesting (Gordon and Craig, 2001; Nagler and Naude, 2014).

A lot of focus has however been accorded to climate change adaption within farming. Several studies document the increasing importance of the non-farm sector to climate change adaption, especially in climate sensitive agro-ecological zones where adaption within farming may not be sustainable. Gordon and Craig (2001) note that non-farm activities are beneficial to farming households in that they reduce risks, offer a coping mechanism during drought periods and improve food security. Moreover, nonfarm activity income can significantly enhance rural household resilience and flexibility (Ellis, 1999). In Burkina Faso, Mertz et al. (2010) found that non-farm income offered a complementary source of income during drought periods. Barbatude and Qaim (2010) concluded that non-farm income had a positive effect on food security and nutrition, with the prevalence of child stunting being lower in participating households in Ethiopia. Similarly, Bryan *et al.* (2008) identified non-farm income as the third most important factor (after education and age) in encouraging climate change adaptation in agricultural livelihoods in Ethiopia and South Africa.

Although non-farm activity participation has a positive effect on farming households' wellbeing, this livelihood option has not been captured in Kenyan climate change adaptation studies. Existing studies primarily focus on climate change adaptation within agriculture (Mariara & Karanja, 2007; Ochieng et al, 2015; Mutunga, et al, 2017). Moreover, attempts have not been made to unearth the nature as well as the contribution of the non-farm sector to household welfare, even in instances where non-farm activities have been identified as possible adaptation avenues. Bryan et al (2008) notes that sustainable climate change adaptation may be elusive if low remunerative, survivalist and weather dependent activities are pursued (Bryan et al, 2008).

### 3. Methodology

A descriptive cross-sectional method was employed in conducting this study. The study population constituted all the 41, 878 farming households residing at the study area and excluded child headed households. Purposive sampling was used to determine the study area (Kathonzweni sub-county), being the most drought affected sub-county in Makueni county (IFRC, 2011). A multistage sampling procedure was used to identify the sub-locations where the study would be conducted. A sample of 313 households was drawn using Fishers' formula (Fisher et al, 1991). Using Probability Proportional to Size (PPS), 121 and 192 households were selected from Ituka and Thavu sub locations respectively. A semi structured questionnaire was administered. Data analysis involved the use of SPSS version 21 to generate descriptive statistics on proportions as well as a Pearson correlation to determine the relationship between non-farm income and other sources of income. Approval to carry out the study was granted by Moi University, the National Council for Science, Technology and Innovation (NACOSTI) as well as the Ministry of Education, Makueni County.

### 4. Findings of the Study

The study was guided by five research questions namely; (1) what are the socio-demographic characteristics of the respondents in terms of age, sex, education, family size and income? (2) What is the contribution of non-farm income to total household income? (3) What is the relationship between nonfarm income, farm income, and other sources of income with total household income? (4) What is the nature and characteristics of non-farm activities pursued by farmers in Kathonzweni sub-county? (5)What is the implication of pursuing non-farm activities on climate change adaptability in the study area? Results of this study are discussed according to guiding research questions as follows:

#### 4.1 What are the socio-demographic characteristics of the respondents?

The first research question sought to establish demographic characteristics of respondents. As Table 1 indicates, out of

the 271 respondents, 57.2% were from Thavu sub-location while the rest (42.8%) were drawn from Ituka sub-location. Majority of the households (67.2 %) were headed by males. The mean age for the respondents was 53 years, with a majority (42.4%) falling within the 40-59 years age bracket. Slightly more than one third (42.4%) of the respondents were above 60 years with the rest (23.24%) being below 40 years. The highest educational attainment for a vast majority of the respondents (63.8%) was primary education; a fifth of the respondents (20.3 %) did not have any formal education. A relatively small proportion (13.3%) had attained secondary education and the remaining (2.6%) had acquired post-secondary education. On average, there were six members per household.

**Table 1: Demographic characteristics of households participating in non-farm activities**

Characteristic	Frequency	Percent
Sex of Household Head		
Male	136	75.14
Female	145	24.86
Age of Household Head		
<40 years	43	23.75
40-59 years	88	48.62
=/> 60 years	50	27.62
Educational Level		
None	23	12.71
Primary	123	67.96
Secondary	28	15.46
Tertiary	7	3.87
Household Size		
< 5 members	72	38.12
=/> 5 members	109	60.22
Household Income		
<ksh. 60,986	69	38.12
=/> ksh 60,986	112	61.88

With regard to households participating in non-farm activities, 75.14% were headed by males, 48.62% household heads aged between 40-59 years and a majority (60.22%) had more than 5 family members. Additionally, most households (67.96%) had acquired primary education) while a vast majority (61.88%) were living above the established poverty line of Ksh. 60, 986 (Table 1).

Studies have documented the importance of certain household characteristics to non-farm activity participation, which in turn affects household adaptability to climate change. Socially constructed perceptions about men and women have been found to affect access to livelihood assets and thus non-farm activity participation (Kollmaire & Gamper, 2013). Demissie and Legesse (2013) found that male headed households were more likely to participate in non-farm activities. Other studies have however found women headed families to be more diversified (Ridges & Costa, 2012; Ackah, 2013). More

male headed households in the study area may be explained by the nature of non-farm activities pursued, which are mainly labour intensive (Fig. 3)

Educational and skill level attainment play an important role in establishing and sustaining non-farm ventures, and thus by extension cushioning farmers against climate change variability (Gordon & Craig, 2001). The level of education and skill attainment further determines the nature of activities pursued (Demessie & Legesse, 2013). Thus, most (67.96%) of the farmers undertaking non-farm activities had primary education. This corresponds the labour-intensive, low entry-barrier as well low remunerated activities that are dominant in the study area (Fig 3)

Families headed by older household heads were more diversified. This finding is contrary to findings emanating from studies in Uganda (Smith et al, 2001) and Ethiopia (Demissie & Legesse, 2013) where families headed by younger household heads were more diversified. Low education and skill level attainment in the study area may have reduced the capacity of the young to participate in non-farm activities

Most (60.22%) of the households had five or more household members, an observation consistent with that of Gordon and Craig (2001) as well Demissie and Legesse (2013) who found that households with more family members were more lively to venture into non-farm activities. The availability of surplus labour in larger households in the study area may have contributed to their extensive participation in non-farm activities.

A vast majority (60.22%) of the households participating in non-farm activities had income above the poverty line (Ksh. 60,986) as opposed to 38.12% who were living below the poverty line. This finding shows the significance of non-farm income to household welfare; and is finding is consistent with Gordon and Craig's (2001) observation that households participating in non-farm activities are more likely experience an upsurge in household welfare (income) based on studies conducted in Kenya, Uganda and Tanzania

#### 4.2 What is the contribution of non-farm activities to household income?

In response to this research question, non-farm activities were found to play a very important role in sustaining households through the provision of income. Most of the respondents (68 %) were participating in non-farm employment as shown in figure 1. Household income for the study sample was derived from farm, non-farm, and 'other' income generating activities. 'Other' sources included income from remittances, contributions from socio-economic groups, cash transfers and pension.

The total annual household income for the study sample was KES 32,688,260. Non-farm income contributed immensely to the total household income, accounting for

71.6% of the total household income. Farm income accounted for 19.9% of the total household income while 'other' sources of income accounted for 8.5% of the total household income (Figure 2). This observation is consistent to Nagler and Naude's (2014) study findings, which established that non-farm activities in Africa contribute immensely to household income, often times, and accounting for more than 50% of the total household income. Although the proportion of non-farm income varies between countries, higher volumes such as the one established in the current study may be accounted for by the high climate variability and the consequent agricultural losses in the study area.

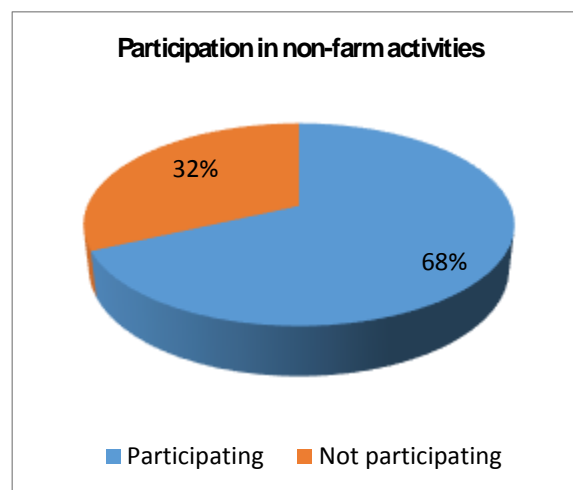


Figure.1. Participation in non-farm activities in Kathonzwani Sub-county.

With regard to the proportion of respondents who derived their income from the various sources, farm activities accounted for 85.6% (N= 232) of respondents while 69.74% (N=189) had drawn their incomes from non-farm activities (Table 2). 'Other' sources of income were an essential source of income for 64.57% (N=175) of the respondents.

Table 2: Average annual incomes from various sources

Type of Income	N	Proportion of Respondents	Mean Income (K.shs)
Non-Farm Income	189	69.74	128078.09
Farm Income	232	85.6	29031.78
Income from other Sources	175	64.57	16479.89
Overall Mean Income	268		121971.11

These findings confirm the increasing importance of the non-farm sector, especially as a climate change adaptation pathway in the wake of diminishing agricultural productivity in ASALs. Despite the fact that most of the respondents relied on agriculture for income generation,

the earnings from such ventures are quite minimal when compared to those from the non-farm sector.

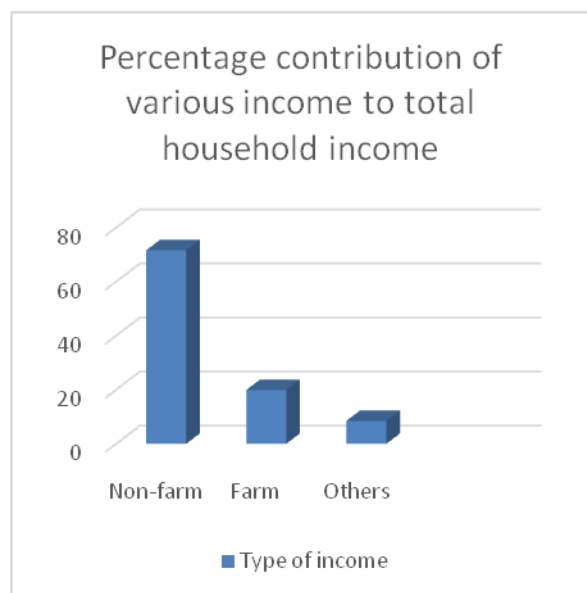


Figure 2: Percentage contribution of various incomes to total household income

#### 4.3 Relationship between various types of income with total household income

A Pearson correlation ( $r$ ) analysis between various types of income and the total household income found a significant correlation ( $r = 0.873$ ,  $p = 0.000$ ) between non-farm activity income and total household income. Similarly, a significant ( $p < 0.05$ ) correlation, albeit weaker, was found between the total household income and farm income as well as with income from ‘other’ sources of income (Table 3)

Table 3: Correlation between various types of income and total household income

Type of Income	$r$	$p$ - value
Non Farm Activity Income	0.873	0.000
Farm Income	0.474	0.000
Other Sources	0.171	0.024

Barret, Reardon and Webb (2001) found that high levels of non-farm income positively correlated with higher household welfare (measured in terms of income and nutrition) in Kenya, Tanzania, and Ethiopia. In a review of eighteen field studies, Reardon (1997) found a strong positive correlation between high household income and rural non-farm income. This implies that rural non-farm income is more important (in terms of returns) and can thus better foster climate change adaptability to farming in

ASAL regions where agricultural and ‘other’ sources of income may not be predictable.

#### 4.4 What is the nature and characteristics of the non-farm activities pursued in the study area?

The most common types of non-farm activities in the study area were: offering casual labour in other’s farms and homesteads (36.5%), small scale business ventures 19.8% (such as selling vegetables and operating small scale shops), masonry (11%) weaving (10.5%), brick making and quarrying (6.6%) and offering services in the civil service sector (5.5%). Others included charcoal burning, repairs and maintenance

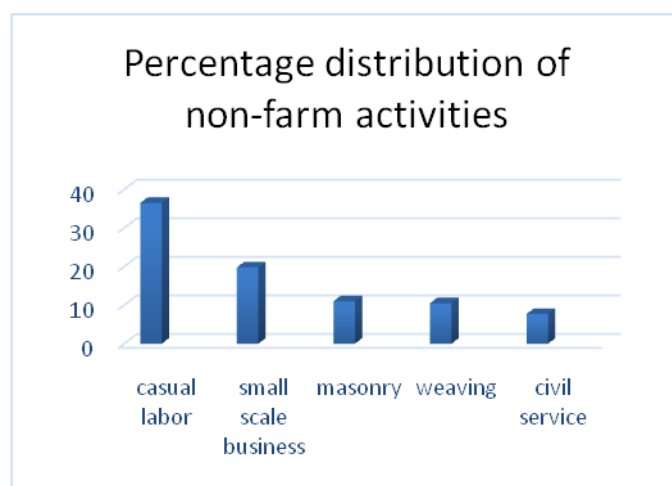


Fig 3: percentage distribution of non-farm activities

The non-farm sector in the study area is informal and small scale (Fig 3). Casual labour accounts for the biggest share of non-farm activities. This finding is consistent with Nagler and Naude’s (2014) comparative study findings on the rural non-farm sector using data from five African countries: Ethiopia, Niger, Nigeria Malawi and Tanzania which concluded that, albeit a few differences across countries do exist, the non-farm sector is predominantly small scale and informal.

Most of the activities are manual labour based, with casual labour, masonry and weaving accounting for the largest share of non-farm activities (fig 3). The dominance of informal manual labour based non-farm activities in the study area may be attributed to the low educational and skill attainment as well as the high poverty incidence (64.1%) in the study area. These activities highly correspond to the low educational and skill attainment of the respondents. Thus, nearly two thirds (63.8) of all household heads engaging in non-farm activities had primary education as the highest level of education. Slightly more than a fifth (20.2%) had not acquired any education, while only 13.2 and 2.5% of the participants had acquired secondary and tertiary education respectively as shown in figure 3. This finding is consistent with

Mahabub's (2004) study in Bangladesh, where manual labour based activities were the dominant non-farm activities. In his findings, the intensity of participation in these activities negatively correlated with the level of education of the workers and positively associated with poverty level of the participating households (ibid).

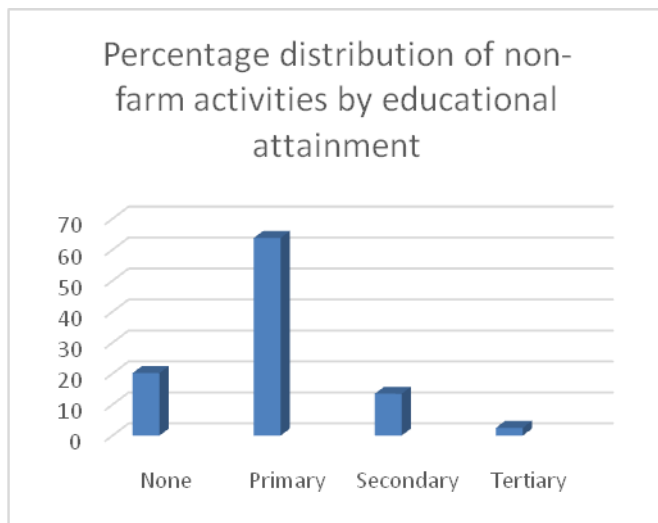


Fig. 4 Percentage distribution of non-farm activities by educational attainment

In all major non-farm activities undertaken, the greatest number of participating household heads had primary education as the highest academic attainment except in the civil service, where tertiary education as well as secondary education were the highest levels.

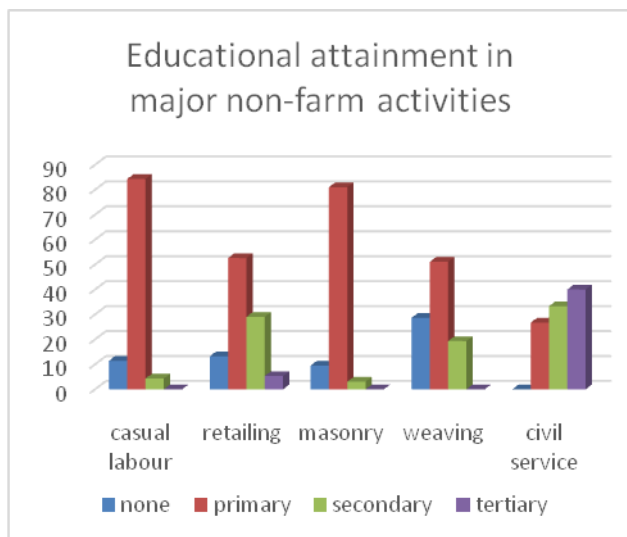


Fig.5.Educational attainment in major non-farm activities

Most of the non-farm activities pursued have low entry barriers in terms of educational and skill development as well as capital. The dominance of low entry barrier activities may be explained by the fact that most of the activities, especially casual labour, weaving and to some extent small scale retailing do not require high skill and capital investment to begin and maintain. Several studies

document the importance of education and training into the non-farm sector, citing higher levels of educational attainment and skill development as a pre-requisite for highly remunerative activities. In Nepal, Ghimire, Huang and Shrestha (2014) found that the likelihood to participate in higher remunerative activities increases with increase in level of education. Demissie and Legesse (2013) found the educational level of household head to be significantly and negatively associated with non-farm wage employment in Ethiopia. These findings are also reflected in the current study. Based on the findings, non-farm activities that do not necessarily need formal education and training had the highest number of participants who had not attained any education or had primary education as the highest level of education. On the contrary, the same activities (casual labour and weaving) did not have any participant who had attained tertiary education. Thus, limited education for most of the respondents is a restricting factor to highly remunerated non-farm activities, which in turn reinforces the existing poverty levels and reduced climate change adaptability capacity.

Lowly remunerated activities are dominant. Casual labour in others' farms and households was the most common non-farm activity (25.8%). Weaving and brick making constituted 14.3% of all non-farm activities undertaken, while 14% of all business activities undertaken (15.8%) were small scale businesses that did not necessarily require specialist skills to operate. This is contrasted to 5.5 % of non-farm activities in the civil service that mainly require specialized education and training. This finding is consistent with Meharia's finding (2002) that a strong positive association exists between traditional rural non-farm activities and low literacy. This implies that low levels of educational attainment encourage activity diversification into traditional low remunerative activities that may not require any specialist skills. This finding, therefore, corresponds to majority of the respondents (63.8%) having primary education as the highest level of education while slightly more than a quarter of the respondents (20.3%) having not acquired any education. The dominance of lowly remunerated non-farm activities may suggest compromised long-term climate change adaptability; given that severe climate change impacts will further constrain farm income.

Survivalist activities as opposed to investment oriented non-farm ventures were dominant. A big chunk of the income derived from non-farm activities was spent on basic needs; with a majority of the respondents (60.9 %) spending their non-farm earnings on food as shown in Table 4.



Table 4: Uses of non-farm income

Activity	Number (N)	Percent (%)
Buying Food	165	60.9
School Fees	114	42.1
Farming	37	13.7
Others	47	17.3

Thus, diversification into the non-farm sector is mainly driven by the need to survive rather than the drive to take advantage of existing activities. These findings confirm the reality of climate change effects on rural households and the need to survive (as opposed to invest) by engaging in non-farm employment. Although non-farm income emanating from these activities may be essential for short-term survival during drought seasons, most of the activities cannot be considered sustainable avenues for long-term climate change adaptation.

#### 4.5 What are the implications of pursuing non-farm activities to climate change adaption in the study area?

The dominance of non-farm activities (with 68% households participating) may be attributed to the increasing severity of climate change impacts to agricultural livelihoods. Similarly, the large share of total household income (71.6%) emanating from non-farm ventures as opposed to 19.9 % derived from farm sources further confirms this observation. Despite the undeniable significance of nonfarm activities in mitigating against the adverse effects of climate change, several issues emerge with regard to the capacity of non-farm activities pursued to support long-term climate change adaptation in the study area. Of importance is the suitability, viability and sustainability of non-farm activities, given their nature and characteristics.

With climate change projections pointing out to more severe scenarios, the dominance of small scale survivalist as well as lowly remunerated non-farm activities signals limited adaptive capacities for a vast majority. With severe climate change, income derived from farm sources may diminish (Asfaw et al, 2017), further complicating adaptive capacities in the study area.

Relying on climate sensitive non-farm activities in the study area might have a negative implication on future climate change adaptability. As noted by Byg (2014), overreliance on climate sensitive non-farm activities not only increases farmer’s vulnerability to climate change, but also impacts negatively on food security. Thus, with 36.5% of the respondents relying heavily on casual (farm) and other climate sensitive ventures such as weaving, charcoal burning, and small scale trade on agricultural produce, the possible loss of livelihoods as a consequence of climate change might diminish future adaptation efforts. Additionally, climate sensitive activities may not

be viable in the long run, implying a serious loss of income for many households.

The sustainability of climate change adaption through non-farm activities may be further jeopardized by overreliance on natural resource dependent as well as environmentally degrading activities prevalent in the study area. A relatively big percentage of respondents rely on such activities as masonry, weaving, and quarrying among others. Thus, unchecked exploitation of natural resources may occasion long term environmental damage, which would in turn imply eroded climate change adaptive capacity as natural resources get depleted.

## 5. Conclusions and Recommendations

This section gives conclusions and recommendations of this study, based on the findings.

### 5.1 Conclusions

Based on the study findings, the following conclusions were drawn:

1. Non- farm activities play a very important role in sustaining household welfare, accounting for 71.6% of the total household income. Moreover, the strong positive correlation ( $r = .0.873$ ,  $p = 0.00$ ) between non-farm income and total household income further confirms the increasing importance of non-farm activities, especially in mitigating the impacts of climate change in Arid and Semi-Arid Lands.
2. Despite their immense contribution to household welfare, most non-farm activities pursued require low entry barriers, are manual-labour based, lowly remunerated, small scale and survivalist in nature. The nature of the non-farm activities is reinforced by the low educational and skill attainment in the study area.
3. Overreliance on climate dependent as well as primary extractive non-farm activities may not guarantee a sustainable long term climate change adaptation strategy. The productive potential for climate dependent non-farm activities will diminish with increasing severe climate change projections while extractive activities have the capacity to degrade the natural environment, thus increasing climate change vulnerability to a vast number of farming households.

### 5.2 Recommendations

Based on conclusions of this study, it is recommended that in order to empower the large number of people who are expected to suffer from severe climate change effects, there is need for governments (county and national) as well as other development partners need to:

1. Encourage the development of highly remunerated as well as environment friendly non-farm activities

through offering farmers such incentives as education and training on the need for diversified livelihoods that integrate farm and non-farm activities.

2. Incentivize environmentally friendly non-farm enterprises so as to motivate farmers to safeguard the environment while at the same time enhancing long-term climate change adaptability.

Finally, future studies may investigate the factors behind farmers' non-farm activity diversification.

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