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Determinants of Adoption of Indigenous Strategies for Climate Change Adaptation among the Tharaka People in Tharaka Nithi County, Kenya

Caxton Gitonga Kaua^{1*},

¹ Wangari Maathai Institute of Peace and Environment Studies, University of Nairobi, P. O. Box 10718 – 00200, Nairobi, Kenya.

*Author for Correspondence email: Caxtonk2008@gmail.com

ORCID: <https://orcid.org/0000-0003-4231-9127>

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This study envisaged analyzing factors affecting the adoption of indigenous climate change adaptation strategies among the Tharaka People in Tharaka Nithi County, Kenya. The study used descriptive research design and employed multi-stage sampling design. Data collection involved the collection of primary and secondary data. Data analysis was done using descriptive analysis and Spearman's rank correlation analysis. The study concluded that the adoption of indigenous climate change adaptation strategies is subject to prevailing socio-economic and institutional factors that affect it. These socioeconomic factors include age, local experience, land size, income level and income diversity that have a significant positive relationship thus influence on adoption. On the other hand, other socioeconomic factors including household dependency and education have a negative thus influence on adoption. Moreover, institutional factors including market access, information access, credit access, participation in community activities and membership to social networks have a significant positive relationship with adoption of indigenous climate change adaptation strategies. Conversely, other institutional factors including access to extension service and individualization of land tenure have a significant negative relationship with adoption of indigenous climate change adaptation strategies. Perception of climate has a positive relationship with the adoption of indigenous climate change adaptation strategies. These factors need to be leveraged upon in the development of policies and programs aimed at enhancing adaptation of climate change in indigenous communities.

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INTRODUCTION

IPCC (2007), notes that global warming is now indisputable given the observed increases in global average air and ocean temperatures, widespread melting of ice and rising global average sea levels. Global temperatures have risen by 1 degree centigrade since 1850 while glaciers and ice sheets are melting across the globe as temperature records are increasingly broken (Kirkland, 2012). Besides, the average global surface temperature is likely to rise by 1.8 to 4 degrees centigrade by the year 2100 and the sea level rise may rise by 30 to 60 centimetres (IPCC, 2007). Greater intensity and frequency of droughts, floods and storms due to climate change will constrain economic development (Nelson et al., 2008) and decrease agricultural productivity (Easterling, 2007). This is especially in developing countries which are characterized by multiple stresses and low adaptive capacity (IPCC, 2007).

Due to over-dependence on climate-sensitive natural resources, the habitation of fragile ecosystems and marginalization, indigenous people are the most vulnerable to climate change (Edgar et al., 2004). Indigenous people's climate change adaptation strategies based on their knowledge systems offer the best option in addressing current and future impacts of climate change (Nyong, Adesina & Elasha, 2007). These strategies have enabled them to adapt to changes in their environments for a very long time (Shizha & Abdi, 2014).

However, indigenous knowledge has largely been assumed, is largely undocumented, inaccessible and quickly getting eroded. It has thus not been considered in the design of modern climate change adaptation strategies (Nyong, Adesina & Elasha, 2007) that are largely formulated at the national level resulting in ineffective and counterproductive measures.

Climate change adaptation interventions undertaken in Kenya's indigenous communities have been based on top-down approaches that do not recognize the existing knowledge systems. The interventions are not based on detailed analysis of local perceptions of climate change, the existing indigenous adaptation strategies nor the factors that influence their adoption. The interventions are thus often out of context, poorly targeted and counterproductive. Linkages between information generated by indigenous people and conservation policies and practices pursued by authorities are virtually nonexistent (Bisong & Essien, 2010).

This is more so in among the Tharaka people in Tharaka Nithi County, Kenya who are severely negatively impacted by climate change. The study, therefore, envisioned to understand the local people's perceptions, identify existing indigenous adaptation strategies and analyze factors affecting their adoption. The area has been severely affected by the climate change given their inherent vulnerabilities as an indigenous community.

MATERIALS AND METHODS

Study area

The study targeted the Tharaka people of Tharaka Nithi County form part of Kenya indigenous population. Tharaka Nithi County has a total population of 393,177 people living in 109,860 households (Government of Kenya, 2019). It has a surface area of 2,504.4 Km² and a population density of 37 persons per Km² (Government of Kenya, 2019). The population is largely agropastoral consisting of three livelihood zones which include the: mixed farming zone, marginal mixed farming and the rain-fed/irrigation farming zone (Government of Kenya, 2008). Tharaka Nithi County is part of Kenya's ASALs (Kirraine, Sharkey & Naess, 2013). Its rainfall pattern is bimodal fluctuating between 500 to 800 mm per annum while temperatures range between 24 to 37 degrees centigrade (Government of Kenya, 2005) at times rising to 40 degrees centigrade (Kabui, 2012).

It is constituted of four agroecological zones namely the: lower midland 4, lower midland 5, intermediate lowland 5 and the intermediate lowland 6 (Owino et al., 2014).

Study design

The study used descriptive research design

Sampling Design and Data Collection

The sampling used multistage sampling design. Firstly, three sub-locations were purposively selected, each representing one of the three major agroecological zones and livelihood zones. Secondly, Systematic sampling was then be used to select individual respondent's households from each of the three sublocations. This involved sampling 10% of the total households in each of these sub-locations selected for the study. The sample size arrived at is as shown in *Table 1*.

Table 1: Sample size determination

Sampling area	Agroecological zone	Livelihood zone	Number of households	Sample size (10% of total Households)
Tubui	Lower midland 4	Rain-fed/irrigation farming	292	29
Gaceraka	Lower midland 5	Mixed farming	476	48
Kamanyaki	Intermediate lowland 5	Marginal mixed farming	282	28
Total			1050	105

Data collection involved the collection of secondary and primary data. Secondary data collection involved review of previous topic related literature especially on the study area including journals, research papers, discussion paper and reports. Primary data was collected through observation, focused group discussions, key informant interviews and household questionnaire survey. Results from the various methods were crosschecked, validated and harmonized using methodological triangulation.

The data collection tools were tested for reliability using the test-retest method. In doing this, 10 questionnaires were administered to a sample outside the selected sampling areas and then re-

administered to the same respondents after two weeks. The two results were then and a correlation coefficient of 0.671 arrived at indicating good reliability. Validity analysis was done based on expert consultation.

Data Analysis Methods and Procedures

Data was analyzed using descriptive analysis, thematic analysis and Spearman's' rank correlation coefficient. This was done with the aid of SPSS 20.0 statistical software.

A households' level of adoption was measured based on the use of indigenous strategies for various aspects of climate change adaptation.

RESULTS AND DISCUSSIONS**Table 2: Description of socioeconomic and institutional characteristics in Tharaka Nithi County**

Variable	Percentage
Age	1 to 35 years = 33.3% >35 to 50 years = 21.9% >50 to 65 years = 16.2%
Credit access	No access = 28.6% 1 to 2 times = 29.5% 3 to 4 times = 26.7% >4 times = 15.2%
Education level	None = 23.8% Lower primary school = 33.3% Upper primary school = 27.6% Post primary education = 15.2%
Extension service access	No access = 41% 1 to 3 times = 25.7% 4 to 6 times = 19% >6 times = 14.3%
Gender	Female = 25.7% Male = 74.7%
Household dependency	No dependency = 21.9% >0 to 25% dependency = 33.3% 25% to 50% dependency = 21.9% >50% dependency = 22.9%
Household size	1 to 4 members = 13.3% 5 to 6 members = 36.2% 7 to 8 members = 34.3% >8 members = 16.2%
Income diversity	1 Income source = 13.3% 2 Income sources = 33.3% 3 Income sources = 41.9% >3 Income sources = 11.4%
Income level	KES 0 to 50000 = 23.8% KES 50000 to 100000 = 27.6% KES 100000 to 150000 = 26.7% KES > 150000 = 21.9%
Information access	1 Source of information = 21% 2 Sources of information = 28.6% 3 Sources of information = 31.4% >3 Sources of information = 19%
Land size	>0 – 2 Acres = 39% >2 – 3 Acres = 17.1% >3 - 4 Acres = 21% >4 Acres = 22.9%
Local livelihood experience	1 to 25 Years' experience = 28.6% 26 to 40 Years' experience = 32.4% 41 to 55 Years' experience = 21.9% >55 Years' experience = 17.1%

Variable	Percentage
Market access	1 to 2 times per month = 11.4% 3 to 4 times per month = 28.6% 5 to 6 times per month = 36.2% >6 times per month = 23.8%
Participation level	No development meetings attended = 61% 1 to 2 development meetings = 17.1% 3 to 4 development meetings = 14.3% >4 development meetings = 7.6%
Membership to social networks	Doesn't belong to any group = 18.1% Member of 1 group = 36.2% Membership to 2 groups = 29.5% Membership to >2 groups = 16.2%
Perception of climate change	High perception = 76.2% Moderate perception = 16.2% Low perception = 7.6%

A Spearman's rank correlation was calculated to find the relationship between age and adoption of indigenous climate change adaptation strategies. A positive significant correlation ($r = 0.666$, $p < 0.01$) was found (Table 3).

This implies the adoption of indigenous climate change adaptation strategies increases with age. This could be due to older farmers having more knowledge and experience on indigenous methods and a better understanding of local climate change. The younger farmers are more receptive to modern methods and thus could shun the indigenous ones. This is in agreement with Ziervogel and Zermoglio (2009) and Gbetibouo (2009).

Moreover, a Spearman's rank correlation was calculated between credit access and adoption of indigenous climate change adaptation strategies. A significant positive correlation ($r = 0.516$, $p < 0.01$)

was found. This means the adoption of indigenous climate change adaptation strategies increases with access to credit. This is because access to affordable credit increases the capacity to adopt indigenous climate change adaptation strategies. This is in agreement with Tazeze, Haji and Ketema (2012).

A Spearman's rank correlation was calculated between education and adoption of indigenous climate change adaptation strategies. A negative significant correlation ($r = -0.544$, $p < 0.01$) was arrived at. This implies that a higher level of education leads to reduced adoption of indigenous climate change adaptation strategies. This could be since the modern education system is not tailored on indigenous knowledge and thus tends to erode it, interrupt channels of its transmission and inculcates values that tend to undermine it. This is in agreement with Nakashima et al., (2012).

Table 3: Correlation between socioeconomic and institutional characteristics and adoption of indigenous climate change adaptation strategies

Variable	Correlation Coefficient	Sig
Age	.666**	.000
Credit access	.516**	.000
Education level	-.544**	.000
Extension service access	-.643**	.000
Gender	.072	.464
Household dependency	-.534**	.000
Household size	.051	.605
Income diversity	.576**	.000
Income level	.528**	.000

Variable	Correlation Coefficient	Sig
Information access	.633**	.000
Land size	.596**	.000
Local livelihood experience	.679**	.000
Market access	.590**	.000
Participation level	.759**	.000
Membership to social networks	.704**	.000
Perception of climate change	.735**	.000

A Spearman's rank correlation was calculated between access to extension service and adoption of indigenous climate change adaptation strategies. A negative significant correlation ($r = -0.643$, $p < 0.01$) was found. Therefore, access to extension service has leads to lower adoption of indigenous climate change adaptation strategies. This could be because extension services mostly promote modern technologies at the expense of indigenous ones leading to their erosion. About 79% of the respondents said that extension officers don't train on indigenous strategies. This is in agreement with Reid et al., (2009) and Mati (2006).

Further, a Spearman's rank correlation analysis was calculated to find out the relationship between gender and adoption of climate change adaptation strategies. A positive correlation ($r = 0.72$, $p > 0.05$) that was not significant was arrived at. Therefore, women adopt indigenous climate change adaptation strategies more. This could be due to women being more involved in land-based production activities and having less financial capacity to invest in and access to modern technologies.

A Spearman's rank correlation analysis was calculated between household dependency and adoption of indigenous climate change adaptation strategies. A negative significant correlation ($r = -0.534$, $p < 0.01$) was found. Greater household dependency thus reduces the capacity to adopt indigenous climate change adaptation strategies. This could be due the higher burden in taking care of the larger household. This finding is affirmed by Apata (2011).

A Spearman's rank correlation analysis was calculated between household size and adoption of indigenous climate change adaptation strategies. A positive non-significant correlation ($r = 0.051$, $p < 0.01$) was found. Therefore, household size increases adoption of indigenous climate change

adaptation strategies. This is because larger households have more labor force hence capacity to undertake indigenous climate change adaptation strategies. They may also be forced to divert to divert part of their labor to nonindigenous activities in a bid to cope with the higher consumption pressures. Yirga (2007) also noted the same findings.

On calculating a Spearman's correlation analysis between income diversity and adoption of indigenous climate change adaptation strategies. A positive significant correlation ($r = 0.576$, $p < 0.01$) was found. This means more income diversity lead to increase in adoption of indigenous climate change adaptation strategies. Those who have more diverse income sources have more livelihood choices and more income thus greater capacity to adopt. Greater diversity also means espousal of more diverse technologies which could also include indigenous strategies. This finding is in agreement with Conway (2009) and Onubuogu, Chidebelu & Eboh (2014).

A Spearman's rank correlation was calculated between income and adoption of indigenous climate change adaptation strategies. A positive significant correlation ($r = 0.528$, $p < 0.01$) was found. This means income increases adoption. This could be because greater income means greater capacity to undertake indigenous strategies, more latitude in making choices. Greater income also reduces risk averseness and discount rate hence greater willingness to adopt. This finding is in agreement with CIMMYT (1993) and Nhamachena and Hassan (2007).

A Spearman's rank correlation was calculated between access to information and adoption of indigenous climate change adaptation strategies. A positive significant correlation ($r = 0.633$, $p < 0.01$) was found. More access to information means

greater knowledge and thus capacity to adopt indigenous climate change adaptation strategies. This is in agreement with Baethgen et al. (2003).

A Spearman's correlation analysis was calculated between land size and adoption of indigenous climate change adaptation strategies. A positive significant correlation ($r = 0.596$, $p < 0.01$) was found. This means owning more land increases adoption of indigenous climate change adaptation strategies. This is because those who larger lands have more capital and resources to invest in adaptation strategies. This concurs with Gbetibou (2009).

A Spearman's rank correlation was calculated between local livelihood experience and adoption of indigenous climate change adaptation strategies. A positive significant correlation ($r = 0.679$, $p < 0.01$) was found. This is because the more experience farmers have the greater their knowledge on local climate change and indigenous practices hence increased adoption. This is in consonance with Nhamachena and Hassan (2008)

A Spearman's rank correlation was calculated between market access and adoption of indigenous climate change adaptation strategies. A positive significant correlation ($r = 0.59$, $p < 0.01$) was found. This is because markets are avenues of information exchange. Greater to inputs and produce markets access could also mean greater access to resources. More access markets thus leads to greater capacity to adopt. This is in agreement with Maddison (2006), Tazeze, Haji & Ketema (2010) and Gutu, Bezabih, & Mengistu (2012).

A Spearman's rank correlation was calculated between participation in community issues and activities and adoption of indigenous climate change adaptation strategies. A positive significant correlation ($r = 0.759$, $p < 0.01$) was found. This is because participation in community issues and activities increases access to livelihood opportunities, information and social capital hence the capacity to adoption. This is in agreement with Ofouku and Emieke (2012).

A Spearman's rank correlation was calculated between membership to social networks and adoption of indigenous climate change adaptation strategies. A significant positive correlation ($r = 0.704$, $p < 0.01$) was arrived at. This is because social

networks act as platforms for shared learning and channels of information exchange. They also foster access mutual support and reciprocity mechanisms and empowerment hence participation in decision making. They thus foster access to livelihood opportunities and access to capital assets including through credit schemes such as table banking. This is in agreement with Below et al. (2010) and Deressa (2009).

A spearman's rank correlation was calculated between perception of climate change and adoption of indigenous climate change adaptation strategies. A positive correlation ($r = 0.735$, $p < 0.01$) was arrived at. This implies that climate change perception increases adoption of indigenous climate change adaptation strategies. This is because adoption starts with perception of the problem followed by response. Perception of climate change by the household head thus increases the household likelihood of adopting. This in agreement with findings by Assan (2014), Shongwe (2014) and Prager & Posthumus (2010).

CONCLUSION

The study analyzed determinants of adoption of indigenous climate change adaptation strategies among the indigenous Tharaka People in Tharaka Nithi County, Kenya. Adoption of indigenous climate change adaptation strategies is subject to prevailing socioeconomic and institutional factors that affect it. These socioeconomic factors include age, local experience, land size, income level and income diversity that have a significant positive relationship thus influence on adoption. On the other hand, other socioeconomic factors including household dependency and education have a negative thus influence on adoption. Moreover, institutional factors including market access, information access, credit access, participation in community activities and membership to social networks have a significant positive relationship with adoption of indigenous climate change adaptation strategies. Conversely, other institutional factors including access to extension service and individualization of land tenure have a significant negative relationship with adoption of indigenous climate change adaptation strategies. Perception of climate has a positive relation with adoption of indigenous climate change adaptation

strategies. These factors need to be leveraged upon in development of policies and programs aimed at enhancing adaptation of climate change in indigenous communities.

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