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A Comparative Analysis of Poverty Dynamics in Relation to Household, Regional Characteristics and Farming Systems in Kenya

Samuel Kimote^{1*} and Mutuku Muleli²

¹*Kimstat Marketing Intelligence and Statistical Consultants LTD, P.O.Box 30005-00100, Nairobi, Kenya.*

²*Ministry of Devolution and Planning, Kenya.*

Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

This study aimed at describing poverty incidences in Kenya in relation to regional characteristics, household characteristics and farming systems, with a view to using the research findings to make recommendations for poverty alleviation and wealth creation. The study used social capital; a non-monetary indicator to gain a deeper understanding of causes of poverty in Kenya with a view to identifying the poor and what makes them poor in order to plan for them. A logistic regression model was fitted using secondary data from the Kenya National Bureau of Statistics' Integrated Household Budget Survey of 2005/2006. The model had household characteristics, regional characteristic and farming systems as independent variables (IVs) and socio-economic status as the Dependent Variable (DV). The results indicated that the likelihood that a household is poor is related to household income, the household head traits, household characteristics, regional (provincial) characteristics and farming systems' characteristics. The results further proved that the use of Multiple Correspondence Analysis (MCA) approach to determine the composite poverty indicator

*Corresponding author: E-mail: Kimote.samuel@gmail.com;

yields the same results as when an asset index or any other technique is used. From the findings, there is need for concerted efforts, from government as well as other stakeholders, towards provision of services (seedlings, extension services and other agricultural inputs) to both large scale and small case farmers; increasing awareness on the importance of crops diversification; construction; and rehabilitation of infrastructure facilities and checking on population growth.

Keywords: *Composite poverty indicator; determinants; logistic; MCA; multiple.*

1. INTRODUCTION

The Kenya Vision 2030 is motivated by a collective aspiration of a better society by 2030. It aspires to make Kenya a globally competitive country, providing high quality life to all Kenyans. Poverty and food insecurity remain widespread in rural Kenya and in informal settlements. One of the main reasons for food insecurity in the country has been over-dependence on subsistence agriculture, small land-holdings which are un-equal, poor storage leading to post-harvest losses, low productivity in agriculture due to low adoption of agricultural inputs (including fertilizers, extension services, seedlings etc.) and low income from non-agricultural activities. In recent times, food insecurity has worsened in several parts of the country partly due to persistent drought and also due to the effects of the financial crisis, high fuel and commodity prices.

For a period of time, aggregated households expenditures have been the preferred measure of poverty in developing countries due to lack of mechanisms to mobilize resources for extensive surveys let alone developing and maintaining databases on income, expenditure and consumption levels. However, poverty analysis focusing on financial measures gives partial information on poverty dynamics as compared to social capital approach. Further, few (if any) studies have been done in the Kenyan context using social capital as a threshold for poverty. In view of the foregoing, this paper used social capital approach to model poverty determinants in Kenya. In addition, the study was expected to make a contribution to the existing knowledge on poverty reduction by exploring how subsidies and transfers important Government strategies for long-term poverty reduction, influence poverty status of households.

Hence, the specific objectives were to;

1. Describe poverty incidences in relation to regional characteristics, household

characteristics and farming systems in Kenya; and

2. Using the research results, make recommendations for poverty alleviation and wealth creation.

2. LITERATURE REVIEW

2.1 Poverty and Development in the Kenyan Context

Kenya is a low-income country with a population of about 40 million people. The country had a GDP of \$32 billion Dollars in 2010 with an annual growth rate of 5.6% based on 2010 estimates. The country has life expectancy (at birth) of 55.6 years while the Human Development Index stands at 0.47 compared to a world index of 0.624; Kenya is ranked 128 in the world [1]. The multi-dimensional poverty index ($k \geq 3$) is 0.302 with a gender in-equality index of 0.738 [2]. In terms of poverty, it is estimated that 65.9% of Kenyans will be living in poverty by 2015 unless evidence-based economic policies aimed at accelerating economic growth are implemented [2]. Currently, majority of citizens in Kenya are threatened with imminent starvation due to extreme poverty levels [1, 3, and 4].

2.1.1 Poverty indicators

In Kenya, poverty reduction and wealth creation have been critical in formulation of different national development plans such as the five-year District Development Plans (DDPs), Economic Recovery Strategy for Wealth, Employment Creation, 2003-2007, and Kenya Vision 2030 among others. However, systematic analysis of poverty dynamics has not been done as expected. One of the reasons for this is the lack of an implementation and monitoring and evaluation framework and also due to the application of measures which do not capture current household trends.

Both monetary and non-monetary indicators may be used measures of poverty dynamics and the

choice depends on the availability of reliable and valid data. In monetary measures, both income and consumption can be used to measure household wellbeing [5,6]. However, consumption is the better measure when compared to income in that the level of household consumption gives a clear picture of households with the ability to meet other basic needs. Further, income in informal context is hard to document as it is erratic while large shares of informal income is not monetized and households may consume what they have produced [5]. In case of detailed information on both consumption and income, then a researcher would use both approaches and compare the results. The only problem with this approach is the need to aggregate the information which is a complex process and which requires information adjustments leading to different understanding of poverty.

To [7,8], researchers have become aware that poverty analysis focusing only on financial measures gives partial information on poverty dynamics. In this regard, [7,8] propose three approaches to measure poverty in a non-financial way. Approaches include the asset-based approach, needs-based approach and the human development approach. The three proposed approaches are multi-dimensional and are participatory in nature leading to better understanding of poverty dynamics. Adato et al. [7,8] provide a sound basis for aggregating all the different non-financial poverty indicators. With this in mind, however, getting reliable and valid non-monetary indicators of poverty dynamics, is a challenge. In Kenya, non-financial poverty dynamics indicators include food insecurity, illiteracy, religion, region and residence characteristics and household characteristics among others and have been captured comprehensively in KIHBS.

2.1.2 Determinants of poverty in Kenya: The different approaches

Past poverty analyses researches in Kenya indicate that poverty determinant factors are similar to those in other developing countries. Household's socio-economic status is related to household characteristics, location, household composition, household human capital and household income. For example, it is expected that the probability of Kenya's rural households being poor compared to urban households is high. Further, since agriculture is the main economical activity for many rural households, then agricultural output, size of land and its

productivity are important determinants of rural poverty [6, 9, and 10].

Several approaches have been used in the analysis of poverty determinants in Kenya. [11] Using DHS (2003) data used a logistic model to identify key determinants of poverty in Kenya. They used Principal Component Analysis (PCA) to reduce the large data set to manageable levels and used one of the approaches proposed by [7], asset-based approach, and developed an asset index using household assets to establish socio-economic status of the survey households. The logistic model findings indicated that level of education of the household head, location (urban or rural), age of the household head and his/her gender, religion and ethnicity are significant poverty determinants.

An extensive study dealing with measurement, profile and determinants of poverty was done by Mwabu [12]. Mwabu [12] employed the use of a household welfare function, approximated by household expenditure per adult equivalent. One major assumption made in this study was that consumption expenditures are negatively associated with absolute poverty in all households and at all expenditure levels. This implies that factors which increase consumption expenditure at household level reduce poverty levels. This assumption may not hold as raising consumption expenditure levels of those households already above the poverty line will have no impact at all on poverty level [13]. Despite this weakness, the study added significantly to the existing knowledge by pointing out that unobserved region-specific factors, mean age, size of household, place of residence (rural versus urban), level of schooling, livestock holding and sanitary conditions are important poverty determinants.

Oyugi [14] in a study used discrete and continuous indicators of poverty as dependent variables and a set of household characteristics as explanatory variables. Oyugi [14] estimated a probit model using data of the 1994 Welfare Monitoring Survey data. The explanatory variables (household characteristics) included holding area, livestock unit, the proportion of household members able to read and write, household size, sector of economic activity (agriculture, manufacturing/ industrial sector or wholesale/retail trade), source of water for household use, and off-farm employment. The results of the probit analysis showed that almost all variables used were important determinants of poverty in rural areas and at the national level,

but that there are important exceptions for urban areas [14].

Literature on poverty determinants in Kenya have been done by different authors extensively. The studies have been in agreement in terms of the poverty threshold to be applied to represent the bare survival minimum. Some have used the World Bank methodology of 40th percentile proportion while others used a dollar per day while others have used calories consumption per adult per day. All these are agreed thresholds which are valid and reliable. However, different studies have differed significantly in terms of the design, the data used and the approach and the poverty threshold. Achia et al. [11,15,16,17] approach is problematic as it does not take into consideration the sources of the assets, their quality and when they were acquired. Further, the study used the PCA approach for data reduction despite the fact that the approach (PCA) is meant for continuous variables and not categorical, which was the case with data.

In all the past poverty analysis studies done, there is very little information on the determinants of poverty and its resultants, namely the impacts of poverty on Kenya's economic growth. Further, there has been no study on the impact of subsidies and transfers, an important Government strategy for long-term poverty reduction, on poverty in Kenya. Again, farming systems, household characteristics and significance of the interaction effects in determining poverty levels has not yet been studied in the context of Kenya in addition to there being scant information on households below poverty line and those that are in extreme poverty levels in Kenya. Also, there has been little effort in the use of the social capital approach, yet it captures household current realities vividly. PCA approach although meant for continuous variables has been employed extensively but not the MCA approach, meant for nominal variables.

3. METHODOLOGY

3.1 Study Data

The data used in the analysis of poverty was taken from the 2005/06 KIHBS. This is due to the fact that household surveys are essential for the analysis at the household level as they enable the measurement and analysis of different poverty dimensions, their inter-relationships and correlates [9,18,19]. KIHBS was not an exception of [9] arguments and collected detailed

information on education levels; health, fertility and household deaths; labour issues; child health and anthropometry; housing; water, sanitation and energy use; food consumption; consumption on non-food items; expenditures on durables; agriculture holding and output; livestock; household enterprises; transfers and other income sources.

3.2 Poverty Indicator

Kenya is a developing country and, as most developing countries, has no concrete information on monetary metrics to measure poverty levels. In such cases, the use of an index of household welfare has been found appealing. The use of assets index has been explored in Kenya for the last ten years. This practice has been influenced by Filmer and Pritchett (1999) study which used a linear index of household welfare based on asset ownership using data from India. Achia [11] using DHS (2003) used Principal Component Analysis (PCA) to develop assets weights and developed an asset composite index to establish socio-economic status of the survey households and then used logistic regression to model poverty determinants. Jane et al. [13] also used factor analysis methods including PCA, Generalized Canonical Analysis (GCA) and MCA to construct the assets weights and consequently the index used in any extensive analysis of multi-dimensional poverty in Kenya with a focus on women and children.

Other authors have also evaluated the use of assets indicators in analyzing multi-dimensional poverty. Sahn and Stifel [20] used MCA to come up weights for the household welfare indicator. According to Sahn and Stifel, MCA is advantageous over PCA in that it makes few assumptions on the distribution of the explanatory variables and is suitable for both discrete and categorical variables. PCA on the other hand was designed for continuous data since it assumes normal distribution of the indicators variables [13].

The analysis technique used in this research study is the MCA since the household variables included in the KIHBS are in a qualitative form and categorical. Jane et al. [13], before considering the approach to use in modelling multi-dimensional poverty determinants in Kenya, evaluated MCA advantages compared to PCA. The evaluation results pointed the fact that MCA was developed to fill gaps left by PCA when the

assumption of normality of explanatory variables ceases to hold. Another advantage of MCA emanating from the evaluation is that it takes care of smaller categories such that poorest groups receive good rating in the construction of the indicator. Composite indicators constructed using MCA approach are averages of the factorial weights of the indicator categories as shown in Table 4-1.

3.2.1 Weights and the composite poverty indicator

The choice of the weights applied in the construction of a composite indicator is a sensitive issue [13, 3, and 21]. In this regard, [22] proposes three main methods of weighting which include equal weights, frequency-based weights and multivariate weights. To this end, there is no agreed upon method of assigning weights and thus the need for robust tests of effects of the proposed weights. However, [22] advocate for equal weights as it is un-controversial although it cannot be used in all situations as in this case. In this research study, multivariate weights

determined using the MCA approach were adopted for the composite poverty indicator using the variables presented in Table 4-1.

The following equation was used to calculate a composite poverty indicator for each household:

$$MCAh_i = A_{i1}W_1 + A_{i2}W_2 + A_{i3}W_3 + \dots + A_{ik}W_k \quad (1)$$

Where $MCAh_i$ is the i th household's composite poverty indicator score, A_{ik} is the response of household " i " to category " k ", and W_i is the MCA weight for the dimension applied to category " k ". To avoid an arbitrary weights on each variables, factor results were used where lower weights refers to lower welfare, while larger weights indicates higher welfare. The 40th percentile is used as the indicative poverty line. The choice was not arbitrary since the use of the 40th percentile as a poverty line is often suggested by the World Bank for poverty analysis [20,23,and 24]. The World Bank based composite includes same indicators as some of those considered in this study. These include indicators like access to water, sanitation, electricity, type of housing etc.).

Table 4-1. Variables and multiple correspondence analysis weights

Indicator	Variables	Weight
Source of Water for (Drinking, Bathing, Cooking, Livestock etc.)	Piped into dwelling	2.561
	Piped into plot/yard	0.958
	Public tap	0.024
	Tube well/borehole with pump	-0.443
	Protected dug well	-0.560
	Protected spring	-0.647
	Rain water collection	-0.022
	Unprotected dug well/springs	-0.880
	River/ponds/streams	-1.035
	Tankers-truck/vendor	0.615
Highest educational qualification acquired by household head	Bottled water	2.325
	Other	-0.425
	None	-0.808
	CPE/KCPE	-0.188
	KCE/KCSE	0.774
	KJSE	0.745
	KACE/EAACE	0.854
	Certificate	0.644
	Diploma private institution	1.570
	Diploma	2.338
	Degree	2.987
	Post graduate degree/diploma	3.989
	Other	1.028
	Referral hospital	0.774
	District/Provincial/hospital	0.016
	Public dispensary	-0.819

Indicator	Variables	Weight
Sources of medication	Public health centre	-0.472
	Private dispensary/ hospital	0.828
	Private clinic	0.583
	Traditional healer	-0.227
	Missionary hosp./dispensary	0.092
	Pharmacy/chemist	0.123
	Kiosk	-0.661
	Faith healer	0.378
	Herbalist	-0.425
	Other	0.862
Floor of the house is of	Cement	0.942
	Tiles	4.067
	Wood	1.280
	Earth	-1.013
	Other	0.739
	Flush toilet	2.949
Main household toilet facility is	VIP latrine	0.756
	Uncovered pit latrine	-0.292
	Covered pit latrine	-0.350
	Bucket	-0.175
	None	-1.355
	Other	-0.496
	Collected firewood	-0.904
	Purchased firewood	-0.552
	Grass	-0.375
	Paraffin	1.344
Source of Fuel	Electricity	3.432
	Gas/LPG	3.395
	Charcoal	0.714
	Biomass residue	-0.443
	Biogas	1.381
	Other	-0.130

3.3 Logistic Model

In order to identify determinants of poverty diagnostics, the dependent variable (p), whether a household is poor or not poor based on the composite poverty indicator, was determined. The legitimate hypothesis posed was that “the likelihood that a household is poor is related to household income (Y), the Household Head Traits (HHT), Household Characteristics (HC), Regional (provincial) Characteristics (RC) and Farming Systems Characteristics (FSC)”. The above hypothesized variables were the primary interests in this study.

The following equation describes the model:

$$p = f(Y_i, HHT_i, HC_i, RC_i, FSC_i) \quad (2)$$

In view of the foregoing, logistic regression will be used to model the binary dependent variable.

The equation will be:

$$\text{Logit}(p) = \ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 Y_i + \beta_2 HHT_i + \beta_3 HC_i + \beta_4 RC_i + \beta_5 FSC_i + \varepsilon \quad (3)$$

$$\text{Poverty Status} = \begin{cases} 1, & \text{if household "i" is poor} \\ 0, & \text{otherwise} \end{cases}$$

Where “p” denote the probability of a household being poor, Y_i , HHT_i , HC_i , RC_i and FSC_i are vectors of the explanatory variables while β_i 's are a vector of parameters, ‘ ε ’ is the error term.

Table 4-2. Logistic regression results

Variable	Odds Ratio (OR)	P-value
Regional characteristics		
Region		
Nairobi	Reference	
Central	0.9285	0.853
Coast	1.5658	0.296
Eastern	1.3880	0.418
North Eastern	2.2376	0.154
Nyanza	1.5988	0.233
Rift Valley	3.7110	0.001
Western	2.0698	0.066
Household and Household Head Characteristics		
Marital Status		
Monogamous	Reference	
Polygamous	1.3234	0.062
Living Together	0.1309	0.045
Separated	0.5672	0.057
Divorced	0.8133	0.506
Widow/Widower	1.7247	0.000
Never Married	0.3665	0.000
Age	1.0362	0.000
Gender	3.1050	0.000
Family Size	1.3732	0.042
Health		
Not disabled	0.7253	0.352
Not sick in the last 4 weeks	0.6656	0.030
Don't sell assets to pay health provider	0.2633	0.000
Don't borrow money to pay for health provider	0.7021	0.055
Distance to health facility	1.4321	0.004
Farming Systems Characteristics		
Quantity harvested	0.9996	0.070
Total Values sales	0.9998	0.000
Support		
Not received cash transfers	2.2109	0.020
Not aware/(no collateral for) of credit facilities	1.4492	0.186
Using farm inputs (fertilizer, seedlings etc.)	0.5241	0.251

4. DATA ANALYSIS AND EXPLANATIONS

4.1 Results and Discussion

The analysis was done using SPSS Version 17 and Stata Version 11. The first dimension was used as an index of poverty indication and it explained 62.62% of observed inertia (the eigenvalue). The variable weights are as presented in Table 4-1. In this case, factor results were used where a lower weight (< 0) refers to lower welfare, while a larger weight (> 0) indicates higher welfare.

The weights indicated that households with piped water into dwelling/plot/yard and those with access to public tap and bottled water are likely

to have a higher welfare compared to those with access to protected and unprotected springs, dug wells and those that depend on rivers/ponds/streams. Households whose head has no education and where he/she has CPE/KCPE certificate are likely to be lowly ranked in terms of welfare. Where the head has postgraduate education, the household is perceived as having high living standards. This is an indication that poverty incidences are related to education levels. Further, households who seek medication from public health centres, traditional healers, herbalists and those that get medicine from kiosks are said to be poor. Further, the weights indicate that households whose houses have earth floors and those that have no toilets or use buckets,

covered and uncovered pit latrines are likely to be poor.

The composite indicator for each household was developed using equation (1) and the 40th percentile was found to be -9.57 and was considered as the poverty line according to World Bank suggestions.

As shown in Table 4-2, regional characteristics were found to be significant determinants of poverty diagnostics since they capture un-observable household's characteristics which influence choices as hypothesized [25,26,27, and 28]. Using Nairobi province as the reference point, the results indicated that Central province households have a better welfare than Nairobi although the difference is not significant (Odds Ratio = 0.9285, $p > 0.05$). Households in the other provinces i.e. Coast, Eastern, Rift Valley, Western, Nyanza and North Eastern were found to be below Nairobi in terms of welfare. However, only Rift Valley households were found to be significantly different from Nairobi households in terms of welfare. Ideally, it would have been important to control for direct measures of perceived level of the un-observed characteristics, however, KIHBS data did not include variables to take care of this. Statistically significant results call for further examination of the specific characteristics like rainfall trends, infrastructure and other enablers' development, energy supply and cultural inclinations among others.

The level of poverty is high in polygamous families (Odds Ratio = 1.3234, $p > 0.05$) as compared to monogamous families. This can be attributed to the fact that polygamous families have high dependency ratio and thus what is produced is consumed leaving nothing to store or for investments. Further, such families have different priorities and attention shifts randomly meaning that collective contribution by household members is lacking. Widow/widower led households are also likely to be poor (Odds Ratio = 1.7247, $p < 0.05$) than other family settings. This is attributed to the fact that widowhood creates economic hardship due to vulnerability as social security and other benefits plans drop.

Given the same settings, the odds of a female headed households being poor is high (Odds Ratio = 3.1050, $p < 0.05$). Female headed households suffer from poverty since they have a higher dependency ratio, have fewer assets, have little access to resources and tend to be

disrupted from time to time [29]. To [29], access to land, livestock, credit facilities, education, health care and extension services is a preserve of the males in many communities. Household-head age increase by a year increases the odds of the household becoming poor by a significant factor of 1.0362.

Although disability is not inability, households headed by a person who is not disabled have a 27.47% probability, lower than disabled-headed-households, of being poor. In support, [26] argues that, in overall, poor prospects for education, access to resources and employment among disabled people coupled with the intense stigma that they often face, drives them into poverty. The health of a household head is also a key determinant of wellbeing. If he/she does not fall sick often, then the likelihood of poverty is low (33.44%). Poor households are further characterised by the in-ability to pay for health services and likely to sell part of their assets (if any) or to borrow money in order to pay a health service provider. This means that such families are likely to remain poor since accumulation of assets and savings alleviates poverty and creates wealth.

What a household produces, consumes and sells is in direct proportion with wellbeing. High production means high ranking in living standards. A sign test on what is produced and what is consumed proved that poor households in Kenya produce and consume at equal proportions. It was also found out that majority of the households' plant white maize (43.9%) and hybrid maize (28.6%). Households do not take into consideration drought resistant crops, cash crops and alternative crops despite the fact that drought, crop pests and diseases were found to be significant shocks experienced by many household in Kenya causing an average loss of Kshs. 22,379 per occurrence. A test of the difference between total production and the total amount of shock showed that the effect of the shocks is a significant determinant of the final produce and thus should be mitigated ($Z = -29.11$, $p < 0.05$). Further, it was also found out that household which bought seeds harvested significantly high quantities compared to those that did not ($U^2 = 5841351.5$, $p < 0.05$). Mostly, seedlings were bought from merchants, who at time can be unscrupulous. As expected,

² Mann Whitney Statistic

the results indicated that the majority of Kenyans have small land holding with majority households having slightly above an acre of crops land ($M^3 = 1.49$).

Also, those that are not receiving cash transfers either from the Government, individuals, CBOs/NGOs among others, are likely to be poor (Odds Ratio = 2.2109, $p < 0.05$). Households getting transfers are likely to utilize the money to accumulate wealth by, starting a business venture, educating members of the household, getting consumables and accessing basic services thus climbing the poverty ladder. In addition, households without knowledge/collateral to access credit facilities are poor (Odds Ratio = 1.4492, $p > 0.05$). In this regard, such families are more likely to sell the only assets or borrow money in order to access services including health, water, and garbage collection among others.

4.2 Evaluation of the Logistic Model

This was meant to assess the soundness of the logistic model expressed in equation (3). Several tests, as proposed by Chao-Ying [30], were performed and included overall model evaluation, statistical test of the predictors, goodness of fit tests, and predicted probabilities. According to Chao-Ying [30], a model is said to be sound if it demonstrates an improvement over an intercept model. The overall model evaluation using the test and lrttest commands (see Appendix 1 and 2) for the predictor variables showed that they are significant and thus better to predict poverty diagnostics than an empty model. The goodness of fit test was conducted using the Hosmer-Lemeshow (H-L) test and the results were insignificant indicating that the model fitted to the data well [$\chi^2(8) = 4.08$, $p > 0.05$].

In summary, these results correlate well with those from other studies done on poverty in Kenya. In terms of the research hypothesis, the logistic regression and other test results supported the proposition that the likelihood that a household is poor is related to household income, the household head traits, household characteristics, regional (provincial) characteristics and farming systems characteristics.

5. CONCLUSION AND RECOMMENDATION

5.1 Conclusion

The results of the research study indicate that many households in Kenya suffer much from shocks which include droughts, pests and diseases. In this regard, irrigating farm land can cushion farmers and thus enhance food security. Increased production from irrigation schemes can achieve food security both at household and national level. However, this is only possible if farmers get the necessary support from the Government, NGOs/CBOs and other support groups. Such support includes provision of seedlings, extension services and other agricultural inputs. Currently, farmers are at the mercy of unscrupulous sales men who hike prices at will and thus price policy interventions aimed at protecting farmers from frequent price distortions should be formulated. In the short term, agricultural produce prices stability can promote increased production and Kenya can take advantage and encourage households to produce more, store and sell the surplus profitably.

Such kind of interventions will create employment to communities thus increasing household incomes and reducing rural to urban migration. Further, this will enhance diversification of crops as the study has shown, white and hybrid maize is preferred by most households. Crops that can withstand drought are scarce.

Again, such measures will instill hard work to communities hence reducing the habit of over-dependence on food handouts which creates dependency syndrome and laziness. Irrigations schemes do not mean huge investments. If households get water harvesting tanks, then small scale schemes can be developed in communities. Big families consume more and thus the need for concerted efforts from the Government and stakeholders in promoting family planning programmes.

Land size is one of the significant determinants of poverty in Kenya. From the logistic results, an increase in land size is associated with welfare change. However, this does not suggest a tangible reason for land distribution, rather, small scale irrigation schemes through dam construction and water harvesting and conservation are promoted by all to enable

³ Mean

households produce throughout the year. Access to services like water and sanitation, electricity and health services, is an important ingredient in household welfare. In this regard, the

Government of Kenya can construct and rehabilitate infrastructure facilities to boost households' income by providing better roads to enable service accessibility, household water and sanitation services and electricity. Such initiative would mean increased productivity from off-farm activities hence generating more income for the households.

Household head level of education is another key determinant. Education will enable the uptake and adoption of new production technologies. Further, households need more information on health, sanitation and family planning measures. These will first assist households to check on size thus increasing the possibility of becoming non-poor. Secondly, education will minimize the possibility of generational poverty.

Low level of education can lead to lack of awareness on HIV and AIDS pandemic, which continues to rob the country of the productive age. In this regard, there is need for efforts in adult education by concerned stakeholders.

The Government is currently piloting cash transfer programmes to vulnerable groups under the social protection initiative. Such interventions are meant for households with the aged and sickly and those with orphans and vulnerable children. The country has also been receiving transfers from abroad although to a few households. Households getting transfers are likely to utilize the money to accumulate wealth by starting a business venture, educating members of the household, getting consumables and accessing basic services. In this regard, the Government should develop criteria for the implementation of the initiative and consider the inclusion of poor households with many family members, female headed, widows/widower headed, households with disabled heads among other considerations.

The Government has allocated funds for different groups in society including the Women Development Fund and the Youth Enterprise Development Fund. The research results have indicated that households without knowledge/collateral to access credit facilities are poor and are more likely to sell assets or borrow

money in order to access services including health, water, and garbage collection among others. To ensure equal opportunities (both poor and non-poor), the Government should establish a mechanism for identifying the needy and sections of the society where the monies can be deployed with huge impact. Standardization of the process does not ensure equity as envisaged in the social pillar of the Kenya Vision 2030.

Statistically significant results call for further examination of the specific characteristics like rainfall trends, infrastructure and other enablers' development, energy supply and cultural inclinations among others for the regional characteristics.

5.2 Recommendation

1. There should be increased efforts to ensure provision of services to both large scale and small case farmers. These include provision of seedlings, extension services and other agricultural inputs. The option of giving subsidized farm inputs should be explored;
2. Increased production from irrigation schemes can achieve food security both at household and national level. In this regard, relevant stakeholders should make available water tanks, construct dams/pans and protect streams and springs in order to actualize small scale irrigation schemes. Kenyans should also be sensitized on the importance of water conservation through relevant media channels;
3. Efforts should be made to increase awareness on the importance of crops diversification since currently; white and hybrid maize are the commonly used crops. Crops that can withstand drought are scarce while the effect of drought shocks is widely felt;
4. Devolved funds should be channelled to the construction and rehabilitation of infrastructure facilities to boost households' income. Better roads will enable service accessibility e.g. water and sanitation services, health and electricity;
5. Mechanisms meant to ensure checked population growth should be instituted. These will first assist households to check on size thus increasing the possibility of becoming non-poor as more family members means more consumption and less savings;

6. Relevant stakeholders should develop/ review criteria for the implementation of the social protection initiative and consider the inclusion of poor households with many family members, female headed, widows/ widower headed, households with disabled heads among other considerations; and
7. A mechanism for identifying the needy and sections of the society where monies can be deployed with huge impact should be developed. Standardization of the process does not ensure equity as envisaged in the social pillar of the Kenya Vision 2030.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Appendix 1. Predicted probabilities**Logistic:** Predicted probabilities of positive outcome for **poverty**

region	Prediction
Nairobi	0.1134
Central	0.1293
Coast	0.1471
Eastern	0.1669
North Eastern	0.1887
Nyanza	0.2127
Rift Valley	0.2388
Western	0.2670

region	b18	b19	b05a	b04	d09_1
x= 5.4362416	2.1744966	3.0727069	43.805369	1.4384787	5.4753915

Logistic: Predicted probabilities of positive outcome for **poverty**

d09_1	Prediction
Referral Hospital	0.1840
District/Provincial/Hospital	0.1873
Public Dispensary	0.1906
Public Health Centre	0.1939
Private Dispensary	0.1973
Private Clinic	0.2007
Traditional Healer	0.2042
Mission Hospital	0.2077
Pharmacy/Chemist	0.2113
Kiosk	0.2149
Herbalist	0.2222
Other	0.2260

region	b18	b19	b05a	b04	d09_1
x= 5.4362416	2.1744966	3.0727069	43.805369	1.4384787	5.4753915

Logit: Predicted probabilities of positive outcome for **poverty**

b18	Prediction
Catholic	0.3561
Protestant	0.3880
Other Cristian	0.4209
Muslim	0.4545
Traditionalist	0.4886
No Religion	0.5227
Other Religion	0.5567

b18	b19
x= 2.3588611	2.4282125

. prtab b19

Logit: Predicted probabilities of positive outcome for **poverty**

b19	Prediction
Monogomous	0.3984
Polygamous	0.3993
Lining Together	0.4002
Separated	0.4011
Divorced	0.4020
Widow/Widower	0.4029
Never Married	0.4038

Appendix 2. Endogeneity tests

```
. test region
( 1)  region = 0
      chi2( 1) =    11.42
      Prob > chi2 =    0.0007

. test b18
( 1)  b18 = 0
      chi2( 1) =     4.01
      Prob > chi2 =    0.0452

. test b19
( 1)  b19 = 0
      chi2( 1) =     3.43
      Prob > chi2 =    0.0641

. test b05a
( 1)  b05a = 0
      chi2( 1) =    59.62
      Prob > chi2 =    0.0000

. test b04
( 1)  b04 = 0
      chi2( 1) =    27.95
      Prob > chi2 =    0.0000

. test u12
( 1)  u12 = 0
      chi2( 1) =    11.54
      Prob > chi2 =    0.0007

. test r02
( 1)  r02 = 0
      chi2( 1) =    36.26
      Prob > chi2 =    0.0000
```

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