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Research Paper

Analysis of the effect of agricultural extension development initiatives on household's agricultural food productivity and sufficiency among small-scale farmers: A case of Kilifi County, Kenya

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The present study assess the contributions of the numerous agricultural extension and development initiatives on household agricultural food crop production and its sufficiency among small-scale farmers in Kilifi County in Kenya. Multi-stage sampling techniques namely purposive and proportionate sampling was used to select the study area and the sample size for the study. Data were analysed using descriptive statistics and inferential statistics *t* test at p value of 0.025. The results show that agricultural food productivity among small-scale farmers' households in most of the produce except for small seeded cereals (sorghum and millet), cassava and dairy produce were statistically insignificant. The paper recommends that a policy should be developed and implemented to ensure that the government and development partners engaged in implementation of development initiatives carry out a situation analysis prior to development and promotion of crop varieties and types of livestock whose ecological requirements for their performance is supported by the local ecological characteristics, crop varieties that are suitable for the market and at the same time have qualities for long shelf life, last longer in the field long after attaining its physiological maturity to allow for piece meal harvesting. A policy frame should also be developed to provide guidelines on funding of livestock production projects and programmes by the Kenya Government to ensure provision of regular services to farmers.

Key words: Agricultural development initiatives, agricultural productivity, household's food sufficiency, small-scale farmers.

INTRODUCTION

The global demand for food is expected to rise steeply as a result of burgeoning population and shifting dietary preferences. In 2009, the Food and Agriculture Organization of the United Nations estimated that global food production must increase by 70% to meet demands in 2050 (Schmidhuber and Tubiello, 2007). The most important prospects for increased food production in the near future are seen in areas where the current land productivity is significantly lower than the potential (Lobell *et al.*, 2009). These differences between actual and potential production are believed to be especially wide in sub-Saharan agricultural systems where large portions of

the land are still under subsistence farming especially among small-scale farmers who form the bulk of food crop producers in this part of the world. Improving food production for the African small-scale farmer remains one of the biggest and most important challenges. This is because low levels of agricultural productivity are at the root of the problems of food security in sub-Saharan Africa (Sasson, 2012; Rosegrant and Cline, 2003*)*. Both developed and developing countries have advanced agricultural technologies aimed at improving agricultural productivity through its research institutions and disseminated to farmers by the extension agents. Conversely, agricultural production has continued to be low and even declined in most of the developing countries, especially in Africa and Asia (Madukwe, 2006).

In Kenya, the performance of agriculture which remains the backbone of the economy has been sporadic. The production has slackened dramatically over the post independence years from an average of 4.7% in the first decade to only below 2% in the 1990s. This decline culminated in a negative growth rate of -2.4% in 2000 and then rose to 6.4% in late 2000s and subsequently declined from 6.4% in 2010 to 1.5 pc in 2011 (Alila and Atieno, 2006; Kenya National Bureau of Statistics [KNBS], 2012). To address the decline, the Kenya government through its Ministry of Agriculture has developed and disseminated numerous agricultural initiatives and reforms to farmers. The initiatives include National Agricultural Extension Policy (NAEP) that was implemented under National Agricultural and Livestock Programme (NALEP), a national umbrella framework for implementation of programmes and projects supported by Swedish International Development Agency (Government of Kenya, 2016). According to GoK (2016), the key pillars of the NALEP approach were participatory demand driven extension, pluralism in extension provision and transparency and accountability in the management of resources.

Other initiatives include National Agricultural Sector Extension Policy (NASEP), a reviewed NAEP whose objective is to emphasis on the objectives of NAEP, to guide and harmonise management and delivery of extension services in the country, recognises the need to diversify, decentralise and strengthen the provision of extra services with a view to increasing sustainable and relevance to farmers; Strategies for Revitalization of Agriculture (SRA) whose purpose was to transform Agriculture into a viable and vibrant sector that is commercially oriented and internationally competitive sectors 'contribution towards attaining the objectives of the Economic Recovery Strategy for Wealth and Employment Creation, 'Nja Marufuku' Kenya that was formulated in context of Millennium Development Goal number one (MDG-1) to halve number of hungry by 2015. It was a 10 year Programme that was implemented under SRA framework in three phases. Its objective was to provides an overall strategic framework for hunger eradication combining: Development programmes targeting poor and hungry productive safety net programmes for immediate hunger reduction, the Kenya Agricultural Productivity Programme (KAPP) which was a 12 year multi-sectoral and multi-institutional project implemented in three phases from 2004-2012. Its main objective was to improve the overall agricultural system by dissemination and adoption of agricultural technology aimed at synchronization of research, extension and farmers empowerment initiatives, Kenya Agricultural Productivity and Agribusiness Project (KAPAP) whose aim was to empower stakeholders to transform smallholder agricultural production and marketing systems for increased productivity and incomes in the project areas. This was the second phase of KAPAP (GoK, 2016). Another initiative was the National Accelerated Agricultural Inputs Access Programme (NAAIAP) which was a collaborative approach by both public and private sector as well as development partners. The primary objective was to improve input access and affordability of the key inputs for millions of smallholder farmers to get out of poverty and participate in agriculture as a business enterprise (Sheahan *et al.,* 2014).

Despite all these initiatives aimed at increasing agricultural productivity with particular focus in maize production which is driven by its value as a subsistence and commercial crop to the farmers, availability of food at household level remains a national concern (FAOSTAT, 2013). The initiatives and reforms have not achieved the desired objectives in some parts of the country such as Kilifi County which is ranked among the counties with high incidences of food poverty households in KNBS economic survey on basic report on well being in Kenya of 2005-2006 (KNBS, 2007). Kilifi County's household food poverty population is 66.1% which is high and therefore of concern. The County household food poverty rating in the year 2005-2006 was 50.0% (KNBS, 2007). The County's relief food supply increased from 36, 476MT during the year 2002 to 43,556MT in the year 2004 for a total of 97,992 beneficiaries. This means that 15% of the population relied on relief food most of the time in the year due to poor performance of agricultural food production (Kilifi County Integrated Development Plan (KCIDP), 2013).

The objective of the study

The purpose of this study was to assess the effect of the numerous agricultural extension development initiatives on household's food crop productivity and sufficiency at household level among small-scale farmers in Kilifi County, whose household food poverty population is 66.1%. The study was guided by the following specific objectives: To identify the demographic characteristics of the small-scale farmers, and to establish the contributions

of agricultural extension development initiatives disseminated among small-scale farmers on household agricultural food productivity among small-scale farmers.

METHODOLOGY

The study was conducted in Kilifi County. Kilifi County is one of the forty three Counties in Kenya and it is located in the coastal region. The County covers an area of 50,448 km^2 (Goverment of Kenya GoK, 2013) and is divided into seven sub-counties with an estimated population of 63,218 farm families. Most of the farmers are mainly small scale farmers occupying four coast lowland zones. The accessible population for the study included: 1) 21,025 households among whom the policy reforms and agricultural development initiatives were implemented.

The study used a combination of purposive sampling, snowball sampling, simple random and proportionate random sampling techniques. First, purposive sampling was used to select the County in which the development initiatives were implemented but did not translate to increased agricultural productivity. Simple random sampling was then used to select the three sub-counties. Proportionate random sampling was used to select representative sampling unit from each selected sub-county. One hundred and fifty (150) small-scale farmers were sampled. Sampling frame for small-scale farmers from the selected focal areas was obtained and arrangements made on when to visit the field and administer the questionnaire to the selected sample of small-scale farmers.

One set of semi-structured questionnaire was administered to small-scale farmers to collect information on personal profile of the respondents which included demographic data, land holding and utilization, crop diversification and performance of agricultural production; food sufficiency at household level and to obtain suggestions from households on the implications of agricultural initiatives implemented in the field by agricultural extension service providers to improve agricultural production. Observation schedule was used to collect data on observation made on the performance of the crop and livestock activities in the respondents' field. A focus group discussion was used to provide insights and triangulation of information elicited from the study sample. Data collected were analysed using descriptive statistics such as percentages, frequencies and graphics. Hypotheses were analysed using *t* test at α 0.05 using the SPSS version 20.0.

RESULTS AND DISCUSSION

Small-scale farmers personal profile

Objective one sought to identify the personal profile which included bio data, land holding and utilization and livestock and crop diversification among small-scale farmers. The identification of the personal data was important because they are the crucial characteristics that could have an influence on agricultural productivity due to the implementation of the agricultural development initiatives and policy reforms.

Bio data of small-scale farmers

Distribution of the respondents according to gender, age, and education level are as shown in (Table 1). The results show that there were slightly more (50.3%) female farmers than male farmers. The findings agree with those of Lastarria-Cornhiel (2006) who observed that half of the labour force in agriculture, particularly in rural Africa and Asia are women. The type and depth of participation varies widely over regions and culturally differentiated areas. Information elicited in Focus Group Discussion indicated that cultural norms were barriers to female famers' access to development initiatives especially if implementation is spear headed by male members of the programme/projects. Majority of respondents were in the young (18 to 35 years) and old (over 50 years) age brackets. These findings agreed with those of Nganga, et al., (2010) who indicated that aged farmers of over 50 years tend to exhibit higher levels of inefficiency due to reduced ability to practice the contemporary innovation packages and show low energy output. Researcher's personal experience observed that accessibility to agricultural development initiatives and adoption of appropriate agricultural technologies may decline due to advanced age caused by becoming more conservative and accepting change becomes difficult. Most of respondents (65.7) had formal education with the highest percentage (36.7%) having attained primary level of education. Education level may influence the individual's access to agricultural development initiatives, rate of adoption of appropriate technologies and perception to the type of development initiatives and interventions. The high percentage of farmers with formal education is pointer to anticipation of high rate of adoption of technology for enhancing agricultural production. Acquisition of formal education encourages individuals to interact and engage in negotiations that take place among farmers and outsiders who introduce interventions to the farming community. These findings agree with those of Lockheed *et al.* (1988, cited in King, 2004,) who identified that at least four years of primary schooling are required to have a significant effect on farm productivity in terms of efficiency and gains. Lockheed *et al.* explained that primary education generates skills useful for adoption of innovations. The study findings also agree with those of Ong'ayo and Akoten, (2007) who found that education is important for farm production in a rapidly changing technological and economic environment

Table 1. Bio data of the Small-scale Farmers in Kilifi County (n=150).

Variable		Percentage
Gender	Female	50.3
	Male	49.7
Age in years	Young (18-35)	34.7
	Middle age	29.0
	Old (over 50)	36.3
Education Level	None	34.3
	Primary	36.7
	Secondary	18.4
	Tertiary	10.6

Source: Survey Data, 2014.

Table 2. Small-scale farmers' land tenure, agricultural and operational land holding in Kilifi County (n=150).

Variable		Percentage
Land Tenure System:	Hired	2.3
	Individual (inherited, bought)	66.7
	Communal	31.0
Agricultural Land Holding (Hectares):	≤ One	40.7
	> One	59.3
Operational Land Holding (Hectares):	<two	64.0
	≥two	36.0

Source: Survey Data, 2014

than in traditional agriculture. The findings are further supported by Foster and Rosenzweig (1995), as cited in Gurgand, 2003) who observed that schooling for farmers directly influenced their agricultural productivity through their interaction with institutional variables such as access to credit, provision of skills necessary for waged employment that generates cash to finance agricultural investment.

Land tenure, agricultural and operational holding

Distribution of the respondents according to land tenure system, agricultural holding and operational holding are shown in (Table 2). The most common (66.7%) land tenure system was the individual ownership. The type of land tenure systems may influence farmers' response and adoption of development initiatives and consequently the crop and livestock productivity. Observations made in the field indicated that the individual land tenure system influenced the type of farming activities a farmer engaged in. The finding are supported by studies done by Garrity et al. (2006) who found that farmers applied somewhat more labour and intensive use of sustainable inputs such as manure, which has long term positive impact when cultivating their private plots than on hired and communal land. Majority (70.0%) of respondents owned more than one hectare of land. The highest percentage (64%) of farmers utilized less than two hectares of land. Observations made in the field indicated that vast hectares of land were under fallow.

Crop and livestock diversification

The identification of the crop and livestock diversification was important in understanding the extent to which households engaged in growing and rearing of different types of crops and livestock, respectively. The diversification may provide an insight as to the adequacy of food at household level that may last different durations and coping strategies (Table 3).

Table 3 shows the variation in the number of crops grown by small-scale farmers in the sampled study area. Only two (2.1%) percent of the small-scale farmers grew one type of crop with the rest of them engaging in diversified food crop production. Observation made in the field showed that most of the crops were cultivated on small portions of land due to less land acreage put under production. Most (62.1%) of the respondents kept one type of livestock. Observations made in the field showed that very few of the households kept a combination of cattle, shoats, local poultry, pigs and domestication of birds especially guinea fowls. The results imply that although livestock diversification among farmers is an important practice as it contributes to household food

Table 3. Small-scale farmers' crop and livestock diversification in Kilifi County (n=150).

Variable		Percentage
Number of Crops grown per household:	None	0.0
	one	2.1
	>one	97.9
Number of Livestock reared per household:	None	23.2
	one	62.1
	>one	14.7

Source: Survey Data, 2014

Table 4. Percentage of households with different number of bags harvested per hectare for commonly grown cereals and legumes before and after implementation of agricultural development initiatives in Kilifi County (n=150).

Food crops grown	Period	% of H/H with >25 *Bag/ha*	% of H/H with 17-25 *Bag/ ha*	% of H/H with 8-16 *Bag/ ha*	% of H/H ≤7*Bag/ ha*
Maize	Before	19.0	12.4	72.3	0.0
	After	7.7	19.7	75.6	0.0
Sorghum	Before	4.6	0.0	22.4	73.0
	After	3.7	0.0	10.7	85.3
Millet	Before	0	0	0	100.0
	After	0	0	0	100.0
Legumes	Before	11.3	1.0	5.2	81.3
	After	1.3	6.0	9.0	80.7
Others	Before	15.0	30.2	20.1	34.7
	After	12.3	10.7	52.3	24.7

Source: Survey Data, 2012

security, especially in times of crop failure and as an income generating enterprise, small-scale farmers were not zealous on livestock keeping as a form of livelihood which could enhance their socio-economic status.

Agricultural food production and household food adequacy

The findings on household agricultural food production and adequacy are presented and discussed in the following sub-sections. A three months period was used to determine the adequacy of produced agricultural food for individual the household as is the seasonal period most of the annual crops take to maturity in the study areas.

Agricultural food crop production

Table 4 shows the percentages of households in different categories based on the number of bags harvested per hectare for commonly grown food crops prior to and after the implementation of development initiatives in the study area. The results show that: the production of maize in most households was between 8-16 bags per hectare, sorghum production in most households declined resulting in an increase in the percentage (85.3%) of household with seven or less than seven bags per hectare while millet was not grown at all. Over 80% of households produced 7 or less bags of legume per hectare. The sustained high percentage (over 70%) of households engaged in maize production was due to the emphasise placed on it by development initiatives due to the crop being a staple food in over 90% of the households. In order to ascertain any significant differences between the percentage of households in different categories of cereal and legume production before and after the implementation of the development initiatives, a paired sample t-test was performed at significance level of 0.05 on the hypothesis that "*The implementation of the development initiatives did not significantly improve the small-scale farmers household cereal and legume production in Kilifi County".* The results are summarised in (Table 5). The results as shown in Table 5 indicate that:

(1) The *t*-values for the two tailed significance levels of the difference between sample means for the response was 0.004 which was less than 0.025 The results indicate that there was statistically significant differences at $P \leq 0.025$ observed in the percentage of households that had different categories of maize per hectare due to its improved production resulting from the implementation of agricultural development initiatives vis. NAEP, Strategies for Revitalizing agriculture (SRA), KAPAP, NAAIAP and NASEP.

The *t*-values for the two tailed significance levels of the

Table 5. Paired sample statistics t test on percentage of households with different number of bags harvested per hectare for commonly grown cereals and legumes in Kilifi County.

Effect of the implemented development initiatives	Development initiatives implementation	Mean	*t*-test	df	Sig (2-tailed)
		Mean			
If the general cereal and legume production was better before or after implementation of development initiatives	before	1.67	-	-	-
	after	1.67			
If maize production was better before or after of implementation of development initiatives vis. NAEP, SRA-Strategies for Revitalizing Agriculture, KAPAP, NAAIAP, NASEP.	before	1.67	0.67	4.000	149	0.004
	after	1.00			
If the production of Sorghum was better before or after implementation of development initiatives vis. NAEP, SRA-Strategies for Revitalizing Agriculture, KAPAP, NAAIAP, NASEP.	before	1.56	0.37	2.060	149	0.061
	after	1.33			
If the production of Millet was better before or after implementation of development initiatives vis. NAEP, SRA-Strategies for Revitalizing Agriculture, KAPAP, NASEP	before	1.67	-	-	-
	after	1.67			
If the production of legume was better before or after implementation of development initiatives vis. NAEP, SRA-Strategies for Revitalizing Agriculture, KAPAP, NASEP	before	1.38	0.63	4.033	149	0.003
	after	1.25			

Note: p≤ 0.025.

difference between sample means for the response was 0.061 which was greater than 0.025. The results indicate that there was no statistically significant difference at P ≤ 0.025 observed in the percentage of households that had different categories of sorghum per hectare due to its improved production resulting from the implementation of agricultural development initiatives vis. NAEP, Strategies for Revitalizing agriculture (SRA), KAPAP, NAAIAP and NASEP.

(2) The *t*-values for the two tailed significance levels of the difference between sample means for the response was 0.003 which was less than 0.025. The results indicate that there was statistically significant difference at P ≤ 0.025 observed in the percentage of households that had different categories of legumes per hectare due to their improved production resulting from the implementation of agricultural development initiatives vis. NAEP, Strategies for Revitalizing agriculture (SRA), KAPAP, NAAIAP and NASEP.

(3) There was no evidence to show significant change since there were no household figures for the difference in both means that had different categories for the general cereal and legume production and for millet production per hectare before and after the implementation of agricultural development initiatives.

(4) On the basis of the results, the means for half of the items used to measure percentage of households with different number of bags harvested per hectare for commonly grown cereals and legumes showed statistically significant difference at α = 0.05 when both end of the distributions were added together and therefore the null hypothesis was rejected. The statistically significant difference was influenced by the emphasis placed on the crop by most of the development initiatives advanced by researchers in relation to the other cereals. The crop is the staple food and is considered to be of high value with immediate market demand. Observation made in the field indicated that although the crop is given more priority in most of the development initiatives such as NAAIAP, SRA and KAPAP, small-scale farmers primarily grow it as the major cereal crop but the ecological characteristics such annual rainfall, soil water holding capacity and the soil fertility which is mainly sandy is not provide a very conducive condition for it to flourish very well. According to FAOSTAT (2013), Maize is both subsistence and commercial crop grown on an estimated 2.1 million hectares of Kenya's 5.3 million hectares of all crops harvested area by small-scale farmers (75%) and large-scale (25%) farmers which is more than 30% of arable land. Maize production is the key food crop in Kenya and technology innovation for increased production in Kenya is driven by the value of the crop to the farmers. Legumes among the sampled farmers were grown as intercrop with the cereal crops. Some farmers intercrop cereals such as maize and sorghum. The most common legume is cowpeas and pigeon pea. And it's grown on very low hectare.

Inadequate production of small seeded cereals such as sorghum and millet was due to: The cereal was regarded as inferior when compared to maize with very minimal usage. It is promoted as special projects by the Ministry

Table 6. Households with different Metric Tonnes of Root crops harvested per hectare before and after implementation of agricultural development initiatives in Kilifi County (n=150).

Root crops grown	Period	% of H/H with ≥10MT/*ha*	% of H/H with 5-7MT/*ha*	% of H/H with 2-4 MT/*ha*	% of H/H ≤1MT/*ha*
Cassava	Before	6.6	6.0	33.7	53.7
	After	0.0	26.7	18.6	51.2
S/potatoes	Before	8.3	0.0	10.0	81.3
	After	0.0	10.0	10.3	82.7

Source: Survey Data, 2014.

of Agriculture and development partners. According to the data collected by Ministry of Agriculture (2010), yield of sorghum per hectare is 6.09 bags and its increase is based on increased acreage. The increased acreage is attributed to increased area dedicated to the crop as a drought resistant and a primary poverty eradication vehicle by projects implemented to promote it in the marginal agricultural areas of Eastern, Nyanza and Coastal regions of Kenya. Millet receives minimal support from the government since it was not a popular cereal among households with very low demand in the local market (Mukarumbwa and Mushunje, 2010). Food Agriculture Organization (FAO) (1995, as cited in Rivera *et al*., 2009), noted that unstable supplies and relatively low demand of sorghum products contributed to its low acreage consequently low emphasis for its production. Table 6 shows the percentages of households in different categories based on the number of MT harvested per hectare for commonly grown root crops prior to and after the NAEP reform in the two study areas.

The production of cassava increased resulting in percentage of household that had production of 5-7 metric tonnes increase and a decline in percentage of those who had 10 or more metric tonnes, 2-4 metric tonnes per hectare and without. While percentage of households with 5-7, 2-4 metric tonnes per hectare of sweet potato production and without increased and declined in those with 8 or more metric tonnes. According to data collected from focus group discussion, the root crops that were promoted by the development initiatives were for ready market. The improved varieties like the orange flesh that was promoted attained its maturity early and at the same time. This implied that the crop had to be harvested immediately to avoid deterioration. As a result, those varieties that were not supportive of the cultural practice of piece meal harvesting that was traditionally common in the community ended up losing its value as a food security crop in household. It was also observed that the promotion of ready for market sweet potatoes and cassava crops resulted in their glut in the market. Lack of market may affect the productivity of a particular crop especially if it is not preserved for future use.

To ascertain any significant differences between the level of households' root crops production per hectare before and after the implementation of the development initiatives, a paired sample t-test was performed at significance level of 0.05 on the hypothesis that "*The implementation of the development initiatives did not significantly improve the small-scale farmers' household root crops production in Kilifi County".* The results are summarised in (Table 7). The results as shown in (Table 7) indicate that:

(1) The *t*-values for the two tailed significance levels of the difference between sample means for the response was 0.004 which was less than 0.025 The results indicate that there was statistically significant differences at $P \leq 0.025$ observed in the percentage of households that had different categories of root crop metric tonnes per hectare due to its improved production resulting from the implementation of agricultural development initiatives vis. NAEP, Strategies for Revitalizing agriculture (SRA), KAPAP, NAAIAP and NASEP.

(2) The *t*-values for the two tailed significance levels of the difference between sample means for the response was 0.051 which was greater than 0.025. The results indicate that there was no statistically significant difference at $P \leq 0.025$ observed in the percentage of households that had different categories of cassava metric tonnes per hectare due to its improved production resulting from the implementation of agricultural development initiatives vis. NAEP, Strategies for Revitalizing agriculture (SRA), KAPAP, NAAIAP and NASEP.

(3) The *t*-values for the two tailed significance levels of the difference between sample means for the response was 0.016 which was less than 0.025. The results indicate that there was statistically significant difference at $P \leq 0.025$ observed in the percentage of households that had different categories of sweet potato metric tonnes per hectare due to it improved production resulting from the implementation of agricultural development initiatives vis. NAEP, Strategies for Revitalizing agriculture (SRA), KAPAP, NAAIAP and NASEP.

The means for two thirds of the items used to measure the effect of agricultural development initiatives on small-scale farmers' household root crop production per hectare when both end of the distributions were added together showed that there was statistically significant differences at $\alpha = 0.05$. The null hypothesis was therefore

Table 7. Paired sample statistics t test on percentage of households with different metric tonnes of root crops harvested per hectare in Kilifi County(n=150).

Effect of the implemented development initiatives	Development initiatives implementation	Mean	*t*-test	df	Sig (2-tailed)
		Mean			
If the production of root crops was better before or after implementation of development initiatives vis. NAEP, SRA-Strategies for Revitalizing Agriculture, 'Nja maarufuku Kenya', KAPAP, NAAIAP, NASEP	before	1.90	0.67	4.000	149	0.004
	after	1.80				
If the production of cassava was better before or after implementation of development initiatives vis. NAEP, SRA -Strategies for Revitalizing Agriculture, KAPAP, NAAIAP, NASEP	before	1.63	0.36	2.060	149	0.051
	after	1.33				
If the production of sweet potatoes was better before or after implementation of development initiatives vis. NAEP, SRA-Strategies for Revitalizing Agriculture, KAPAP, NASEP	before	1.38	0.13	2.433	149	0.016
	after	1.25				

Note: p≤ 0.025

Table 8. Households with different number of Livestock for Various types before and after the implementation of development initiatives in Kilifi County (n=150).

Food crops grown	Period	% of H/H with ≥8	% of H/H with 5-7	% of H/H with 2-4	% of H/H ≤*1*
Cattle	Before	9.0	7.7	12.3	71.0
	After	6.6	9.0	10.7	73.7
Poultry	Before	28.6	24.0	22.4	35.0
	After	29.0	28.3	19.7	23.0
Goats	Before	6.6	6.0	23.7	63.7
	After	6.4	16.0	18.3	59.3
Sheep	Before	0.0	2.4	10.3	87.3
	After	0.0	3.0	10.7	86.3
Others (pigs, guinea fowl)	Before	0.0	0.0	0.3	99.7
	After	0.0	18.0	10.0	72.0

Source: Survey Data, 2014.

rejected. The statistically significant difference in percentage of households in different categories of root crops production was attributed to promotion of cassava and sweet potato variety meant for ready market. The crops attracted the male members of the family into growing them consequently increased the percentage of households engaged in their production. The statistically insignificant difference in cassava production could be attributed to the decline in production caused by implementation of projects that promoted cassava variety that could not be cooked or chewed in its fresh form. According to data collected in group discussion and individual farmers, the cassava had high cyanide content and could not be easily identified by children especially during times of scarcity consequently caused fear that hindered farmers from growing it.

Livestock production

Table 8 shows the average households that kept various livestock production in Kilifi County prior to and after NAEP reform implementation. The results in (Table 8) show that the percentage of households that engaged in production of various livestock before and after the implementation of development initiatives was generally below 50% except for poultry production which was over 60%. Observation in the field showed that most households kept an average of one cow, less than three goats or sheep mainly for security purposes. Poultry served immediate need that may have required special attention in terms of food.

Observation made in the field showed that most the initiatives did not have a specific component on addressing cattle (dairy and beef) production and this contributed to the inadequate implementation of livestock projects among farmers. Further observation showed that introduction of cost sharing of veterinary services and failure to implement livestock projects may have resulted to households keeping either none or few livestock consequently inadequate or lack of dairy product in most

Table 9. Paired Sample Statistics t test on Percentage of Households with different number of Livestock for Various types before and after the implementation of development initiatives in Kilifi County (n=150).

Effect of the implemented development initiatives	Implementation of Development initiatives	Mean	Mean	*t*-test	df	Sig (2-tailed)
If livestock production was better before or after implementation of development initiatives vis. NAEP, SRA-Strategies for Revitalizing Agriculture-'Nja Marufuku Kenya', KAPAP, NASEP	before	1.37	-0.01	-0.242	149	0.809
	after	1.39				
If cattle production was better before or after implementation of development initiatives vis. NAEP, SRA-Strategies for Revitalizing Agriculture, KAPAP, NASEP	before	1.56	0.36	2.060	149	0.061
	after	1.33				
If Poultry production was better before or after implementation of development initiatives vis. NAEP, SRA-Strategies for Revitalizing Agriculture-'Nja Marufuku Kenya', KAPAP, NASEP.	before	1.55	-0.37	8.010	149	0.000
	after	1.18				
If goat production was better before or after implementation of development initiatives vis. NAEP, SRA-Strategies for Revitalizing Agriculture-'Nja Marufuku Kenya', KAPAP, NASEP.	before	1.67	0.67	4.000	149	0.004
	after	1.00				
. If sheep production was better before or after implementation of development initiatives vis. NAEP, SRA-Strategies for Revitalizing Agriculture-'Nja Marufuku Kenya', KAPAP, NASEP.	before	1.48	-	-	149	-
	after	1.48				
If the production of Others (pigs, guinea fowl) was better before or after implementation of development initiatives vis. NAEP, SRA-Strategies for Revitalizing Agriculture -'Nja Marufuku Kenya', KAPAP, NASEP	before	1.38	0.13	2.433	149	0.016
	after	1.25				

Note: p≤ 0.025

households. These finding agreed with those of World Bank (WB) (2007) who found that insufficient livestock as direct and indirect source of food was due to inadequate funding of the livestock sector in developing countries. WB (2007) noted that only four percent of loans given to agriculture and rural development sector were for livestock projects.

The results as shown in (Table 9) indicate that:

(1) The *t*-values for the two tailed significance levels of the difference between sample means for the response was 0.809 which was greater than 0.025 The results indicate that there was no statistically significant differences at P ≤ 0.025 observed in the percentage of households that had different categories of livestock production improved as a result of the implementation of agricultural development initiatives vis. NAEP, Strategies for Revitalizing agriculture (SRA)-'Nja Maarufuku Kenya', KAPAP, and NASEP.

(2) The *t*-values for the two tailed significance levels of the difference between sample means for the response was 0.061 which was greater than 0.025. The results indicate that there was no statistically significant difference at P ≤ 0.025 observed in the percentage of households that had different categories of cattle production improved as a result of the implementation of agricultural development initiatives vis. NAEP, Strategies for Revitalizing agriculture (SRA)-'Nja Maarufuku Kenya', KAPAP, and NASEP.

To ascertain any significant differences between the level of households' livestock production before and after the implementation of the development initiatives, a paired sample t-test was performed at significance level of 0.05 on the hypothesis that "*The implementation of the development initiatives did not significantly improve the small-scale farmers' household livestock production in Kilifi County".* The results are summarised in (Table 9).

(3) The *t*-values for the two tailed significance levels of the difference between sample means for the response was 0.000 which was less than 0.025. The results indicate that there was statistically significant difference at P ≤ 0.025 observed in the percentage of households that had different categories of poultry production improved as a result of the implementation of agricultural development initiatives vis. NAEP, Strategies for Revitalizing agriculture (SRA)-'Nja Maarufuku Kenya', KAPAP, and NASEP.

(4) The *t*-values for the two tailed significance levels of the difference between sample means for the response was 0.004 which was less than 0.025. The results indicate that there was statistically significant difference at P ≤ 0.025 observed in the percentage of households that had different categories of goat production improved as a result of the implementation of agricultural development initiatives vis. NAEP, Strategies for Revitalizing agriculture (SRA)-'Nja Maarufuku Kenya', KAPAP, and NASEP.

(5) The *t*-values for the two tailed significance levels of the difference between sample means for the response

Table 10. Households' Food Crop Sufficiency in Kilifi County (n=150.

Food crops grown	Period	H/H % with surplus for market	H/H % with adequate food for 3 months	H/H % with inadequate for 3 months	H/H % without food crop
Maize	Before	7.7	40.0	52.3	0.0
	After	20.7	6.7	72.6	0.0
Sorghum	Before	0.0	4.6	22.4	73.0
	After	0.0	3.7	10.7	85.3
Cassava	Before	6.0	6.6	33.7	53.7
	After	26.7	0.0	18.6	54.7
Legumes	Before	1.0	10.3	7.4	81.3
	After	6.0	4.3	9.0	80.7
S/potatoes	Before	0.0	8.3	10.0	81.7
	After	9.0	0.0	10.3	80.7
Others	Before	30.2	15.0	20.1	34.7
	After	10.7	12.3	52.3	24.7

Source: Survey Data, 2014.

was 0.016 which was less than 0.025. The results indicate that there was statistically significant difference at P ≤ 0.025 observed in the percentage of households that had different categories of other types of livestock (pigs, guinea fowl) production improved as a result of the implementation of agricultural development initiatives vis. NAEP, Strategies for Revitalizing agriculture (SRA)-'Nja Maarufuku Kenya', KAPAP, and NASEP.

1) There was no evidence to show significant change since there were no household figures for the difference in both means that had different categories for sheep production before and after the implementation of agricultural development initiatives.

Except for the statement; 'If livestock production was better before or after implementation of development initiatives and 'If cattle production was better before or after implementation of development initiatives vis. NAEP, SRA-Strategies for Revitalizing Agriculture, KAPAP and NASEP' which had significance level of greater than 0.05, the rest had p values less than 0.025. The differences for most of the statements were therefore statistically significant at two tailed significant level of 0.025. The null hypothesis was therefore rejected as there was statistically significant difference in 80% of the statements that were used to measure the effect of agricultural development initiatives on small-scale farmers' household livestock production. However, the statistically significant difference in percentage of households with different categories of livestock production is attributed to the implementation of livestock projects and programmes whose objective was more biased on promoting emerging livestock and goat rearing than on cattle production. The observed negative statistically significant difference in livestock production by farmers could be attributed to low level of education among farmers as observed in (Table 1). The low level of education makes farmers become unable to access more information from literature distributed in form of pamphlets.

Households' agricultural food crop sufficiency

Table 10 shows the averages of households in various categories of commonly utilized food crop sufficiency in Kilifi County prior and five years after implementation of programmes, projects and policy reforms aimed at increasing agricultural productivity at household level. Results in Table 10 show that after the implementation of the programmes, projects and policy reform, all the households experienced an increase in the surplus for the market in various types of food crops except for sorghum. The increase was more than 5% except for maize and cassava, which increased by more than two (20.7%) and three (26.7%) folds respectively. The percentage of households with enough for three months declined to below 10%. Except for households with sorghum and cassava, the percentage of households with inadequate maize, legume and other crops increased. Households' with inadequacy of sweet potato sufficiency remained more less the same. Except for maize which all households did not lack, the percentage of households without various food crops increased by 30% to 85%.

To ascertain any significant differences between the households' commonly utilized food crop sufficiency before and after the implementation of the development initiatives, a paired sample t-test was performed at significance level of 0.05 on the hypothesis that "*The implementation of the development initiatives did not significantly improve the small-scale farmers' household food crop sufficiency in Kilifi County".* The results are summarised in (Table 11).

(1) The *t*-values for the two tailed significance levels of the difference between sample means for the response was 0.653 which was greater than 0.025 The results indicate that there was no statistically significant differences at P ≤ 0.025 observed in the percentage of small-scale farmers' households that was sufficient in

Table 11. Paired Sample Statistics t test on Households' Food Crop Sufficiency in Kilifi County (n=150).

Effect of the agricultural development initiatives on households' food crop sufficiency	Implementation of Development initiatives	Mean	Sig	Mean	*t*-test	df	Sig (2-tailed)
If households' food crop sufficiency was better before or after implementation of agricultural development initiatives	before	1.67	-	-	-	-	-
	after	1.67					
If households' maize crop sufficiency was better before or after implementation of agricultural development initiatives	before	1.80	0.212	-0.13	-0.459	149	0.653
	after	1.93					
If households' sorghum crop sufficiency was better before or after implementation of agricultural development initiatives	before	2.20	-	-	-	-	-
	after	2.20					
If households' root crop sufficiency was better before or after implementation of agricultural development initiatives	before	1.89	0.000	0.11	1.000	149	0.347
	after	1.78					
If households' legumes sufficiency was better before or after implementation of agricultural development initiatives	before	1.38	0.0125	0.13	2.010	149	0.083
	after	1.25					

Note: p≤ 0.025

maize crop as a result of the implementation of agricultural development initiatives.

(2) The *t*-values for the two tailed significance levels of the difference between sample means for the response was 0.347 which was greater than 0.025. The results indicate that there was no statistically significant difference at P ≤ 0.025 observed in the percentage of small-scale farmers' households that was sufficient in root crops as a result of the implementation of agricultural development initiatives.
(3) The *t*-values for the two tailed significance levels of the difference between sample means for the response was 0.083 which was less than 0.025. The results indicate that there was no statistically significant difference at P ≤ 0.025 observed in the percentage of small-scale farmers' households that was sufficient in legumes as a result of the implementation of agricultural development initiatives
(4) There was no evidence to show significant change since there were no household figures for the sufficiency in general food crop and sorghum as a result of the implementation of agricultural development initiatives.

The differences for most of the statements were not statistically significant at two tailed significant level of 0.025. The null hypothesis was therefore not rejected as there was no statistically significant difference in all the statements that were used to measure the effect of agricultural development initiatives on small-scale farmers' household food sufficiency. Observation made during farmers' FGD indicated that sorghum and millet crops were not a common food crop at household level due to inadequate knowledge on its preparation or utilize. It was also observed that some maize varieties that were implemented by projects initiated by SRA to improve its production were susceptible to weevil attack resulting in heavy post harvest losses especially when stored for a reasonable period of over three months. While the sweet potato and cassava varieties bred for early maturing and ready market and the later being resistant to cassava mosaic virus could not remain in the field long after attaining physiological maturity to allow piece meal harvesting, a common traditional practice among most small-scale farmers. One of the cassava varieties bred for resistance had higher cyanogenic glucosides, which could lead to chronic toxicity when processed wrongly and when taken in its fresh form. This made it to be unpopular in most households. To avoid post harvest losses caused by weevil attack and lack of processing, the crops were either disposed soon after harvest by selling, as gifts to relatives or avoiding its production.

The study findings agreed with those of Veteto and Skarbo, (2009) who found that availability of various food crops in households is influenced by farmer's selection of crop varieties they may wish to grow and its purposes in terms of uses at household and marketability. Veteto and Skarbo, (2009) observed that availability may be influenced by the processing, storability and perceived risk of the crop or yield instability. Onyango *et al.* (2010) in their study found that for food security to be attained, researchers and agricultural development practitioners need to identify how farmers form opinions on technologies introduced for crop improvement. A study carried out by Dube and Sigauke, (2015) found that most families shunned new sorghum variety introduced in demonstrations plot due to its unpalatable and a traditional food that is considered ancient with no place in

Table 12. Households Sufficiency in Livestock and Dairy Produce in Kilifi County (n=150).

Livestock and Dairy produce	Period	H/H % with adequate	H/H% with Surplus	H/H % with Inadequate	H/H % without
Livestock (Cattle,	Before	7.3	6.3	27.4	59.0
Shoats, Poultry)	After	8.3	4.0	21.3	66.4
Dairy produce	Before	10.5	16.0	38.2	44.9
(Milk, Eggs)	After	11.5	8.0	33.3	47.2
Others	Before	2.6	0.0	0.3	97.1
	After	2.3	9.7	18.0	70.0

Source: Survey Data, 2014.

modern society. According to Nazerea, (1995, cited in Nazarea *et al.,* 2013) and Immink and Alarcón (1992, as cited in Carr, 2005), insufficient food at house hold level has been due to the displacement of many native varieties by the modern cultivars of the green revolution, the so called miracle or high yielding varieties of the crops integrated into markets and by cash crops. The more recent cause of loss of traditional varieties which is due to the contamination of native crops with genes from genetically modified organisms that have been introduced to improve agriculture and food security has also attributed to food crop insufficiency (Scurrah *et al.,* 2008 and Chandler and Dunwell, 2008 cited in Nazarea *et al*., 2013).

The implications of the findings indicate that food crop sufficiency at household level may be influenced by various factors attributed to the agricultural development initiatives implemented to improve food crop productivity. This includes initiatives for increasing productivity per acre such as Strategies for Revitalization of Agriculture and Kenya Agricultural Productivity whose objectives were to transform smallholder agricultural production and marketing systems for increased productivity and incomes in the project areas.

Households' sufficiency in livestock and dairy produce

Table 7 shows the averages of households with livestock and dairy products that small-scale farmers produced in terms of adequate, in surplus or inadequate, or not available before and five years after implementation of agricultural production initiatives. The results in Table 12 shows that before and after the implementation of the initiatives, more than half (59.0% and 66.4% respectively) of households did not have livestock for use either directly or indirectly as a source of food. More than 40% of households did not have dairy produce such as milk and the percentage increased (47.2%) after the implementation of the development initiatives. Over 20% of the household were in the bracket of inadequate livestock and dairy produce. Majority of households did not have other types of livestock. It was observed that most of households with livestock kept poultry and the number ranged between one to two animals.

To ascertain any significant differences between the households' livestock and dairy produce sufficiency before and after the implementation of the development initiatives, a paired sample t-test was performed at significance level of 0.05 on the hypothesis that "*The implementation of the development initiatives did not significantly improve the small-scale farmers' household livestock and dairy produce sufficiency in Kilifi County".* The results are summarised in (Table 13). The results as shown in Table 13 indicate that:

1) The *t*-values for the two tailed significance levels of the difference between sample means for the response was 0.009 which was less than 0.025 The results indicate that there was statistically significant differences at $P \leq 0.025$ observed in the percentage of small-scale farmers' households that was sufficient in livestock produce as a result of the implementation of agricultural development initiatives.
2) The *t*-values for the two tailed significance levels of the difference between sample means for the response was 0.053 which was greater than 0.025. The results indicate that there was no statistically significant difference at $P \leq 0.025$ observed in the percentage of small-scale farmers' households that was sufficient in dairy produce as a result of the implementation of agricultural development initiatives.
3) The *t*-values for the two tailed significance levels of the difference between sample means for the response was 0.006 which was less than 0.025. The results indicate that there was statistically significant difference at $P \leq 0.025$ observed in the percentage of small-scale farmers' households that was sufficient in other types of livestock produce as a result of the implementation of agricultural development initiatives.

The means for two out of three items used to measure the effect of agricultural development initiatives on small-scale farmers' household livestock and dairy sufficiency when both end of the distributions were added together showed that there was statistically significant differences at $\alpha = 0.05$. The null hypothesis was therefore rejected. The observed negative means of sufficiency in livestock and dairy produce indicates that mean after the implementation of the development initiative was higher than before, implying that although the change was

Table 13. Paired sample statistics t test on households sufficiency in livestock and dairy produce in Kilifi County (n=150).

Effect of the agricultural development initiatives on households' food crop sufficiency	Implementation of Development initiatives	Mean	Mean	*t*-test	df	Sig (2-tailed)
If households' livestock produce sufficiency was better before or after implementation of agricultural development initiatives	before	1.79	-0.13	.093	149	0.009
	after	1.85				
If households' dairy sufficiency was better before or after implementation of agricultural development initiatives	before	1.80	-0.15	-0.469	149	0.053
	after	1.93				
If households' other types of livestock produce was better before or after implementation of agricultural development initiatives	before	1.27	-0.13	.090	149	0.006

statistically significant, as a result of the implementation of agricultural development initiatives it was negative change resulting from a decline in sufficiency especially in households with adequate to more households with inadequate. Information gathered during FGD on why the number of livestock kept by individual households ranged between one to two livestock at the most. Due to insecurity, harsh climatic conditions and lack of funds to meet the cost of feeds and veterinary services, most of the projects (pilot) and programmes implemented in the field placed less emphasis on livestock production.

Conclusion and recommendation

The overall increase in households' agricultural food production due to implementation of development initiatives whose objectives were to promote their productivity was statistically significant. The increase was observed in most of the produce except for small seeded cereals (sorghum and millet), cassava and dairy produce that were statistically insignificant. Percentage of households engaged in sorghum production declined while millet was not grown at all. However, the increase in productivity in these households did not translate to household food sufficiency. Several factors attributed to the continued food insufficiency:

(1). The highest percentage (64%) of farmers utilized less than two hectares of land with vast hectares of land left under fallow and majority (62.1%) kept none or very low number of livestock despite the large acreage of individual land ownership and most of household members being in the active age bracket with formal education which gives the individual ability to interact and engage in negotiations amongst farmers and outsiders who introduce interventions and development initiatives to the farming community.

(2). More emphasis was placed on maize productivity by projects and programmes implemented to improve food production due to being subsistence and commercial crop and a staple food in over 90% of the households. Its productivity remained inadequate due to poor yields caused by the harsh ecological characteristics. Drought resistant crops such as sorghum, cowpeas, pigeon peas and cassava received minimal support from the government and development partners.

(3).The characteristics of the improved food crop varieties that were promoted by implemented projects such Farmer Field Schools, Strategies for Revitalizing Agriculture-Njaa Marufuku and KAPAP had characteristics that could not serve the purpose of addressing food security. The improved maize varieties were very susceptible to weevil infestation making households to dispose it soon after harvesting to avoid post harvest losses. The early maturing and ready for market orange flesh sweet potato and cassava grown as cash crops attracted the male members of the household to engage in its production. The increase in yields with inability to preserve the root crops resulted in their glut in the local market consequently lost their value as household security crops traditionally known to last long in the field long after attaining their physiological maturity and in the process allowed for piece meal harvesting especially during the period of scarcity. Some of the improved cassava variety bred for resistance to cassava mosaic virus could not be cooked or chewed in its fresh form. The cassava variety had higher cyanogenic glucosides which could lead to chronic toxicity when processed wrongly and when taken in its fresh form and this caused fear that hindered some farmers from growing it since it could easily cause harm if harvested especially during times of scarcity.

(4).Small-scale farmers were not zealous on livestock keeping as an important practice in contributing to household food security, especially in times of crop failure and an income generating enterprise. Most households kept a low number of livestock due to the less emphasis placed on the livestock production projects and inadequate government and development projects support to farmers. Most of the initiatives did not have a specific component on addressing cattle (dairy and beef)

production. Also the inability to afford the cost sharing of veterinary and demand driven approach mode of extension services may have resulted to households keeping either none or few livestock consequently inadequate or lack of dairy product in most households.

A policy should be developed and implemented to ensure that the government and development partners engaged in implementation of development initiatives such as reforms, programmes and projects whose objective is to increase agricultural food production, carry out a situation analysis prior to promotion of crop varieties and types of livestock whose ecological requirements for their performance is supported by the local ecological characteristics. This will allow for the crops and livestock to perform well based on the prevailing weather conditions. A policy implementation framework should be developed to ensure that new programmes and projects that are implemented should promote crop varieties that are suitable for the market and at the same time have qualities for long shelf life, resistant to weevil attack, last longer in the field long after attaining its physiological maturity to allow for piece meal harvesting. This will play a crucial role in serving both as household food security crops and as cash crop with no fear of physiological deterioration. A policy frame for implementation of agricultural development initiatives should be developed to provide guidelines on funding of livestock production projects and programmes by the Kenya Government to ensure provision of regular services to farmers. This will enable farmers who engage in the production of livestock to access veterinary services and ensure they are cushioned against losses.

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