FARMER PARTICIPATION IN PROJECT EXECUTION AND SUSTAINABILITY OF SMALLHOLDER IRRIGATION SCHEMES IN BUSIA COUNTY, KENYA

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ABSTRACT

In Kenya sustainability of smallholder irrigation schemes is low and hence the need to examine the extent to which farmer participation in project execution influence sustainability of smallholder irrigation schemes in Busia County, Kenya. If this is determined and addressed then plans to achieve 300,000ha of land under irrigation by 2030 may succeed. The purpose of the study was to determine the extent to which farmer participation in project execution influence sustainability of smallholder irrigation schemes in Busia County, Kenya. This study is grounded in citizen empowerment theory and guided by pragmatism paradigm. The study adopted descriptive cross sectional survey research design and correlation research design. A sample of 300 was selected using Cochran's formulae from 1,371 farmers spread out in 8 smallholder irrigation schemes and 14 project staff using censors approach to arrive at a sample size of 314. Quantitative data was collected using questionnaires and analyzed descriptively and inferentially while qualitative data was gathered using interview guide, observation schedule and documents analysis using patterns features and themes. Descriptive analyses such as arithmetic means and standard deviations and inferential statistics such as Pearson's Product Moment Correlation (r) and regression analysis (R^2) were used. *F*-test was used to test hypotheses that farmer participation in project implementation does not have significant influence on sustainability of smallholder irrigation schemes. Analysis showed that r = 0.431, F (1,272) = 62.01, R^2 = 0.1857 at p = 0.01 < 0.05, H_0 was rejected and it was concluded that farmer participation in project implementation has significant influence on sustainability of smallholder irrigation schemes. Analysis also showed that r = 0.666, F (1,272) = 204.53, R^2 = 0.4438 at p =0.01 < 0.05, H_0 was rejected and it was concluded that farmer participation in project control has significant influence on sustainability of smallholder irrigation schemes. Therefore in order to create project ownership, it is recommended that farmers be encouraged to contribute their resources at 90:10 government to farmer recommended contribution ratio. It is recommended TNA forms the basis for capacity development and that the 7 manuals used for farmer training be revised into 4 modules to that conform to the project management phases.

Keywords: Farmer participation, Project execution, Project implementation, Project control, Sustainability of irrigation schemes.

INTRODUCTION

Before the late 1970s, the state and development partners delivered initiatives through top down methods; an approach that contributed to low sustainability of community projects. Based on these outcomes, Kurt and Warren (1989) observed that this failure resulted in massive shift in interest from the externally imposed expert-oriented project execution to introduction of participatory approaches (Elaine and Sundeep, 2007). This shift was testimony that sustainability of community projects relied on how project execution was undertaken. This shift was based on the idea that community projects are people centered and

not process oriented as (Kurt and Warren, 1989) argued that such unsuccessful initiatives were as a resulted of limited beneficiary participation in project execution. This means that projects become unsustainable due to limited beneficiary involvement.

Ministry of Water and Irrigation, (2013) observed that participatory approaches enhance farmer participation in project execution. International Water Management Institute (2004); Afzal and Barbhuiya (2011) reported increase in area of land put under irrigation in smallholder irrigation schemes in Bangladesh, China, India, Indonesia, Pakistan and Vietnam which jointly account for over 51 percent of irrigated land in the whole world. Similarly, in Latin America and the Philippines, National Irrigation Administration Consultancy (1993); Sam-Amoa and Gowing (2001); Salas and Wilson (2004); Svendsen and Huppert (2003) reported better irrigation systems management while (Ghos and Kumar, 2012) observed that successful transfer of management responsibilities from government agencies to smallholder irrigation farmers in Ghana led to higher crop yields. These studies therefore empirically demonstrated that farmer participation in execution of smallholder irrigation projects influence sustainability of smallholder irrigation schemes.

In Zimbabwe, Chifamba, Nyanga, and Gukurume (2013) similarly observed that farmer participation was an avenue for addressing irrigation management related challenges. Wotie and Hanaraj (2013) in Ethiopia acknowledged that farmer participation in project execution was a means through which sustainability of smallholder irrigation schemes was realized. In Kenya however, despite extensive use of these approaches sustainability of smallholder irrigation schemes still remains low. Ministry of Water and Irrigation, (2012) reported that out of a total national irrigation potential of 1,341,900 ha, only 161,840 ha or 12% of land was achieved while the remaining 88% of the potential was not exploited. Out of the irrigated potential, 57,760 ha (or 35.7%) was achieved by 2 million smallholder farmers in 3,600 irrigation schemes. This implies that a large proportion of irrigation potential in Kenya is not exploited due to farmer participation in project execution among other reasons.

Similarly, part of Lake Victoria catchment area within Kenya a potential of 200,000 hectare out of which only 11,600 hectare or 5.75% has been exploited by smallholder irrigation schemes (MWI, 2012). Busia County, Kenya which lies within this catchment area has an irrigation potential of 15,600ha out of which only 904ha or 5.8% is exploited (Ministry of Water and Irrigation, 2016). This shows that despite farmer participation in project execution, a large proportion of smallholder irrigation schemes in Kenya and Busia County in particular remain unexploited resulting in low sustainability. Although the Ministry of Planning and National Development, (2007); Ghosh and Kumar (2012) recognize that farmer participation in project execution influence sustainability of smallholder irrigation schemes, the extent of this influence in Kenya. If this knowledge gap is established it may contribute to the development of appropriate strategies for increasing area of land put under irrigation. It is for that reason that the extent to which farmer participation in project execution influence sustainability of smallholder irrigation schemes in Busia County, Kenya needed to be established.

Research objectives

The study aimed to achieve the following research objectives:

i. To assess the extent to which farmer participation in project implementation influence sustainability of smallholder irrigation schemes in Busia County, Kenya.

ii. To examine the extent to which farmer participation in project control influence sustainability of smallholder irrigation schemes in Busia County, Kenya.

Research Hypotheses

The study tested the following hypotheses:

i. **H_1**: Farmer participation in project implementation has a significant influence on sustainability of smallholder irrigation schemes.
ii. **H_1**: Farmer participation in project control has a significant influence on sustainability of smallholder irrigation schemes.

LITERATURE REVIEW

Theoretical and empirical literature related to the study was reviewed based on the concept of farmer participation in project execution and sustainability of smallholder irrigation schemes. The concepts execute means to carry out something. Hornby, (2010) visualized *execute* to imply to put into effect or launch something. In this study, project execution refers to both project implementation and its subsequent control upon completion. The study therefore investigated how farmer participation in project implementation and how farmer participation in project control has influence on sustainability of smallholder irrigation schemes in Busia County Kenya.

Sustainability of smallholder irrigation schemes

The concept *'sustainability'* is defined variously by different organizations. The World Commission on Environment and Sustainable Development (1987) defined sustainability as development which meets the needs of the present without compromising the ability of future generations to meet their own needs. Nowak, Stein, Randler, Greenfield, Comas, Carr, and Alig (2010) conceptualized it as a social and environmental practice that protects and enhances human and natural resources needed by future generations to enjoy the quality of life equal to or greater than that of the present generation. Rotary International (2014) similarly defined sustainability as the provision of long-term solutions to community needs that project beneficiaries can maintain long after external funding is over. Based on these conceptual thoughts, irrigation schemes are sustainable when farmers create sense of ownership due to increased area under irrigation (MWI, 2003). In this study, sustainability of smallholder irrigation scheme was depended variable that refers to farmers' willingness to pay for irrigation water, increase in area under irrigation and sense of project ownership.

Participation in project implementation and sustainability of smallholder irrigation schemes

Farmer participation in project implementation entails joint mobilization of resources and incorporation of farmers' lay expertise in transforming project inputs into tangible outputs and outcomes. MWRMD, (2003) stated that farmer participation in project implementation anticipates their contribution in labor, locally available construction materials and supervision of the implementation activities. Based on this understanding, Adeniji, (2011) investigated smallholder irrigation farmers in three schemes in Adamawa, Nigeria to determine the influence labor contributions on sustainability. He used cross-sectional survey design and a sample of 150 to establish that farmers' labor contribution during project implementation did not influence their willingness to pay for irrigation water upon project completion. This means that there is no evidence to link farmers' labor contributions at implementation phase and their willingness to pay for water in the irrigation scheme upon project completion.

Koopman *et al* (2001) however disagreed when studying four irrigation projects using case study in Iringa and Mbeya regions of Tanzania to determine influence of farmer participation in project implementation where top-down and bottom-up approaches were used. In their study they demonstrated that farmers' willingness to pay for water increased by 45% in projects where bottom up approaches were adopted compared to the projects where top down approaches were adopted. In projects where top down approaches were used, farmers didn't contribute as much labor and therefore were not willing to pay for irrigation water. Marks, Komives and Davis (2014) similarly established that farmers developed sense of ownership only if they participated in project implementation process. This means that when farmers contribute their own labor they develop sense of ownership whereas if they don't contribute then they scarcely feel any obligation leading to less water use.

Another indicator of farmer participation at project implementation phase is their role in supervision of implementation activities. In a study by Marks, Komives and Davis (2014) it was established that farmer involvement in supervision of implementation activities had influence on area of land put under irrigation. Wandera, Naku and Afrane (2013) similarly demonstrated that farmer participation in supervision at project implementation phase led to higher sense of ownership when 22% of respondents in Ejisu irrigation scheme expressed sense of ownership compared to 78% who did not participate while in Asotwe scheme 78.8% did not participate in the supervision activities against 21.2% who did. Marks and Davis (2012) similarly concurred with this finding. While, Marks and Davis (2012) used cross-sectional design, Wandera, Naku and Afrane (2013); Marks, Komives and Davis (2014) adopted descriptive survey design yet their findings are similar. This means that when farmers supervise the project implementation activities they develop sense of ownership as opposed to when they do not participate. In the literature reviewed, however, the extent to which farmer participation in supervision influence sustainability of smallholder irrigation schemes is not known. The unavailability of this information was a knowledge gap that required further interrogation. This study used descriptive cross sectional survey research design and correlation research design to determine the extent to which farmer participation in supervision at project implementation phase influence sustainability of smallholder irrigation schemes.

Similarly, farmers' contribution of locally available construction materials is known to influence sustainability. In their study, Koopman *et* al (2001) used case study and established that farmers' contributions in locally available construction materials during project implementation has influence on area of land put under irrigation by 33%. Marks and Davis, (2012) concurred when they too showed that farmers who contributed construction materials during project implementation experienced sense of ownership compared to those who did not. Komives and Davis (2014) also established that when farmers contribute construction materials they expressed sense of ownership but only if they also participated in implementation work. This means that contribution of locally available construction materials has influence on sustainability of smallholder irrigation schemes. In the literature reviewed, Koopman *et al* (2001) used case study design, while Marks and Davis, (2012); Komives and Davis (2014) used descriptive survey design yet their findings showed similar results. Despite this influence however, the extent to which labour contributions influence sustainability was not established. The unavailability of this information is a knowledge gap that required further investigations. This study used descriptive cross sectional survey research design and correlation research design to determine the extent to which farmers' contribution of locally available construction materials influence sustainability of smallholder irrigation schemes.

Farmer participation in project control and sustainability of smallholder irrigation schemes

Farmer participation in project control shifts management responsibilities of smallholder irrigation scheme from government or donor agencies to WUAs by empowering farmers to manage irrigation water. Braimah, King and Sulemana (2014) stated that farmer participation in irrigation project control is a user-centered approach to the general management of irrigation scheme while (Vermillion, 1997) argued that it is evidenced WUA capacity to manage irrigation scheme. WUA mandate is farmers' ability to effectively manage the irrigation scheme with little or no external assistance. MWRMD, (2003) opined that this mandate is acquired when WUA strengthens and maintains its own ability to supervise water distribution and allocation. This means that farmer participation in project control is evidenced through capacity development of WUA to supervise water distribution, allocation, application and farmers' subsequent compliance with rules of water use.

While assessing performance of 17 irrigation schemes for sustainable policy reforms in Lower Oshun Basin Lagos State in Nigeria, Olubode-Awosola, Idowu and Van Schalkwyk (2007) sampled 137 respondents from a study population of 1800 using systematic sampling technique, descriptive survey design and established that 45% of farmers who participated in capacity development compared as to 21.7% non-participants increased their land under irrigation. Khwaja (2004) had earlier similarly observed that WUA mandate had influence on area of land put under irrigation. In another study, Finsterbusch and Warren (1989) established that farmers who participated in the project control were able to address water management related problems compared to those who did not participate. Wotie and Hanaraj (2013) also showed that inadequate capacity among project teams contributed to failure by WUAs to exercise their mandate effectively the result of which was low willingness to pay for water. From this discussion, it is apparent that WUA mandate has influence on sustainability of smallholder irrigation schemes while the lack of it influences sustainability negatively.

These findings however differ from what Muriungi (2015) found out when he showed that despite farmer participation in project control they still lacked skills supervise irrigation water distribution in irrigation schemes. This means that WUA mandate notwithstanding, sustainability is not guaranteed. Olubode-Awosola, Idowu and Van Schalkwyk (2007); Muriungi (2015) used descriptive survey design while(Khwaja, 2004; Wotie and Hanaraj, 2013) adopted case studies while (Finsterbusch and Warren,1989) used cross-sectional design yet their findings did not all agree. Likewise, in all these studies the extent to which WUA mandate influence sustainability was not known and therefore remained a knowledge gap. This study therefore used descriptive cross sectional survey research design and correlation research design to establish this knowledge gap by determining the extent of this influence.

In another study, Naik and Kalro (2000) investigated the oversight role of WUAs by comparing two sets of irrigation schemes namely; one set of two schemes with WUAs and another set of two schemes without WUAs in Mula and Bhima area in Maharashtra, India. In this study the researchers established that 75 percent of respondents in schemes with WUAs expressed willingness to pay for water by submitting to the WUA authority as compared to schemes irrigation schemes without WUAs in which farmers didn't feel compelled to pay for water. Acheampong and Venot (2011) while undertaking a study in Northern Ghana also established that 33% of farmers recognized the role of WUAs in water allocation, while 67% did not because they instead acknowledged the local traditional chiefs as the sources of authority in irrigation schemes. Beath, Christia and Enikopolov (2012) concurred when they

too showed that WUAs only recognized by water users when they relied on local traditional chiefs without whom farmers' willingness to pay for irrigation water was reduced. This means that supervision of water allocation by WUA is determined by its ability to exert its supervisory authority in the scheme by enforcing compliance.

In the reviewed literature, study findings on the role of WUAs vary. For instance, in their study Beath, Christia and Enikopolov (2012) used experimental design while their finding differ with (Naik and Kalro, 2000; Acheampong and Venot, 2011) who used descriptive survey design. Besides the differences, these studies did not establish the extent to which WUA's role in supervision of water allocation influence sustainability of smallholder irrigation schemes. The unavailability of this information was a gap that needed to be established. This study therefore used descriptive cross sectional survey research design and correlation research design in determining the extent to which supervision of water allocation by the WUA influence sustainability of smallholder irrigation schemes.

Similarly, compliance with rules of water use is the basis for equitable water distribution in irrigation schemes. Ndou (2012) used correlation design and descriptive survey design to evaluate the impact of NGOs and farmer involvement in participatory monitoring and evaluation of agricultural projects and showed that compliance with rules of water use creates sense of project ownership. This finding supports an earlier study in which Narayan (1993) investigated 121 rural projects in 49 countries across Africa, Asia and Latin America and established that 85% of respondents who complied with rules of water use expressed sense of project ownership compared to 11% who did not. In another study, De los Reyes and Jopillo (1985) further distinguished between farmer groups who participated and those who did not participate in project control in the National Irrigation Authority (NIA) initiated irrigation schemes in the Philippines by comparing two sets of schemes; those in which participatory monitoring and evaluation formed the basis for enforcing water use regulations by WUAs and those with external technically-oriented and imposed approaches in which the WUAs did not exist. In schemes where WUAs enforced water use rules, crop yields were higher by between 10-22%, had 15% more farmers willing to pay for water and 12% more of land put under irrigation compared to those schemes where compliance with water use regulations were externally imposed. These results show that in schemes where farmers themselves enforced rules of water use sustainability was higher compared to schemes where farmers did not participate in enforcing such rules at all.

Although Ndou (2012) used correlation design and descriptive survey design his finding is similar to what Narayan, (1993) established when he used case study and De los Reyes and Jopillo, (1985) who used field experiments. However despite showing that compliance with rules of water use influence indicators of sustainability, the researchers did not demonstrate the extent to which these indicators influence sustainability of smallholder irrigation schemes. The unavailability of this information is a knowledge gap that needed further studies. This study therefore used descriptive cross sectional survey research design and correlation research design to determine the extent to which compliance with rules of water use influence sustainability of smallholder irrigation schemes.

The study was grounded in citizen empowerment theory that was propounded by Burns, Hambleton, and Hoggett (1994) and has found extensive use by theoretical and research experts in arguing the inadequacies of the ladder of citizen participation theory in which (Arnstein, 1969) shaped the thinking of academicians and policy-makers on how participation is conceived. The philosophical underpinning of this theory is that farmer participation in

project execution elaborates into different typologies of empowerment for which farmer participation in project implementation creates something new when project inputs are transformed into inputs. This transformation is explained by theory of change in which Weiss (1990) argued that change occurs and observed in chronological steps for while (Arendt, 1958) illustrated farmer participation in project control through WUA authority when its leadership is recognized by the farmers in an irrigation scheme. This recognition made Weber, (1978) to distinguish the leader-subordinate relations within social settings in order to reinforce legitimacy and recognition of authority. This means that farmer participation in project execution depends on WUA empowerment in ensuring compliance with rules of water use.

METHODOLOGY

The study adopted pragmatism research paradigm because of its flexibility in interrogating multiple realities of the phenomena under study making it easier for the researcher to triangulate data from different sources. The research design adopted was descriptive cross sectional survey research design and correlation research design. Descriptive survey design was suitable for the study because the researcher was interested in describing multiple realities of farmer participation in project implementation and farmer participation in project control by studying a large group of farmers drawn from eight (8) smallholder irrigation schemes spread out across Busia County, Kenya. Correlation research design was suitable for the study because the researcher was interested in establishing the strength and dependence of sustainability of smallholder irrigation schemes on both farmer participation in project implementation and also on farmer participation in project control.

This study had a target population of 1,385 elements made up of two sub-sets namely, the first sub-set of 1,371 farmers drawn from eight (8) smallholder irrigation schemes and the second subset of 14 technical staff drawn from the Department of Irrigation, in Busia County, Kenya. The characteristics of smallholder irrigation farmers included presence of irrigation components such as open earth or concrete lined water canals, PVC or GI pipelines, masonry storage water tanks, hose pipes, risers, overhead sprinklers, open furrows, earth basins, hydrants or any other hydraulic structure in the farmers' fields that is used for abstracting, conveying, distributing and applying irrigation water to crops. The second sub-set of the population under study was the technical staffs of the Department of Irrigation who were assigned to plan design and implement smallholder irrigation projects in Busia County, Kenya. Their characteristics were their professional qualifications which included; Diploma, Bachelors or Master of Science Degree in Agricultural, Hydrology, Civil and Water Engineering or any other related discipline.

Cochran's formula for sample size determination was used to get the desired sample size of the first sub-set. The researcher set the alpha level at 0.05, acceptable error at 0 5%, and the standard deviation at 0.5. Cochran's formula for sample size determination used is outlined here below;

$$n_o = \frac{(Z)^2 * (p)(q)}{(d)^2}$$

Where Z = value for selected alpha = 0.025 in each tail = 1.96,
(p)(q) = estimate of variance = 0.25.
d = acceptable margin of error for the proportion being estimated = 0.05 (i.e. the error the researcher was willing to accept).

Therefore sample size, $n_0 = \frac{(1.96)(1.96)*(0.5)(0.5)}{(0.05)*(0.5)}$

$n_0 = 384$.

This means that for a sub-population of 1,371 smallholder irrigation farmers, the desired sample size was 384. However, Cochran, (1977) recommended that when the sample size exceeds 5% of the population under study (i.e. 1,500⋆0.05=84), the use of Cochran's correctional formula is necessary for calculating the final sample size. Cochran's correctional formula is given as;

$n_1 = \frac{n_0}{(1+{}^{n_0}/_{population})}$

Where n_1= corrected sample size,

$$n_1 = \frac{384}{(1 + {}^{384}/_{1371})}$$

$n_1 = 300$

Therefore the desired sample size for the study based on Cochran's correctional formula was 300. The sampling design of farmers in the (8) eight smallholder irrigation schemes from where the desired sample was drawn is as shown in the table 1.

Table 1: Sampling Design

S/no	Name of Irrigation scheme	No. of farmers in each scheme	Proportion of farmers in the study population	No. of farmers from the desired sample size
1.	Mabale Dynamic	148	0.108	32
2.	Maira/Mukemo	270	0.197	59
3.	Neela	206	0.151	45
4.	Ludacho	98	0.071	21
5.	Namalenga	143	0.104	31
6.	Samia Fruit	241	0.176	53
7.	Nandikinya	157	0.115	35
8.	Sisenye	108	0.079	24
Total		**1,371**	**1.000**	**300**

The second subset of 14 elements in the study population was sampled through censors approach. Mugenda and Mugenda, (2003) recommended the use of census approach when the total number of elements is less than 100 and characteristically diverse. The project manager and their teams were diverse in both their technical specialization and area of deployment to justify use of censors approach as a sampling technique.

Stability of the research instrument was undertaken by use of Cronbach's alpha reliability coefficient in order to measure the interrelatedness of items in the questionnaire. George and Mallery (2003) further suggested a rule of thumb that Conbrach's alpha reliability coefficient > 0 .9, is excellent, > 0.8 – is good, > 0.7 – is acceptable, > 0.6 – is questionable, > 0.5 – is poor, while < 0.5 – is unacceptable. They further suggested that Conbrach's alpha reliability coefficient of 0.8 and above is reasonable and consistent while a coefficient less than 0.5 is not consistent and therefore unacceptable. To determine Cronbach's alpha reliability coefficient of the questionnaire, a total of 50 items were used to measure both the predictor and dependent variables in which all items produced Conbrach's alpha reliability coefficient more than 0.7. The Cronbach's alpha reliability coefficients for the items used in the study the study is as shown in table 2.

Table 2: Conbrach's Alpha Reliability Coefficient

Variable	No. of cases	No of items	Reliability Coefficient
Farmer participation in project implementation			
Labour contribution	273	5	0.819
Farmer supervision	274	5	0.878
Cash contribution	274	5	0.703
Reliability coefficient for farmer participation in project implementation	**273**	**15**	**0.800**
Farmer participation in project control			
Mandate of WUA	274	5	0.843
Supervision of water allocation	274	5	0.939
Compliance with water use rules	274	5	0.920
Reliability coefficient for farmer participation in project control	**274**	**15**	**0.901**
Composite Cronbach's (α) alpha reliability coefficient for project execution	**274**	**30**	**0.851**
Willingness to pay for water	273	5	0.893
Increase in crop yields	274	5	0.932
Area of land put under irrigation	274	5	0.670
Sense of ownership	274	5	0.659
Reliability coefficient for sustainability of smallholder irrigation schemes	**273**	**20**	**0.789**
Composite Cronbach's (α) alpha reliability coefficient for the research instrument	**274**	**30**	**0.820**

The items in the questionnaire produced composite Cronbach's alpha reliability coefficient of 0.820. This means that items in the research instrument were fairly homogeneous, reflected the same underlying construct(s) and therefore consistent.

Null hypothesis (H_0), that there is no significant influence of farmer participation in project implementation on sustainability of smallholder irrigation schemes was tested and null hypothesis (H_0), that there is no significant influence of farmer participation in project control on sustainability of smallholder irrigation schemes was also tested. Both hypotheses were tested at $\alpha = 0.05$ using *P*-value method and a criterion that null hypothesis not rejected if *P*-value is less than 0.05 or otherwise rejected.

RESULTS

General Information about the respondents

300 questionnaires were issued out for data collection out of which 274 were duly filled and returned that gave a return rate of 91.94%. The return rate was close to 94% that Adeniji, (2011) got when he undertook a study on importance of participatory management on project execution through direct labour in Adamawa state projects. Nachmias and Nachmias, (2005) recommended that a return rate of over 75% is high enough for statistical generalizations. This means that 91.94% return rate was high enough for reliable statistical generalization on influence of farmer participation in project execution and sustainability of smallholder irrigation schemes in Busia County Kenya. The study found that distribution of subjects across different irrigation schemes was proportional to the strength of each scheme in the study population. Similar result was demonstrated by Ndou, (2012) while investigating NGOs and beneficiary participation in agricultural development projects in South Africa in which the sample size was distributed proportionately according to the strengths of each scheme within the study population.

The results indicated that, 148(54%) were females while 126(46%) were males. This means that the distribution of respondents by gender in the irrigation schemes was skewed towards

the males. This meant that there were more females than males in the WUAs. The finding agrees with what Chifamba, Nyanga, and Gukurume (2013) in Zimbabwe established when they showed that females constituted 66% while males were 34% of the study population. This implies that sustainability of smallholder irrigation schemes relies more on female involvement. This observation was further confirmed by one WUA leader from Mabale Dynamic irrigation scheme, when he stated that,

> *".....the allocation of land for irrigation to women creates incentive for their labour contributions and hence their active involvement in WUA activities...."*

The study results indicated that farmers aged below 50 years constituted 188(68.61%) while those above 50years were 86(31.39%) with a mean age of 42.74 years. This distribution showed that respondents' ages were skewed towards below 50 years. This finding is similar to what Chifamba, Nyanga, and Gukurume (2013) established when they showed that 70% of farmers in Nyanyandzi irrigation schemes in Zimbabwe were below 50 years while those above 51 years were 30%. This means that since irrigation is labour intensive, it mainly relies on participation of elderly whose labour contribution may lead to low sustainability. However this view notwithstanding, interviews revealed that although majority of famers were below 50 years, majority of males were engaged in other alternative forms of income generation as one farmer from Mabale Dynamic Irrigation scheme ably put it,

> *".....we do not entirely rely on irrigation since the majority of the males in each households*
> *engages in other off-farm economic activities such as sand harvesting, fishing and "boda boda"*
> *transport businesses, leaving behind their women to mostly take care of irrigation activities....."*

This observation partly explains why more women were involvement in irrigation than their male counterparts. This means that involvement of male farmers alone in project control may not ensure sustainability of smallholder irrigation schemes.

The study results indicated the distribution of farmers by level of education that 243(88.8%) had at least secondary education while 31(11.2%) had only formal education. This means that majority of farmers with at least secondary education were compared to those with formal education. This finding disgrees with what Chifamba, Nyanga, and Gukurume (2013) found out when the results of his study showed the contrary that farmers with formal education were 86%while those without formal education were only14%. The level of farmers' education is essential because it has a bearing on decision making. This observation was evident when one farmer with secondary education from Maira Mukemo irrigation scheme remarked that,

"…….unless we get involved in monitoring the level of water use and ensure equity in its
distribution for each farmer we may never succeed in ensuring increase in the area of land put
under irrigation in this scheme. This kind of follow-up requires knowledge in record keeping……

This means that farmers' level of education has influence on sustainability of smallholder irrigation schemes.

The study findings showed that the minimum area of land put under irrigation was 0.01 while the maximum acreage was 21acres with a mean acreage of 1.178 and standard deviation of 1.662 acres. The results further showed that 200(73%) respondents irrigated less than 1.0 acre while 74(27%) irrigated more than 1.0 acre. This means that the majority of the farmers cultivated small uneconomical units of land that did not exploit much of the irrigation potential. This finding disagrees with what Khalkheili and Zamani (2008) established when they showed that farmers in Doroodzan Dam Irrigation Network in Fars Province, Iran cultivated a minimum of 1.25 and a maximum of 37.5 acres with a mean of 8.63 acres and standard deviation of 4.5acres. By comparison, it implies that more land was put under irrigation in Fars Province, Iran than in Busia County, Kenya. This means that in Fars Province Iran, irrigation schemes were more sustainable compared to those in Busia County, Kenya.

Study findings showed that the mean land size put under rain-fed farming was 1.357 acres with standard deviation of 1.963 acres. By comparison, 167(60.9%) respondents cultivated less than 1.0acre compared to 107(39.1%) who cultivated more than 1.0 acre of land under rain-fed farming. It was further confirmed that farmers put more land under rain-fed farming at 1.357acres compared to 1.178 acres under irrigation per household. This implies that farmers depend more on rain-fed farming than irrigation within the irrigation schemes. This finding however differs from what Khalkheili and Zamani (2008) found out when they showed that farmers in Doroodzan Dam Irrigation Network cultivated a mean 1.63 acres under rain-fed farming per household compared to 13.2acres under irrigation. This shows that in Fars Province Iran, farmers almost entirely relied on irrigation while farmers in Busia County, Kenya rely more on rain-fed farming. This means that by comparison, Doroodzan Dam Irrigation Network was more sustainable as compared to smallholder irrigation schemes in Busia County, Kenya. This observation was explained through interviews when one farmer from Mabale Dynamic irrigation scheme noted that,

> *"…while ordinarily it costs almost nothing to grow crops with rain water; to the contrary application of irrigation water costs money through its abstraction, distribution, allocation and application in the form of operations and maintenance charges which must be paid for upfront by all water users……."*

This means that more land was put under rain-fed farming as compared to under irrigation due to cost implications and therefore it explains why sustainability of smallholder irrigation schemes in schemes in Busia County was low.

The study results showed that respondents' experience in years of practiced irrigation was skewed toward less than 7 years with a mean score of 5.15 years and a standard deviation of 4.435 years while the range was between 1-20 years. Document analysis for GIZ/KfW (2016) feasibility study report recommendations for the Nzoia River Watershed Management and irrigation projects in Kakamega, Bungoma and Siaya Counties indicated that Internal Rate of Return for high value irrigated horticultural crops is seven (7) years. Therefore with an overall mean of 4.8 years of farmers' practiced irrigation experience meant that smallholder irrigation schemes in Busia County were not operationally economical. This explains why majority of smallholder irrigation schemes in Busia County Kenya whose farmers have operated for less than 7 years, exploit do not yet exploit much of the irrigation potential leading to low sustainability. This means that the smallholder irrigation schemes in Busia County were not sustainable. This finding differs from what Khalkheili and Zamani (2008) found out when they showed that farmers in Doroodzan Dam Irrigation Network, Iran had a

mean practiced irrigation experience of 23.2 years and a range of 2 to 70 years. This further confirms that sustainability of smallholder irrigation schemes is associated with years of practiced experience in irrigation. This observation was supported by a WUA member from Maira Mukemo when he stated that,

> *".....the more years one spends practicing irrigation enables him to venture Into irrigating more land the evidence of which is expansion of area of land put under irrigation per household the result of which is increase in total area of land under irrigation in the scheme...."*

This means that the more the experience measure in years of practiced irrigation the higher the sustainability of smallholder irrigation scheme.

Sustainability of smallholder irrigation schemes

Indicators of sustainability of smallholder irrigation schemes were; area of land put under irrigation and sense of project ownership. These two sub-variables were tested using 15 items in the research instruments and results of the responses are summarized shown in table 3.

Table 3: Sustainability of smallholder irrigation schemes

Sub-variables	n	SA 5	A 4	N 3	D 2	SD 1	Mean	Std. Dev
Willingness to pay	274	30 (10.95%)	58 (21.31%)	36 (12.99%)	70 (25.69%)	80 (29.05)	2.593	1.140
Area under irrigation	274	61 (22.26%)	97 (35.40%)	36 (13.14%)	45 (16.35%)	35 (12.85%)	3.37	0.823
Sense of ownership	274	81 (29.42%)	86 (31.46%)	42 (15.33%)	39 (14.22%)	26 (9.56%)	3.57	0.776
Composite mean of sustainability of irrigation schemes	**274**	**71 (25.84%)**	**92 (33.43%)**	**37 (14.24%)**	**42 (15.29%)**	**30.5 (11.21%)**	**3.178**	**0.913**

Items that interrogated willingness to pay sought to determine whether farmers were willing to pay for water and 30(10.95%) respondents strongly disagreed, 58(21.31%) disagreed, 36(12.99%) were neutral, 70(25.69%) agreed and 80(29.05%) strongly agreed giving a mean score of 2.593 with a standard deviation of 1.140. This meant that that majority of farmers were indifferent towards paying for irrigation water. The indifference demonstrated by farmers' non payment of water implied that sustainability of smallholder irrigation schemes was neither high nor low. Interviews similarly revealed that most farmers did not pay for irrigation water as anticipated as one WUA leader from Maira Mukemo irrigation scheme when he stated that,

> *".....non remittance of water charges and O&M fees by WUA members despite undertaking irrigation for eight straight years upon commissioning and handing over of this project to us is one of the reason why the government subsidy is still being channelled to Maira Mukemo irrigation scheme; the absence of which would lead to total collapse of irrigation activities here....."*

This observation demonstrates farmers' lack of willingness to pay for water despite abstracting it for irrigation. This finding supports what De los Reyes and Jopillo (1985) found out when he showed that an increase of 15% of area under irrigation in smallholder irrigation schemes in the Philippines was attributed to 12% additional farmers willing to pay for water. This means that when farmers are willing to pay for water, sustainability of smallholder

irrigation schemes is assured while if they don't, then irrigation schemes may as well not be sustainable.

Items that interrogated area of land under irrigation sought to determine whether irrigation resulted in increase in area of land under cultivation and results indicated that 61(22.26%) strongly agreed, 97(35.40%) agreed, 36(16.14%) were neutral, 45(16.35%) disagreed and 35(12.85%) strongly disagreed giving a mean score of 3.37 and standard deviation of 0.823. This meant that majority of the respondents were undecided whether or not irrigation increased area of land under cultivation. This view was further confirmed through interviews when farmers said that that although area of land under irrigation was less compared to area of land under rain-fed farming, irrigation had higher productivity as one farmer from Maira Mukemo stated that,

> *"……irrigation has progressively enabled me to harvest more crop per unit area of land as compared to crop production under rain-fed farming……."*

This means that farmers generally believed that irrigation increased their crop yields. The implication of this observation is that although area under irrigation per household was smaller farmers acknowledged that crop yield per unit of area was higher. This observation is in agreement with what Vandesypen *et* al, (2007) showed when they found out that continued supply of irrigation water increases crop yields. This confirms that the supply of water for irrigation has influence on sustainability of smallholder irrigation schemes in Busia County, Kenya.

The items that interrogated sense of ownership examined whether irrigation created sense of project ownership and the results showed that 81(29.42%) of respondents strongly agreed, 86(31.46%) agreed, 42(15.33%) were neutral, 39(14.22%) disagreed and 26(9.59%) strongly disagreed giving a mean score of 3.57 and standard deviation of 0.776. This meant that majority believed irrigation created sense of project ownership. Interviews similarly revealed that project ownership was a perception nurtured by farmers as a result of their direct involvement in the irrigation project over time as one farmer ably put it,

> *".....we have toiled over time to create this project through mobilization of our own resources and also patiently investing invaluable time. Our attachment to this project is therefore both tangible and intangible; something that continuously evokes a deep feeling that it belongs to all of us through the shared water that is distributed through the infrastructure that runs through our individual fields....."*

This observation confirms what Alam, *et* al (2012) found out when he demonstrated that sense of ownership enabled farmers to express their views, share, contribute and act with mutual responsibility in promoting a common goal within the irrigation scheme. This means that sense of ownership is developed over time due to emotional and material investment in the project.

The composite mean score for sustainability of smallholder irrigation scheme showed that 71(25.84%) respondents strongly agreed, 92(33.43%) agreed, 37(14.24%) were neutral, 42(15.29%) disagreed and 31(11.21%) strongly disagreed giving a mean score of 3.178 and standard deviation of 0.913. The results showed that majority of respondents were not sure whether smallholder irrigation schemes in Busia County, Kenya were sustainable or not. This analysis was confirmed through interviews when a farmer from Mabale Dynamic Irrigation scheme stated that,

> *".....our continued access to irrigation water makes a big difference between a good*

and poor harvest, the geographical location of an individuals' plot notwithstanding. This difference is observable through increased area under irrigation..."

This means that farmers acknowledged that access to water was synonymous with sustainability of smallholder irrigation schemes. This observation supports a study by Olubode *et* al (2007) who while assessing performance of 17 smallholder irrigation schemes for policy reforms in Lower Oshun Basin Lagos State, Nigeria, found out that access to irrigation water increased area of land under irrigation. Despite this perception however, CGB (2017) report on Performance Contracting for financial year 2016/2017, showed that only a combined total of 904ha out of 15,900ha in all the eight (8) smallholder irrigation schemes in Busia County was under irrigation. This report confirms that sustainability of smallholder irrigation schemes in Busia County was low and contradicts farmers' perception the implication of which is that schemes were sustainable; the level of sustainability was actually quite low.

Farmer participation in implementation and sustainability of smallholder irrigation schemes

Indicators of farmer participation in project implementation were; feasibility study, project selection, and authorization which were tested using 15 items that are summarized as shown in table 4.

Table 4: Project identification on sustainability of smallholder irrigation schemes

Participation in project implementation	n	SA 5	A 4	N 3	D 2	SD 1	Mean	Std. Dev
Labour contribution	274	89 (32.55%)	84 (30.58%)	59 (21.46%)	35 (12.85%)	7 (2.55%)	3.859	0.819
Farmer supervision	274	76 (27.88%)	105 (38.22%)	50 (17.95%)	32 (11.68%)	11 (4.16%)	3.752	0.910
Cash contributions	274	41 (14.96%)	59 (21.53%)	25 (9.34%)	75 (27.23%)	74 (26.93%)	2.690	0.936
Composite mean for Participation in project implementation	274	69 (25.13%)	83 (30.15%)	45 (16.25%)	47 (17.25%)	30 (11.22%)	3.434	0.888

The study sought to determine whether farmers contributed their own labour during project implementation and results showed that 89(32.55%) of respondents strongly agreed, 84(30.58%) agreed, 59(21.46%) were neutral, 35(12.85%) disagreed and 7(2.55%) strongly disagreed giving a mean score of 3.859 and standard deviation of 0.819. The mean score for willingness to pay for water was 2.593 with standard deviation of 1.140. From decision point of view therefore majority of respondents were of the view that farmers contributed their own labour and but were not willing to pay for water. This means that farmers' labour contribution has no influence on their willingness to pay for water. However despite this finding interviews revealed the contrary when farmers intimated that their labour contribution was the fulfilment of their sense of ownership of the irrigation projects. This was expressed by one such farmer from Mabale Dynamic Irrigation scheme when he noted that,

"....project ownership is evidenced through our involvement through labour contribution during the transformation of the project inputs into outputs....."

This sentiment is in conformity with finding by Marks, Komives and Davis (2014) that farmers' labour contribution has influence on their sense of ownership. This implies that

despite contrary perceptions by descriptive analysis farmers' involvement in project implementation and their capacity to utilize water seems to have a relationship. However, Adeniji (2011) disagreed when he adopted cross-sectional survey design and a sample of 150 to establish that farmers' labor contribution during project implementation had no influence on their willingness to pay for irrigation water. This means that despite the study findings there are cases where farmers labour contributions has no influence on willingness to pay for water.

The study sought to determine whether farmers participated in supervision during project implementation and results showed that 76(27.88%) of respondents strongly agreed, 105(38.22%) agreed, 50(17.95%) were neutral, 32(11.68%) disagreed and 11(4.16%) strongly disagreed giving a mean score of 3.752 and standard deviation of 0.910. Sense of ownership was 3.57 and standard deviation of 0.776. From decision point of view therefore majority of respondents were of the opinion that farmer participated in supervision of implementation the project and it created sense of ownership. This means that farmer participation in project supervision has influence in sense of ownership of smallholder irrigation schemes. Interviews similarly confirmed this observation when a farmer from Maira Mukemo exclaimed that,

> "*….by supervising the Contractor during project implementation we ensured that the project quality was not compromised and that the project was delivered as agreed upon by the MoU....*"

This observation agrees with what Wandera, Naku and Afrane, (2013) established when they demonstrated that 22% of respondents in Ejisu irrigation scheme expressed sense of ownership compared to 78% who did not participate while in Asotwe scheme 78.8% who did not participate in the supervision activities against 21.2% who did. This view was also shared by Marks, Komives and Davis (2014) when they established that farmer involvement in supervision of the implementation activities has influence on area of land put under irrigation. This means that farmers involvement in supervision at project implementation activities has influence on their sense of ownership which is evidenced through increase in area of land put under irrigation.

The study also sought to determine whether farmers contributed their own cash during project implementation and results showed that 41(14.96%) of respondents strongly agreed, 59(21.53%) agreed, 25(9.34%) were neutral, 75(27.23%) disagreed and 74(26.93%) strongly disagreed giving a mean score of 2.690 and standard deviation of 0.936 while sense of ownership had a mean score of 3.57 with a standard deviation of 0.776. From decision point of view therefore majority of respondents did not contribute cash during project implementation although they still had sense of ownership. Interviews revealed that farmers never contributed cash during project implementation because they believed the project was fully funded by the Exchequer and their token cash could not make much difference as one WUA leader from Maira Mukemo ably put it that,

> *"….we were never compelled to contribute cash as a precondition for project implementation;other than our own labour and locally available construction materials that we offered, the project implementation continued uninterrupted with or without our cash contributions. Upon project completion we could therefore not tell how much the government spend on it……"*

These sentiments therefore disagree with what Marks and Davis (2012) established when they showed that farmers cash contributions creates a sense of ownership. This means that farmers' sense of ownership was not influenced by their cash contributions.

Overally, farmer participation in project implementation had a composite mean of 69(25.13%) of respondents who strongly agreed, 83(30.15%) agreed, 45(16.25%) were neutral, 47(17.25%) disagreed and 30(11.22%) strongly disagreed with a mean score of 3.434 and standard deviation of 0.589 while sustainability of smallholder irrigation schemes had a mean of 3.31 and standard deviation of 0.616. These results showed that majority of respondents in smallholder irrigation schemes in Busia County participated in project implementation whose influence was neither high nor low. Inferential statistical analysis further showed that a moderate positive correlation of 0.431 existed between farmer participation in project implementation and sustainability of smallholder irrigation schemes while regression analysis indicated that 18.57 per cent in sustainability of smallholder irrigation schemes is explained by farmer participation in project implementation. Null hypothesis was rejected when F (1,272) = 62.01, at p = 0.01 < 0.05 and it was concluded that farmer participation in project implementation has significant influence on sustainability of smallholder irrigation schemes. This means that farmer participation in project implementation has influence on sustainability of smallholder irrigation schemes in Busia County.

Although study findings agree with what Wandera, Naku and Afrane, (2013); Marks, Komives and Davis (2014); Marks and Davis, (2012) discovered they disagree with what (Adeniji, 2011) found out when he established that farmers' labor contribution during project implementation has no influence on farmers' willingness to pay for irrigation water. The study went further to demonstrate that a moderate positive correlation of 0.431 existed between farmer participation in project implementation and sustainability of smallholder irrigation schemes. It also demonstrated that 18.57 per cent in sustainability of smallholder irrigation schemes is explained by farmer participation in project implementation. In this study therefore the knowledge gap which was the extent to which farmer participation in project implementation influence sustainability of smallholder irrigation schemes in Busia County was established. These study findings are therefore confirmatory on the extent to which farmer participation in project implementation influence sustainability of smallholder irrigation scheme in Busia County, Kenya.

Indicators of farmer participation in project control were WUA mandate, Farmers' supervision and compliance with rules of water use. The sub-variables were analysed using data gathered by 15 items summarized in table 5.

Table 5: Participation in project control and sustainability of smallholder irrigation schemes

variable	n	SA 5	A 4	N 3	D 2	SD 1	Mean	Std. Dev
WUA Mandate	274	79 (28.91%)	92 (33.50%)	41 (14.96%)	29 (10.72%)	33 (11.9%)	3.577	1.015
Farmer supervision	274	75 (27.45%)	95 (34.6%)	31 (11.24%)	33 (11.9)	40 (14.82%)	3.496	1.221
Compliance with rules of water use	274	76 (27.96%)	92 (33.58%)	43 (15.62%)	32 (11.53%)	31 (11.31%)	3.548	1.023
Composite mean for Participation in project control	**274**	**77 (28.11%)**	**93 (33.89%)**	**39 (13.94%)**	**31 (11.38%)**	**34 (12.68%)**	**3.540**	**1.086**

The study sought to determine whether WUA mandate was felt within the irrigation scheme and the results showed that 79(28.91%) of respondents strongly agreed, 92(33.50%) agreed, 41(14.96%) were neutral, 29(10.72%) disagreed and 33(11.9%) strongly disagreed giving a

mean score of 3.577 and standard deviation of 1.015. The mean score for area under irrigation was 3.57 with standard deviation of 0.776. From decision point of view therefore majority of respondents felt the WUA exercise its mandate and that had it influence on area of land under irrigation. This means that WUA mandate has influence in area of land under irrigation. This finding agree with what Olubode-Awosola, Idowu and Van Schalkwyk (2007) established when they sampled 137 respondents from a sample frame of 1800 using systematic sampling technique and descriptive survey design to establish that 45% of farmers who submitted to the oversight role of WUA compared as to 21.7% of those who did not submit increased area of land under irrigation. Similarly, interviews confirmed that farmers associated the role of the WUA to monitor water allocation with sustainability when a farmer from Mabale Dynamic Irrigation scheme explained that,

> *".....the WU's role in supervision of water allocation to water users was not only recognized by all but also but its decision respected as final in the scheme……"*

These sentiments are in agreement with what Khwaja (2004) had earlier observed when he observed that the ability of WUA to superintend on the water use has influence on the area of land put under irrigation. What this means is that when the WUA exercises its mandate, sustainability is assured.

The study sought to determine whether farmers participated in supervision of water distribution and the results showed that 75(27.45%) of respondents strongly agreed, 95(34.6%) agreed, 31(11.24%) were neutral, 33(11.9%) disagreed and 40(14.82%) strongly disagreed giving a mean score of 3.496 and standard deviation of 1.221. The mean score for willingness to pay for water was 3.69 with standard deviation of 1.106. From decision point of view, majority of respondents were in agreement that farmers participated in supervision and that increased their willingness to pay for water. This means that farmer supervision in water distribution has influence on their willingness to pay for water. This observation agrees with what Naik and Kalro (2000) established when they investigated one set of two schemes with WUAs and another set of two schemes without WUAs in Mula and Bhima area in Maharashtra, India and establish that 75 percent of respondents in schemes with WUAs expressed willingness to pay for water due to constant supervision by the WUA compared to schemes without WUAs where farmers did feel compelled to pay for water. Interviews further revealed that there is a strong relationship between water allocation and its use as one Block leader from Maira Mukemo irrigation scheme put it,

> *".....as a leader when I commit my time to supervise water allocation it not only leads to efficient water use at the plot level but also in its equitable distribution within the block...."*

These sentiments are in agreement with what Acheampong and Venot, (2011) observed when they noted that farmers recognized the role of WUA in water allocation due to its involvement in participatory monitory and evaluation of water use in the irrigation scheme. This means that when water allocation is supervised by WUA leaders, its equitable distribution and use is assured

The study sought to determine whether farmers complied with rules of water use and the results showed that 76(27.96%) of respondents strongly agreed, 92(33.58%) agreed, 43(15.62%) were neutral, 32(11.53%) disagreed and 31(11.51%) strongly disagreed giving a mean score of 3.548 and standard deviation of 1.023. Sense of ownership had a mean score of 3.57 and standard deviation of 0.776. From decision point of view majority of farmers complied with rules of water use and this created a sense of ownership. This means that compliance with rules of water use by farmers has influence on their sense of ownership. This

finding agrees with what Ndou, (2012) discovered when he used correlation design and descriptive survey design to show that compliance with rules of water use created in farmers' sense of ownership. Interviews similarly confirmed that differences existed between farmers who were involved in supervision during project implementation and those who did not when one team member ably stated that,

> *"…the distinction between farmers who were involved and those who were not is evident in the care with which one safeguards the project infrastructure; I have observed that those who invested their time in supervision are generally more protective of the irrigation infrastructure and comply with rules of the water use than those who did not……"*

These sentiments agree with what Olubode-Awosola, Idowu and Van Schalkwyk (2007) found out when they showed that 45% of farmers who complied with rules of water use due to capacity development on the same compared to 21.7% who did not participate had increased by 33% area of land put under irrigation in the scheme. This means that compliance with rules of water use has influence on area of land put under irrigation as well as sense of ownership.

Overally, farmers participation in project control recorded a composite of 77(28.11%) farmers who strongly agreed, 93(33.89%) agreed, 39(13.94%) were neutral, 31(11.38%) disagreed and 34(12.68%) strongly disagreed with a mean score of 3.540 and standard deviation of 1.086 while sustainability of smallholder irrigation schemes had a mean score of 3.31 and standard deviation of 1.086. From decision point of view therefore the majority of farmers participated in project control while sustainability of smallholder irrigation schemes was neither high nor low. What this means is that farmer participation in project control neither had high nor low influence on sustainability of smallholder irrigation schemes in Busia County, Kenya.

Although findings by Olubode-Awosola, Idowu and Van Schalkwyk (2007); Khwaja (2004); Naik and Kalro (2000); Acheampong and Venot (2011); Ndou, (2012) are in agreement with the study finding that farmer participation in project control influence sustainability of smallholder irrigation schemes they do not show by what extent. This study adopted descriptive cross sectional survey research design and correlation research design and randomly sampled 300 out of a population of 1371 smallholder irrigation farmers in Busia County, Kenya to establish that a strong positive correlation of 0.660 existed between farmer participation in project control and sustainability of smallholder irrigation schemes. It also demonstrated that 44.38 per cent in sustainability of smallholder irrigation schemes is explained by farmer participation in project control. Null hypothesis was rejected when $F(1,272) = 204.54$, at $p = 0.01 < 0.05$ and it was concluded that farmer participation in project control has significant influence on sustainability of smallholder irrigation schemes. In this study therefore the knowledge gap which was the extent to which farmer participation in project control influence sustainability of smallholder irrigation schemes in Busia County was established. This study was therefore confirmatory on the extent to which farmer participation in project control influence sustainability of smallholder irrigation scheme.

CONCLUSION

In objective one, descriptive analysis showed that farmer participation in project implementation has influence on sustainability of smallholder irrigation schemes. Inferential statistics indicated that a moderate positive correlation of 0.431 existed between farmer

participation in project implementation and sustainability of smallholder irrigation schemes while regression analysis indicated that 18.57 per cent in sustainability of smallholder irrigation schemes was explained by farmer participation in project implementation. Null hypothesis, H_0 at $p < 0.05$, F (1,272) = 62.01was rejected and it was concluded that farmer participation in project implementation influence sustainability of smallholder irrigation schemes. Interviews showed that project implementation depends on how WUA empowerment is aligned to project implementation process. It was therefore concluded that farmers' be empowered to enable their contributions be consistent with the recommended 90:10 government to farmer contribution ratio.

In objective two, descriptive analysis showed that farmer participation in project control has influence on sustainability of smallholder irrigation schemes. A strong positive correlation of 0.660 existed between farmer participation in project control and sustainability of smallholder irrigation schemes. It also demonstrated that 44.38 per cent in sustainability of smallholder irrigation schemes is explained by farmer participation in project control. Null hypothesis, H_0 at $p < 0.05$, F (1,272) = 204.53, was rejected and it was concluded that farmer participation in project control influence sustainability of smallholder irrigation schemes. Interviews revealed that farmer participation in project control depends on how effective WUAs execute compliance with rules of water use and ensure payment of water used for irrigation. It was concluded that farmer training manuals be revised and aligned to project management phases and that every training programme be preceded by needs assessment.

RECOMMENDATIONS

It was established that farmer participation in project implementation was based on MoU signed between the Department of irrigation and farmer representatives to ensure 90:10 government to farmer contribution ratio during project implementation. This was however never achieved because not all the farmers participated in project implementation. Nonetheless participation of those who were involved still had influence on sustainability of smallholder irrigation schemes. Therefore in order to create project ownership among all farmers, it is recommended that all farmers be encouraged to contribute their resources accordingly. It is also demonstrated that farmer participation in project control has influence on sustainability of smallholder irrigation schemes. It was further observed that farmer participation in project control requires WUA capacity that in turn depends on empowerment in order to enforce compliance with rules of water use. Although farmer empowerment was initiated through WUA training the study established that the training programmes were developed from bulky manuals and not based farmers' needs. Therefore in order to undertake objective training, it is recommended that needs assessments precede all training programmes. It was also recommended that the bulky training manuals currently in use be revised and aligned to the project management phases for ease of capacity development.

LIMITATIONS OF THE STUDY

The main limitations to the study was time and cost because the researcher would have preferred to research on a wider region of Kenya with more smallholder irrigation schemes but the practicability of this approach was however prohibitive due to resource and time constraints. To overcome these challenges a sample size large and representative enough of the target population was considered. Sampling reduced the cost and time of collecting and analyzing data by ensuring that the sampling procedure was undertaken scientifically to the extent that statistical principle of randomization was not compromised in the sampling frame.

Only farmers practicing irrigation within the schemes were considered in the study to ensure conformity during selection of smallholder farmers for the study.

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