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The Implication of Socio-Economic Characteristics of the Farmers on their Level of Participation in Rice Irrigation Management for sustainable household food security in Kisumu County, Kenya

Margaret Awuor Mitema[1*] Dr. Felix Ngunzo Kioli[2] Dr. Benson Ojwang[3]
1. Department of Sociology & Anthropology, Maseno University, Private Bag, Maseno, Kenya.
2. Department of Sociology & Anthropology, Maseno University, Private Bag, Maseno, Kenya
3. Department of Linguistics, Maseno University, Private Bag, Maseno, Kenya
* Corresponding author

Abstract
Community participation in rice irrigation management as acknowledged world over has the potential to boost sustainable household food security. Despite the transfer of irrigation management to rice farmers in Ahero and West Kano irrigation schemes in Kisumu County, Kenya since 2004, recent studies show that there is very minimal participation of the farmers in rice irrigation management, leading to less impact on rice production hence inconsistent household food availability. Consequently, this study sought to examine the implications of socio-economic characteristics of the farmers and their level of participation in rice irrigation management. The study was guided by Participation theory by Arstein (1969) which portrays desired change as something that actualized through collective actions of all participants. The study used cross-sectional descriptive research design and mixed method paradigm for data collection methods and analysis. Out of seven (7) variables tested, only farm size did not have any significant influence on participation in rice irrigation management for sustainable household food security. The other six (6) variables, age, gender, level of education, residential status, farm size, experience in rice farming and income earned from rice farming had significant influence. Thus, the null hypothesis was rejected and alternative, "There is significant relationship between the socio-economic characteristics of the farmers and level of participation" accepted. However, all variables except experience in rice farming, had negative influence on participation in rice irrigation management for sustainable household food security in Ahero and West Kano rice irrigation schemes. The study concluded that there was the minimal participation of farmers in rice irrigation management due to socio-economic factors including inadequate farmers' management capacity among others. The study, therefore, recommends empowerment of farmers through training and review of irrigation Act to allow both male and female farmers to have more control over rice management to improve on rice production, hence food security.
Keywords: Socio-economic characteristics, community participation, rice irrigation scheme, irrigation management, food security

1.0 Introduction

The world food situation is deteriorating, and many countries are increasingly finding it difficult to feed their people chiefly due to the declining agricultural input (FAO, 2009). The continent most affected by food insecurity is Africa closely followed by Asia. To solve the food crisis, several countries and communities have adopted diverse intervention strategies including the transfer of irrigation management of various crops to the local farmers within the schemes. For many decades, many irrigation schemes worldwide were managed by various government agencies. The approach used was a top-down or centralized mode of management. However, top-down management has suffered a lack of ownership, apathy and consequently is unsustainable (Pritchett & Woolcock, 2002). Centralized mode of management or top-down approach entails passive participation of farmers in a sector meant to benefit them (FAO, 2010).

As a result, a large and increasing number of countries around the world have transferred the management authority for irrigation systems including rice irrigation management from government agencies to the local farmers, a phenomenon referred to as Irrigation management transfer (IMT) or devolution (Vermillion, 1997). The strategy is meant to allow for full participation of the local farmers in a sector meant to benefit them (Vermillion, 1997). Empirical studies indicate a strong linkage between farmers participation in irrigation management and poverty reduction among other benefits (Hussain & Hanjira, 2004; Brabben et al., 2004; Angood et al., 2002 and 2003).

More data is available on the impacts of management transfer programmes to the local farmers from both developed and developing countries (Samad & Dingle, 1995; Kairo &Naik, 1995; Johnston et al., 1995; Johnson, 1996, Vermillion, 1997; Ceesay, 2002; Azizi et al., 2009, Njagi, 2009; FAO, 2000; WB, 2010; Thairu, 2010; Arun et al., 2012). Empirical data shows more of positive results in operational, maintenance, finance and economic performance in most developed countries such as Turkey, U.S.A, Mexico, and New Zealand among others. However, empirical studies from developing countries especially in Africa South of Sahara show a

decline in farmers' participation, hence less impact on economic performance (Shah et al., 2002). These studies are limited in information on why some schemes in developing countries experience a decline in production with the introduction of PIM while many schemes in developed countries are successful.

In many respects, the sub-Saharan African smallholder context differs from situations found in areas such as the USA, Mexico, Turkey and New Zealand whose large-scale irrigation predominate and where the impacts have been very successful. One reason given for low performance in rice production leading to unsustainable household food security in many irrigation schemes in sub-Saharan countries is the low and ineffective participation of farmers in such rice irrigation management (FAO, 2000; Thairu, 2010; Isern & Pung, 2007; Njagi, 2009). This reason forms the main thrust of this study. grounds of the low and ineffective participation of farmers in small-scale rice irrigation management, a sector which is meant to benefit the farmers because they are assumed to be more involved than the top-down or centralized mode of rice management.

Farmers' participation in rice irrigation schemes is widely believed to be an effective means of improving their knowledge of irrigation practices and efficiency of water use (Qiao, Zhao, & Klein, 2009; Omid, Akbari, Zarafshani, Eskandari and Fami, 2012). PIM help create the feelings of ownership, stimulate self-development, achieve a more efficient management and improve rice production; hence, household food security (Van Vuren, Papin & El Haouari, 2004) yet some communities in Africa continue to be unsuccessful. It seems the participation arena is more complicated than is expected by many macro-policy documents. Bray (2003) report and Dunne et al. (2007) study Zambia, indicate that it is a false assumption that a community comprises of a homogenous group of individuals or has mutually compatible interest. In reality, a community is a heterogeneous group of people whose difference occur with respect to age, gender, education, status of residency among others (Dunne et al., 2007) and these differences vary from one region or community to the next and they can have an influence on the level of participation. However, no study has gone a step further to identify, explore and analyze the implication of socio-economic characteristics of the farmers vis a vis their level of participation in rice irrigation management for sustainable household food security in the two schemes AIS and WKIS. The farmers from different entities should not be treated as homogenous. Each farm typology is specific to the local context and irrigation scheme in which it is located.

Most irrigation projects fail in their management because when the management are designed, farmers or local ethics, culture and other socio-economic characteristics are not considered (Iqbal, 2007; Sishuta, 2005). According to Manzuri and Rao (2004), development study in Bangladesh among other areas observed that communities should not just use a design simply because it has worked elsewhere. That is, the success of an irrigation management in one area does not guarantee its successful replication in another area with different conditions. The strategies used should have a clear purpose and should not ignore individual community's social and cultural variations and feelings (Pritchett & Woolcock, 2002; Morgan, 2001). The selection of management strategies to adopt should be based on a thorough understanding of socio-economic conditions of the area.

In their study on rice irrigation management in Nigeria, Akinola & Ogunwale (1998) also pointed out that one of the fundamental issues needed for development projects, economic growth, and livelihood sustainability is social consideration of the people involved in management. Thus, the socio-economic characteristics of a community are important as they can inhibit or encourage farmers' participation in community action group including rice scheme management. Bergeret and Dufumier (2002), Tarfa (1990) and Erhabor (1982) identified the major socio-economic characteristics that have been studied on irrigation agriculture to include age, gender, level of education, household size, farm size, land tenure, year of experience, skills, and farm income or benefits among others. Tarfa (1990) and Erhabor (1982) stress that these characteristics should not be ignored as some of them may dictate the success or failure of rice irrigation management in the schemes. Erhabor (1982) adds that the socio-economic characteristics must be those related to on-farm activities of irrigation agriculture.

Studies have been done on the implications of socio-economic characteristics of rice farmers on their level of participation in irrigation management in different schemes worldwide (Chandran & Chackacherry, 2004; Rajbhandari (2008); de Brauw et al, (2008); Zarafshani et al (2008); Omid et al, (2012); Arun et al, (2012)). Result findings show different significance but with varied knowledge gaps. For example, while de Brauw et al (2008) study in China, did not observe any significant implication in management between male and female rice farmers in irrigation management, Rajbhandari (2008) found that women's participation in rice management in Nepal was very minimal especially in connection to WUA management, a condition similar to Gebregziabher (2009) study in Ethiopia and Hamada & Samad (2011) report in Kenya. Given these findings, the question that remains unanswered is why a part of gender, women, who find themselves in irrigation schemes remain just ordinary members of irrigation associations in AIS and WKIS and play little or no role in decision-making processes.

The empirical studies on other socio-economic characteristics that have been examined in relation to rice irrigation management include age, level of education farm size, years of experience in rice growing, income or benefits from rice farms and residency among others. Result findings vary with some information limited. For example, Chandran and Chadrscherry (2004) in their study in Kerala, India, observed no significant implication

on age on farmers' participation in rice irrigation management, while Zarafshani et al. (2008) and Omid et al. (2012) in their studies in two different schemes in Iran, observed that age had significant effects on farmers' participation in irrigation management. According to Omid et al. (2012) findings, the youth (40 years and below) participated to a larger extent than the old (50 years and above) in rice irrigation management in Iran. These findings concur with that Mwea irrigation scheme finding where the youth are said to have been more involved than their parents in rice irrigation management (Kabutha & Mutero, 2012). However, there is very limited knowledge on why the youth participate more than other age brackets in these schemes. This dynamic participation by the youth may have significant implications on the level of participation. Among the segment of potential irrigation workers who are youth, there may be driving and restraining forces affecting their participation.

The youths represent a demographic that has particular importance for promoting sustainable development in rice irrigation at the local level. For example, when the rice farmers revolted in Mwea rice irrigation scheme in Kenya in 1998, the youth, born and bred in Mwea irrigation scheme were the primary source of management changes (Kabutha & Mutero, 2012). Most of the youth had gone to school and acquired good education, but through what Kabutha and Mutero (2012) call "hardship experienced by their parents during the NIB management in Mwea rice irrigation farms." On the other hand, many other studies have also shown the low involvement of young people in agricultural activities such as rice irrigation management. For example, three separate studies in different rice irrigation schemes in South Africa by Tekana and Oladele (2011); Sishuta (2005); Kepe, (2002) and Kamara et al., (2002) have all shown a low involvement of the youth in rice irrigation management. In South Africa, the young people were said to have associated agriculture with the negative experience of the past political dispensation and as such, developed a stigma attached to agriculture (NPDALE, 1999). It is important to identify the forces that make the youth be engaged or not to be engaged in rice irrigation management in the area of study. The conditions making the youth participate or not vary from one area to the other. The empirical study findings are also mainly concentrated on the part played by the youth in rice irrigation management but are silent on other age brackets such as the old in irrigation management yet in community participation all adults should be seen to be involved in rice irrigation management. This study, therefore, analyzed the activities done by all age groups in rice irrigation management in the study area.

Education is one of the primary drivers of community participation particularly regarding community mobilization, effective communication, and provision of leadership, among others. Azizi and Zamani (2009) in their study of Doroodzan in Iran, found that highly educated people participate to a large extent in rice irrigation management than their lesser educated counterparts. This concurs with Analgo et al. (2014) findings in Kpong irrigation scheme in Ghana, Karamjavan (2014) study in Iran and Sahoo (2012) study in Odisha, India where the majority of the farmers who participated in irrigation management were literate and highly educated. However, these studies were done in large scale rice irrigation schemes where according to Tarfa (1990), technical knowledge and skill was a determining factor in participation. Tarfa (1990) found out that more literate farmers had a more ready access to irrigation management knowledge, unlike the illiterate farmers. Pandey and Suresh (2000) study in India too concurred with Tarfa's findings and further found out that the domination of the local elite was advantageous regarding enhancing communication with external agencies, resource mobilization among others. Low level of education was also blamed for limiting access to information and understanding of commercial farming concepts which are critical to sustaining high production levels in rice irrigation schemes in sub-Saharan Africa (Shah et al., 2002). However, these studies are silent on the influence of education on a small scale rice irrigation management like AIS and WKIS. Educational factors may be critical areas of focus for those working to improve local participation in small-scale rice irrigation management. There is a need, therefore, to find out the implication of farmer's level of education and their participation in a small-scale rice irrigation management in AIS and WKIS.

Monetary incentives in rice production vary. Farmers who benefit more concerning income earned from the farm or farm size of the irrigation schemes participate more actively in its management unlike those who get fewer benefits. Analgo et al., (2014) study in Kpong irrigation scheme in Ghana; Gebregziabher et al., (2009) study in Tigray, Ethopia and Maleza and Nishimura (2007) study in Bohol, Philippines on-farm benefits, observed that benefits derived from rice irrigation schemes served as a powerful incentives for farmers participation in irrigation management. In their study in Tamil Nadu, Arum et al., (2012), observed that farmers with large farm sizes participated more in the management unlike their counterparts, the farmers with small sizes of the farm. This is because such farmers benefit more from such large farms regarding profit and hence household food security. Farmers who work tiny plots are forced to pursue what Chambers (1983) calls a 'hedgehog strategy of depending on a variety of sources to earn a livelihood. In AIS and WKIS, the farmers are said to have been allocated 4 acres of land for rice growing (KNBS, 2010), yet the farmers' rice production did not improve even with the changes in rice irrigation management (Thairu, 2010; Njagi, 2009). They were still food insecure. According to KNBS (2010) while the average yield per hectare is about 4 tonnes or more in Kenya, the average yield from each of the two irrigation schemes was only 2.2 tones.

However, Shah et al., (2002) argue that participation by farmers has tended to be smooth, relatively effortless and successful where farm sizes are large (5-20 hectares), rice irrigation is central to a dynamic, high performing agriculture with plenty of profit and where farmers have had experience in rice farming for a long time. For example in Turkey and parts of South Africa (Shah et al., 2002). In South Korea, Japan, and China, the average yields have been above 6 tonnes per hectare (Chackacherry, 2000) though these are large scale rice irrigation farms. The underlying factors associated with these circumstances in AIS and WKIS and outcomes represent a source of insight for the present study. The area of study currently lacks reasons for explaining why there is less production, low community participation in rice irrigation management yet most of the farmers own 4 acres of rice farm.

Permanent residency and land ownership are also essential to community level of involvement in rice irrigation management in the schemes (Nyangito & Odhiambo, 2004). Permanent residency enhances group synergy, cohesion and encourages co-operation among the farmers which, according to Nyangito and Odhiambo (2004), are some of the key components of effective participation in the management of irrigation schemes. But permanent residency without documented evidence like owning title deeds may, however, discourage ownership and affect the level of participation in rice irrigation management. Lahiff (2003) in his study in Mozambique; Manzungu et al. (1996) study in Zimbabwe and Bembridge (1999) study in South Africa added that insecure land tenure limits farmers' incentives to make long-term development investments on their land. Land cannot be used as collateral for retaining credit works. Inability to depend on irrigated farming for a substantial proportion of their livelihood modifies the incentives and behaviour of smallholder farmers (Lahiff, 2003). The smaller the plot, the stronger the tendency for men to seek urban jobs while women cultivate the plots as found out by Mphahlele et al. Ngqaleni and Makhura (1996) studies in South Africa; Abernethy et al., (2000) study in Niger and Manzungu et al., (1999) study in Zimbabwe.

When the males migrate to urban areas in search of jobs, women participate more in rice cultivation, but they have very little control over rice resources. These studies are not clear on water and land rights. Land rights pose an additional intricate challenge to most rice farms in sub-Saharan Africa (Lahiff, 1999).There is the need to have an idea about the incentives which can encourage farmers to participate more even if they have no titles for their farms. Often, lack of clarity among the plot-holders about what their rights precisely are regarding their plots seems more challenging than the absence of ownership (Shah et al. 2002). In a study in Dingleydale, South Africa by Merie and Oudot (2001) and Abernethy et al. (2000) study in Niger, some farmers were reluctant to lease their land because they were afraid of losing it yet they were not actively growing rice. Tenure uncertainty and the high cost of pump schemes may have an influence on the level of participation in AIS and WKIS in Kisumu County.

Therefore, individual and groups in a community may have varied reasons for participating or not participating in rice irrigation management from socio-economic factors though we cannot rule out other external forces influencing management in rice irrigation schemes. No study has gone a step further to identify, explore and analyze the implication of socio-economic conditions of the farmers vis a vis their participation in rice irrigation management for sustainable household food security in AIS and WKIS. Several knowledge gaps worth studying have also been identified and would be included in this study.

1.1Research Objectives

Null Hypothesis: "There is no relationship between the socio-economic characteristics of the farmers and their participation in rice irrigation management in AIS and WKIS".

2.0 Research Design

This study which sought to understand the relationship between the socio-economic characteristics of the farmers and their level of participation in rice irrigation management for sustainable household food security was carried out using a cross-sectional, descriptive design. A descriptive design is used in studies that involve collecting information without doing anything to alter the environment being studied, as in the manipulation of variables carried out in experimental research. Cross-sectional studies are carried out at one point in time or over a short period (Bernard, 2006). The design is economical because it provides a snapshot of the outcome and the characteristics associated with it at a particular point in time (Bernard, 2006). The respondents were contacted at a given point in time in their lives to describe their socio-economic and demographic characteristics and their level of participation in rice irrigation management.

2.1 Study Area

The study was carried out in two rice irrigation schemes in Kisumu County, Kenya namely; Ahero and West Kano, the only irrigation schemes growing paddy rice in Kisumu County, Kenya. Both schemes are located in Kano plains between Nandi escarpment and Nyabondo Plateau and while WKIS on the shores of Lake Victoria uses the water for irrigation, AIS uses Nyando river water for irrigation. Both rice schemes use basin type of

irrigation. The two schemes are separated from each other by the Nairobi- Kisumu road (NIB, 2013). From this background, it can be concluded that the two schemes have more or less same socio-cultural and environmental conditions which were examined to find out if they had an influence on the level of farmers' participation in rice irrigation management for sustainable household food security.

2.2 Study Population

In this study, the study population comprised of small-scale rice farmers in Ahero and West Kano rice irrigation schemes in Kisumu County. Ahero had 579 rice farmers while West Kano had 609 rice farmers totaling 1188 small-scale rice farmers (National Irrigation Board, 2013; GoK, 2008; Njagi, 2009). Therefore, the study population was made up of all farmers of rural communities in Ahero and West Kano rice schemes. Also, the study targeted Key informant officials from NIB, WUAs, Cooperatives and revolving fund committee to assist in giving some information or clarification issues in rice irrigation management process.

2.3 Sample Size, Sampling Procedure, and Data collection methods

This study used both probability and non- probability sampling designs to select respondents for collecting quantitative and qualitative data namely systematic random sampling and purposive sampling. For quantitative data, the size of the sample used in the study factored in the desired level of precision, the confidence level and the degree of variability in the attributes being measured (Orodho & Kombo, 2002). This study employed Cochran equation 1 formula for calculating a sample for proportions (Isreal, 2003). The formula states that:

Sample size $$n = \frac{Z^2.p.q.N}{e^2 (N-1) + Z^2 .p.q}$$ *(Equation 1)*

Where n is sample size, Z is standard variate at a given confidence level, p is sample proportion, q= (1-p), N is the size of population and e is an acceptable error (precision). Using Equation 1 with N= 1188, e = 0.02, Z=1.96 (if the confidence level is 95% as per table), p= 0.02 and q=0.98 the sample population n is computed as 164. To reduce sampling error and improve the quality of data collected; the sample was scaled up to 176 respondents. The computed sample size was proportionately distributed to each scheme based on individual scheme population of Ahero (579), West Kano (609), and giving the individual sample sizes of Ahero (86) and West Kano (90).

The study employed the systematic random sampling to select the 176 respondents. Systematic random sampling is a method of selecting sample members from a larger population based on a start point that is random, and a fixed periodic interval (William, 2006; Benard, 2006). Usually, every “nth” member is selected from the total population for inclusion in the sample. Systematic random sampling gives a handy method when a random number is difficult to apply or when counting every “nth” item is easier (Benard, 2006). Systematic random sampling gives the assurance that the population will be evenly sampled (William, 2006). Using the respective farmer register from AIS and WKIS, The sampling interval was determined by dividing the total population for each scheme by the sample size for each scheme as shown: 579/86= 7, 609/90= 7

For each scheme, every 7^{th} respondent was selected with the first respondent being randomly selected. Using a semi- structured questionnaire, information was sought on various socio- economic characteristics of the farmers and their implication on the level of participation in rice irrigation management for sustainable household food security in AIS and WKIS in Kisumu County, Kenya. For qualitative data, the study used purposive sampling to select respondents. Purposive sampling is a method where participants are selected because of them being knowledgeable about the transfer of rice irrigation management to farmers in 2004.

The study employed purposive sampling in selecting key informants and focus discussion group members. The key informant members included officials from NIB, WUA, Cooperatives and Revolving Fund. These officials are selected purposively because they are believed to be knowledgeable regarding the study (William, 2006) such as the socio-economic characteristics of the farmers and their level of participation in rice irrigation management. Focus group discussion members were also selected purposively because they were well informed about the research topic and interaction among them stimulated expression of feelings, knowledge and beliefs they would not express if interviewed individually (Gall, Gall & Borg, 2007).The principle of homogeneity was observed by ensuring that the discussants in the FGD were male and female farmers who had been in the scheme since the adoption of new rice irrigation management. They provided more information on socio-economic characteristics of the farmers and their implication in participation in rice irrigation management in the area of study.

2.4 Data Analysis and Presentation

The data that was generated for this study was analyzed following mixed method data analysis process. The quantitative data namely numerical variables were analyzed using descriptive statistics namely frequencies, percentages and averages and chi-squires (Hopkins, 2002). The study used frequencies and percentages because

of their ability to distribute the respondents according to the various values of the study variables. Quantitative data was presented using tables.

Qualitative data are analyzed using open coding whereby themes and patterns are identified (Ritchie & Lewis, 2003; Bernard, 2006). Themes and patterns were derived from responses given by respondents, FGDs and from open- ended responses from the Household Survey Questionnaire. After that, the data was classified into categories some of which were further re-examined to establish their linkages and inter-linkages. Qualitative data was presented using narratives.

4.0 Findings and Discussions

The farmers interviewed for the study were 176 and the socio-economic factors analyzed were mainly the ones related to on-farm activities of farmers in a rural setting such as age, gender, level of education, farm size, residency status, year of experience in the rice farm and benefits from rice farms in AIS and WKIS in Kisumu County, Kenya.

4.1 Influence of Gender on level of participation

AIS and WKIS are made up of both male and female headed households. It was noted that in both schemes, AIS and WKIS, there was a higher percentage of male headed households (65%, and 68%) than female headed households (35% and 32%) respectively, engaged in rice growing; child-headed households were also identified at 2.8% although the child headed households were all female. In both AIS and WKIS more male than female actively participated in the rice irrigation management. On the contrary more female than male farmers were passive (Table: 4.1a)

Chi-square statistics was used to test the null hypothesis that "There is no relationship between farmers' gender and participation in the rice irrigation management in AIS and WKIS." The calculated chi - χ^2statistic for both AIS (5.769) and WKIS (11.396) was greater than the critical chi - χ^2statistic (3.84) at 0.05 confidence level (Table 4.1b). The null hypothesis was thus rejected and the alternative hypothesis adopted. While more male actively participated in rice irrigation management in both schemes, female participation was very minimal. This contradicts de Brauw et al. (2008) study in China where it was found out that it mattered not whether one was a man or a woman in irrigation management. All gender more or less participated equally. But the study findings concur with Rajbhandari (2008) study in irrigation projects in Nepal where women were found to be not actively involved in irrigation management. However, this study further discovered that several reasons make women not to participate actively. In many other studies in Africa, irrigation farming has been categorized as men's work (Adeoti, 2009, Wahaj et al, 2007, Hulsebosch & Ombara, 1995) because women are not perceived as the direct stakeholders (Zwarteveen, 1995) and as a result most projects have not factored in any gender dimension during the design and implementation. The result findings in this study confirmed the perception which was realized through FGD that irrigation in the area of study is male dominated thus men hold more authority than women in matters of farm management a fact which further aggravated analysis for underrepresentation of women in the irrigation management. The male had more control over land, rice funds and decision-making than the females.

4.2 Influence of Age on level of participation in rice irrigation management

The following three age groups were adopted: 40 years and below; 41-50 years and 51 years and above. The majority (51% and 53%) of respondents from AIS and WKIS respectively who participated in this study were aged 51 years and above and only 20% and 16% for AIS and WKIS respectively, were below 40 years old (Table 1.2a). The mean age of the respondents was 49 years.

The null hypothesis stating that "There is no relationship between farmers' age and participation in the rice irrigation management in AIS and WKIS" was tested using Chi-square statistics (Table 4.2b). The calculated chi - χ^2statistic for both AIS (9.199) and WKIS (7.437) was greater than the critical chi - χ^2statistic (5.99) at 0.05 confidence level. The null hypothesis was thus rejected, and the alternative adopted(Table 1.2b). The result finding showed that farmers' age had an influence on their participation in rice irrigation management. More of the old were actively participating in rice irrigation management. The involvement of the old may be connected with awareness of irrigation transfer and the fact that they had been in these schemes for a longer time (experience).

Research findings on the influence of age in rice irrigation management in other studies are varied. While Chandran and Chackacherry (2004) observed no significant impact on participation by age in Andhra Pradesh, Zarafshani et al. (2008) and Omid et al. (2012) studies in Iran observed that the age had significant effects on farmers' participation in irrigation as found in this study but with variation on age groups. While in Anaglo et al. (2014) study of Kpong irrigation scheme in Ghana, and Kabutha and Mutero (2012) study of Mwea irrigation scheme in Kenya, observed that middle age group were more active than other age groups in rice irrigation management, this study found the aged (51 years and above) to be actively involved than the younger generation who were few and less actively (29%) involved in rice irrigation management. However, the aged participation in rice irrigation management in AIS and WKIS had obvious implications for capacity building in areas such as

leadership, project management, change management as well as future succession plans. Through FGD's and respondents, it was observed that the old, active participants in irrigation management, were also reluctant in taking up leadership positions because they felt that it was a tedious task yet they did not want to burden themselves with extra duties although they were more aware of the changes in irrigation management unlike the other age groups. This finding further explains why some women who were 51 years and above could not actively participate in leadership management in rice irrigation management.

Instead, through FGD and key informants, it was observed that the youths were more involved in non-agricultural activities such as riding motorbikes; hence, they participated less and passively in rice irrigation management. This implies that age was a limiting factor to participation in irrigation management position in the study area. More aged farmers participated in irrigation management than the young.

4.3 Influence of Education on level of participation in rice irrigation management

The respondents' level of education ranged from basic to university education. The findings showed that over 50 % of the household heads in both schemes AIS and WKIS had attained secondary education and above but most of them were male farmers. About 40% of respondents had attained a primary level of education, and most of them were female farmers (Table 4.3a).

Chi-square statistics was used to test the null hypothesis that "There is no relationship between farmers' level of education and participation in the rice irrigation management in AIS and WKIS." (Table 4.3b). The calculated chi - χ^2statistic for both AIS (7.836) and WKIS (9.848) was greater than the critical chi - χ^2statistic (3.84) at 0.05 confidence level. The null hypothesis was thus rejected and the alternative hypothesis adopted (Table 4.3b). These finding showed that educational status of respondents in both schemes had a significant influence on participation in rice irrigation management. The educational levels of respondents revealed that the majority of the respondents who had attained secondary and tertiary levels of education actively participated in irrigation management than others, but farmers who had attained tertiary education in the two schemes were very few.

This study's finding is consistent with previous findings by Azizi and Zamani (2009) study in a rice irrigation scheme in Iran; Pandey and Zuresh (2007) study in rice irrigation scheme in India who found that highly educated people or the elite participated to a significant extent than their lesser educated counterparts. However, the schemes in Iran and India were large scale rice irrigation schemes (Azizi& Zamani, 2009; Pandey & Zuresh, 2007) where technical skills were a critical requirement. In Pandey and Zuresh (2007) study in India, the domination of the local elites was advantageous regarding enhancing communication with external agencies, resources mobilization among others. Education was identified as one of the key drivers of community participation particularly regarding community mobilization, effective communications and provision of leadership among others and this is supported by Arnstein's (1969) theory which states that the ability to participate depends on people's knowledge and skills among others. This implies that where there is little or no knowledge, participation in rice management will be limited like in AIS and WKIS.

Some discussants in AIS and WKIS reported that the few elites who were participating had retired from white collar jobs (civil service) and thus preferred to work on their rice farm instead of doing nothing at home. Below is a narrative from a retired civil servant.

I retired from The Civil Service 10 years ago.
My pension is too small to cater for my family and since
I have my 2-acre plot for rice; it can subsidize

Information obtained from the UN (2007), revealed that the inability of women to be able to reach leadership position is as a result of lack of education and training. This concurs with the findings in this study. Very few women in AIS and WKIS had attained secondary level of education; none had attained tertiary education, and some women could not even read or write and this denied them active of participation in rice irrigation management. The educational level of the farmers influenced the various levels of participation processes especially considering that participation process involved planning and decision-making among others.

It was also observed that the level of education was crucial because it determined whether one could become an executive member of the management team in any of the associations such as Water users association (WUA) or not. For example, for one to be able to be in the management team, it was necessary for one to be able to express oneself and also be able to read and write. In an FGD, the narration from the respondent revealed the importance of knowing how to read and write including being able to fill nomination forms and represent members at meetings and seminars.

I wanted to be part of the executive but was disqualified
because I could not read and write.

Thus, level of education had significant influence on level of participation

4.4 Influence of Farmers' Nature of Residency on level of participation in rice irrigation management

The residency was used to distinguish between those who had rice plots registered under their names in the rice schemes and those who were not registered (non-permanent). Non-permanent farmers could hire farms for use. A majority of the farmers (71%and 78%) for AIS and WKIS respectively, were permanent residents while only 29% and 22% were non-permanent residents in the two schemes respectively (Table 4.4a).

The null hypothesis that "There is no relationship between residential status of the farmers and participation in the rice irrigation management in AIS and WKIS" was tested using Chi-square statistics (Table 4.4b). The calculated chi - χ^2statistic for both AIS (9.204) and WKIS (16.271) was greater than the critical chi - χ^2statistic (3.84) at 0.05 confidence level. The null hypothesis was thus rejected and the alternative hypothesis adopted. It was anticipated that permanent residency would have implications on the extent of the farmers' involvement in rice irrigation management and by extension household food security in the long term. Permanent residency would facilitate ownership and easy acceptance of community participation in rice irrigation management. Permanent residency would enhance group synergy, cohesion and encourage cooperation among the farmers which according to Nyangito and Odhiambo (2004) are some of the key components of an effective community participation strategy. Bembridge (1999), observed that insecure tenure limits farmers' incentives to make long-term development investments on their land.

Studies in Dingleydale and New Forest schemes in South Africa by Merie and Oudot (2000) found out that some farmers were scared of renting out their plots to strangers due to the insecure tenure. They only lent their plots to trustful persons/ friend or relative or left the land fallow. In another study in Niger by Abernethy et al., (2000), it was found out that lack of clarity about land rights made it difficult to trace ownerships. This affected the level of participation in management in the two studies. These studies concur with the findings in this study. This study in AIS and WKIS observed that although the farmers have been allocated land in the schemes for rice growing and majority were permanent residents, no farmer had been provided with title deed for the land; thus, the farmers were referred to as "tenants." Consequently, there was no broad sense of local ownership, a situation that could have affected the extent of farmers' participation in rice management and production. The inability to use land as collateral for obtaining credit was another disadvantage. Often lack of clarity among the farm holders with respect to what their rights precisely were on their farms seemed more problematic than the absence of ownership.

4.5 Influence of farm size on level of rice irrigation management

The size of the farm for purposes of growing rice was studied. This ranged from 1 acre to 4 acres for the respondents, and It was noted that most of the respondents owned between 3-4 acres (AIS, 50%; WKIS,46 %) as shown in Table 4.5a. Very few farmers (19%, and 24%) in AIS and WKIS respectively owned 1 acre or less land for rice growing. It was also established that rice was the primary source of income among the respondents.

Chi-square statistics were incorporated to test the null hypothesis that "There is no relationship between farmers' farm size and participation in the rice irrigation management in AIS and WKIS." (4.5b). The calculated chi - χ^2statistic for both AIS (5.287) and WKIS (4.505) was less than the critical chi - χ^2statistic (5.99) at 0.05 confidence level. The null hypothesis was thus not rejected. These findings show that farm size had no significant influence on participation in irrigation management. Farmers' participation in the rice irrigation management was similar despite differences in farm size. The result contravenes earlier studies by Arun et al. (2012) who found that participation of farmers in the activities of irrigation management increased as farm size increased. According to Arun et al., (2012) study in Tamil Nadu, the farm size information had the potential of influencing rate of participation and determining the rate of production, but Arun et al.(2012) study was done on a large scale farm size. Shah et al, (2002) reports that it is a lot easier for 5 large farmers with 5-20 hectares each to come together and agree to the rules of self-management than for 1000 smallholders with less than 2 hectares to do the same, but these are also large scale farms in developed world like U.S.A., New Zealand, and Turkey among others.

Originally, all farmers in the two schemes had 4acres of land each for rice growing in the scheme and according to Thairu (2010) and Nyagi (2009), these rice farms were still not producing the expected average of 2.2 tonnes per hectare. Indeed in Japan, South Korea and parts of China, the average yield has been 6 tons per hectare (Chackacherry, 2000) yet these schemes are also small scale farms. It was reported that due to the expanding family sizes in different households in AIS and WKIS, there had been a lot of variation in sizes which may not have been reflected by various farmers. Through FGD, it was learned that many family conflicts were frequent in the rice schemes due to pressure from the growing household members in need of their share of land as culture dictates. For example, if a household had many sons (married) the household head had to allocate them some rice farm though still under his name without a title deed. Such changes and conflicts could have had some effect on the extent of family members' participation in rice management in the area of study.

4.6 Influence of farming experience in rice irrigation agriculture

About 41% and, 52% of the farmers in AIS and WKIS respectively, had over 15 years of farming experience in rice irrigated agriculture. In AIS and WKIS approximately 40% and 34% of the farmers had farming experience of 10 years or less, while 19% and 14% in AIS and WKIS respectively had experience ranging between 11 and 15 years (Table 4.6a).

The mean farming experience was 12 years. The null hypothesis which states that "There is no relationship between farming experience and participation in the rice irrigation management in AIS and WKIS" was tested using Chi-square statistics (Table 4.6b). The calculated chi - χ^2statistic for both AIS (10.188) and WKIS (7.555) was greater than the critical chi - χ^2statistic (3.84) at 0.05 confidence level. The null hypothesis was thus rejected and the alternative hypothesis adopted. The more years the farmers spent in rice irrigation agriculture, the more they acquire skills in irrigation system maintenance and water use efficiency. This show that majority of the farmers in the study area who had more years of experience in rice irrigation farming were actively participating than those with few years of experience. The findings concur with some study in Turkey by Svendsen, (2000) where a 40-year tradition of farmers' participation in the maintenance of the canal system made them acquire a lot of experience in that activity but these schemes in Turkey, were large-scale irrigation schemes. Studies by Erhabor (1982) and Tarfa (1990) in Nigeria also found out that experienced farmers in rice farming participated effectively than those without experience. These studies concur with this study. Farmers' years of experience in rice irrigation farming in AIS and WKIS was, therefore, one of the determinant factors of their participation in different aspects of irrigation management activities.

4.7 Influence of rice benefits on level of participation

The majority of the farmers in the two schemes relied on rice as their primary source of income thus rice played a big part in household food security. A majority of the discussants indicated that they only retain up to 500kg of the rice produced for domestic use. This implies that most of the rice produced by farmers in the two schemes was for sale with a paltry amount of rice produced for domestic consumption. Very few farmers in the two schemes relied on other crops besides rice for their household food security. However, although rice takes only three months to mature, it was reported from a key informant that it was only grown once a season/year in the two schemes; a factor which may have discouraged active participation as shown.

Income earned from rice production was calculated based on each harvest, with the highest earnings falling within the range of Kshs 30,001.00 and 90,000.00. From rice growing, households earn varying income levels annually. In AIS majority (72%) of the respondents surveyed generate between Ksh30, 001- 90,000 annually from rice production. A high proportion of households in WKIS (80%) earns a similar amount of income annually. It is evident from the findings that some household surveyed in AIS (15%) and WKIS (20%) generate lower income levels of Ksh. 30,000 or less annually from the rice growing activities they were engaged in. Only 13% of farmers in generated more than Ksh 90,000 annually.

Chi-square statistics was used to test the null hypothesis that "There is no relationship between income from rice farming and participation in the rice irrigation management in AIS and WKIS." The results were as shown. The calculated chi - χ^2statistic for both AIS (13.023) and WKIS (6.047) was greater than the critical chi - χ^2statistic (5.99 and 3.84) at 0.05 confidence level for AIS and WKIS respectively. The null hypothesis got rejected and the alternative hypothesis adopted (Table 4. 7b). The results showed that respondents who were satisfied with the benefits they obtained from the scheme participated more actively in the management process. This concurs with Maleza and Nishmura (2007) study where they argued that benefits derived from any irrigation schemes serves as a powerful incentive for farmers to participate in management process. Thus the more people get satisfied with benefits they receive from rice farming; the more they participate in rice management process. However, Shah et al., (2002) argue that participation process works well in situations where individual stakes and benefits are high including.

It was further observed in FGD and key informants that income earned from rice was used to purchase other food crops such as maize or fulfill other needs. However, although rice was found to be the main source of income thus the main source of benefit, growing rice once a year had implications for its management. The farmers were not fully committed to rice management because after all, one harvest did not make them to be food secure throughout the whole season. There were times when the farms were dormant. This encouraged the farmers to look for other ways of improving their livelihood.

Studies have shown that farmers are likely to participate more in management of irrigation resources if they rely solely on such activity for their livelihood and when the number of alternative livelihoods available are low (Nishimura, 2007; Analgo et al, 2014; Perera, 2006; Baland & Platteau, 2003; Meinzen-Dick & Knox, 2001). But literature documenting on participation experience suggest that all or a majority of farmers in successful cases in management are full-time farmers, deriving a substantial proportion of their livelihoods from irrigated farming. This builds their stake in self-management and committing time and resources to it. But from the survey, key informants and FGD's, it was also observed that besides rice, the respondents were engaged in other

livelihood activities including trading and growing other subsistence crops to earn a livelihood. It was observed that the income earned from sale of rice was not sufficient for buying food and other necessities required within a season. Besides food, the farmers needed to pay for farm inputs including water use, paying fees for all school/college going children among others.

According to Ruthenberg (1993), continuous rice irrigation is necessary for enhancing food security and economy. Only one growing season for rice in AIS and WKIS meant that farmers were only active participants in rice management during certain periods but not throughout the year. Besides the farming activities undertaken by the farmers in the two rice irrigation schemes, it was observed that other off-farm activities too contributed towards their efforts to survive as well as to participate in enhancing food security albeit indirectly. This included dependence on relief food assistance, stipend from relatives employed in urban areas for regular upkeep and food. Others were engaged in the informal sector or small scale/medium enterprises, such as *boda-boda* among others to make ends meet. These several other activities may have influenced the farmers' level of participation and yet participating in rice management or growing alone could not meet the farmers' needs.

From the findings and discussions, it is evident from the study that socio-economic characteristics of farmers had varied significance influence on the level of farmers' participation in rice irrigation management. The majority of the farmers could not participate fully in irrigation management due to socio-economic factors among others. More male than female actively participated in rice management. Women were not actively involved. Majority of the farmers who actively participated were 51 years and above. Some of the aged were unable to perform certain leadership functions and this affected participation. The youths were few and passively participated due to their negative attitude towards agriculture in general. Majority of the male had attained secondary education, and a few who had tertiary education actively participated but it was learned that the few were retirees who were trying to improve their livelihood by participating. Many women, on the other hand, had basic education, some could not read or write and this affected their participation. Having no title deeds and low benefit (income) from rice also affected level of participation in rice management. Rice was only grown once a season and the income made was not enough for many farmers, so they resorted to other off-farm activities. This too affected their level of participation. Although many farmers owned between 3-4 acres, this had no influence their rate of participation. It was concluded that many family conflicts in dividing the plots could have discouraged some farmers from participating actively.

5.0 Conclusion

Out of seven (7) variables tested, only one (1), farm size, did not have any significant influence on participation in rice irrigation management. The other six (6), gender, age, farmers' level of education, residential status, farm experience and benefits from rice farming had negative significant influence. Thus, the null hypothesis got rejected and alternative, "There is a significant relationship between the socio-economic characteristics of the farmers and level of participation". However, all variables had negative influence on participation in rice irrigation management in AIS and WKIS, in Kisumu County, Kenya. It is suggested that for small-scale farmers to succeed in rice irrigation management, all socio-economic constraints, and other constraints should be addressed at the same time. This should include review of the Irrigation Act to allow both male and female farmers to have more control over rice management. Enlightenment, motivation, and mobilization campaign should be put in place for farmers to know all their duties in management. There should be a stable, reliable market where they can sell their rice immediately after harvesting for motivation.

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TABLES FOR FINDINGS:

Table 4.1a: Distribution of gender and level of participation

Gender	Ahero Irrigation Scheme						West Kano Irrigation Scheme					
	Active		Passive		Total		Active		Passive		Total	
	F	%	F	%	f	%	F	%	F	%	f	%
Male	32	57	24	43	56	**65**	40	75	21	25	61	**68**
Female	9	30	21	70	30	**35**	8	28	21	72	29	**32**
Total	41		45		86	**100**	53		37		90	**100**

Source: Field survey data (2016)

Table 4.1b: Chi-Square Analysis of the Relationship between Gender and Farmers' Participation in Rice Irrigation Management in Ahero and West Kano Schemes

Gender	Ahero Irrigation Scheme			West Kano Irrigation Scheme		
	Active	Passive	Total	Active	Passive	Total
Male	32 (26.7)	24 (29.3)	56 (56.0)	40 (35.9)	21 (25.1)	61 (61.0)
Female	9 (14.3)	21 (15.7)	30 (30.0)	8 (15.5)	21 (13.5)	29 (29.0)
Total	41.0	45.0	86.0	53.0	37.0	90.0
	Calculated χ^2 = 5.769 Critical χ^2 at 0.05 significance level = 3.84 d.f = 1			Calculated χ^2 = 11.396 Critical χ^2 at 0.05 significance level = 3.84 d.f = 1		

Source: Field survey data (2016)

Note: Figures in brackets e.g. (26.7) are the expected values (calculated)

Table 4.2a: Distribution of Age and level of participation

Age (Years)	Ahero Irrigation Scheme						West Kano Irrigation Scheme					
	Active		Passive		Total		Active		Passive		Total	
	f	%	F	%	F	%	F	%	F	%	F	%
0 - 40	9	53	8	47	17	20	5	36	9	64	14	16
41 – 50	18	72	7	28	25	29	18		10		28	31
Over 50	39	89	5	11	44	51	36	64	12	36	48	53
Total	66		20		86	100	59		31		90	100
								75		25		

Source: Field survey data (2016)

Table 4.2b: Chi-Square Analysis of the Relationship between Farmers' Age and Participation in Rice Irrigation Management in Ahero and West Kano Schemes

Age	Ahero Irrigation Scheme			West Kano Irrigation Scheme		
	Active	Passive	Total	Active	Passive	Total
0 - 40	9 (13.0)	11 (4.0)	17 (17.0)	5 (9.2)	9 (4.8)	14 (14.0)
41 - 50	18 (19.2)	7 (5.8)	25 (25.0)	18 (18.4)	10 (9.6)	28 (28.0)
Over 50	39 (33.8)	5 (10.2)	44 (44.0)	36 (31.5)	12 (16.5)	48 (48.0)
Total	66	20	86	59	31	90
	Calculated χ^2 = 9.199 Critical χ^2 at 0.05 significance level = 5.99 d.f = 2			Calculated χ^2 = 7.437 Critical χ^2 at 0.05 significance level = 5.99 d.f = 2		

Source: Field survey data (2016)

Note: Figures in brackets e.g. (13.0) are the expected values (calculated)

Table 4.3a: Farmers' Education Status and Level of Participation

Education Level	Ahero Irrigation Scheme						West Kano Irrigation Scheme					
	Active		Passive		Total		Active		Passive		Total	
	F	%	F	%	f	%	F	%	f	%	f	%
Basic	20	54	17	46	37	43	20	48	22	52	42	47
Secondary	15		23		38	44	26		10		36	40
Tertiary	6	39	5	61	11	13	7	72	5	28	12	13
Total	41		45		86	100	53		37		90	100
		55		45				58		42		

Source: Field survey data (2016)

Table 4.3b: Chi-Square Analysis of the Relationship between Farmers' Level of Education and Participation in Rice Irrigation Management in Ahero and West Kano Schemes

Education	Ahero Irrigation Scheme			West Kano Irrigation Scheme		
	Active	Passive	Total	Active	Passive	Total
Basic	20 (17.6)	17 (19.4)	37 (37.0)	20 (24.7)	22 (17.3)	42 (42.0)
Secondary	15 (18.1)	23 (19.9)	38 (38.0)	26 (21.2)	10 (14.8)	36 (36.0)
Tertiary&	6 (5.2)	5 (5.8)	11 (11.0)	7 (7.1)	5 (4.9)	12 (12.0)
Total	41	45	86	53	37	90
	Calculated χ^2 = 7.836 Critical χ^2 at 0.05 significance level = 5.99 d.f = 2			Calculated χ^2 = 9.848 Critical χ^2 at 0.05 significance level = 5.99 d.f = 2		

Source: Field survey data (2016)
Note: Figures in brackets e.g. (17.6) are the expected values (calculated)

Table 4.4a: Farmers Residence Status and level of participation

Residence	Ahero Irrigation Scheme						West Kano Irrigation Scheme					
	Active		Passive		Total		Active		Passive		Total	
	F	%	F	%	f	%	F	%	f	%	F	%
Permanent	39	64	22	36	61	71	52	74	18	26	70	78
Non-permanent	7	28	18	72	25	29	5	25	15	75	20	22
Total	46		40		86	100	57		33		90	100

Source: Field survey data (2016)

Table 4.4b: Chi-Square Analysis of the Relationship between Farmers' Nature of Residence and Participation in Rice Irrigation Management in Ahero and West Kano Schemes

Residency	Ahero Irrigation Scheme			West Kano Irrigation Scheme		
	Active	Passive	Total	Active	Passive	Total
Permanent	39 (32.6)	22 (28.4)	61 (61.0)	52 (44.3)	18 (25.7)	70 (70.0)
Non-permanent	7 (13.4)	18 (11.6)	25 (25.0)	5 (12.7)	15 (7.3)	20 (20.0)
Total	46	40	86	57	33	90
	Calculated χ^2 = 9.204 Critical χ^2 at 0.05 significance level = 3.84 d.f = 1			Calculated χ^2 = 16.271 Critical χ^2 at 0.05 significance level = 3.84 d.f = 1		

Source: Field survey data (2016)
Note: Figures in brackets e.g. (32.6) are the expected values (calculated)

Table 4.5a: Distribution of Farm Size and Participation in Rice Irrigation Management

Farm Size (Acres)	Ahero Irrigation Scheme						West Kano Irrigation Scheme					
	Active		Passive		Total		Active		Passive		Total	
	f	%	f	%	f	%	F	%	f	%	F	%
1 2 3-4	6 18 36	38 67 84	10 9 7	62 33 16	16 27 43	19 31 50	10 15 32	45 56 78	12 12 9	55 44 22	22 27 41	24 30 46
Total	60		26		86	100	57		33		90	100

Source: Field survey data (2016)

Table 4.5b: Chi-Square Analysis of the Relationship between Farm Size and Participation in Rice Irrigation Management in Ahero and West Kano Schemes

Farm Size (Acres)	Ahero Irrigation Scheme			West Kano Irrigation Scheme		
	Active	Passive	Total	Active	Passive	Total
1	6 (11.2)	10 (4.8)	16 (16.0)	10 (13.9)	12 (8.1)	22 (22.0)
2	18 (18.8)	9 (8.2)	27 (27.0)	15 (17.1)	12 (9.9)	27 (27.0)
3-4	36 (30.0)	7 (13.0)	43 (43.0)	32 (26.0)	9 (15.0)	41 (41.0)
Total	60	26	86	57	33	90
	Calculated χ^2 = 5.287 Critical χ^2 at 0.05 significance level = 5.99 d.f = 2			Calculated χ^2 = 4.505 Critical χ^2 at 0.05 significance level = 5.99 d.f = 2		

Source: Field survey data (2016)

Note: Figures in brackets e.g. (11.2) are the expected values (calculated)

Table 4.6a: Distribution of farming experience and level of participation in rice irrigation management

Farming Experience (Years)	Ahero Irrigation Scheme						West Kano Irrigation Scheme					
	Active		Passive		Total		Active		Passive		Total	
	F	%	F	%	f	%	F	%	f	%	F	%
0 - 10 11 – 15 Over 15 **Total**	16 10 30 56	47 63 83	18 6 6 30	53 37 17	34 16 36 86	40 19 41 100	9 7 41 57	29 54 89	22 6 5 33	71 46 11	31 13 46 90	34 14 52 100

Source: Field survey data (2016)

Table 4.6b: Chi-Square Analysis of the Relationship between Farming Experience and Participation in Rice Irrigation Management in Ahero and West Kano Schemes

Farming Experience (Years)	Ahero Irrigation Scheme			West Kano Irrigation Scheme		
	Active	Passive	Total	Active	Passive	Total
0-10	16 (22.1)	18 (11.9)	34 (34.0)	9 (19.6)	22 (11.4)	31 (31.0)
11-15	10 (10.4)	6 (5.6)	16 (16.0)	7 (8.2)	6 (4.8)	13 (13.0)
Over 15	30 (23.4)	6 (12.6)	36 (36.0)	41 (29.1)	5 (16.9)	46 (46.0)
Total	56	30	86	57	33	90
	Calculated χ^2 = 10.188 Critical χ^2 at 0.05 significance level = 5.99 d.f = 2			Calculated χ^2 = 7.555 Critical χ^2 at 0.05 significance level = 5.99 d.f = 2		

Source: Field survey data (2016)

Note: Figures in brackets e.g. (22.1) are the expected values (calculated)

Table 4.7a: Distribution of Income from Rice and Level of Participation

Income From Rice (Kshs)	Ahero Irrigation Scheme						West Kano Irrigation Scheme					
	Active		Passive		Total		Active		Passive		Total	
	F	%	F	%	f	%	F	%	f	%	F	%
0-30,000	7	54	6	46	13	15	11	61	7	39	18	20
30,001-90,000	47		15		62	72	46	64	26	36	72	80
Over 90,000	6	76	5	24	11	13						
		55		45								
Total	60		26		86	100	57		33		90	100

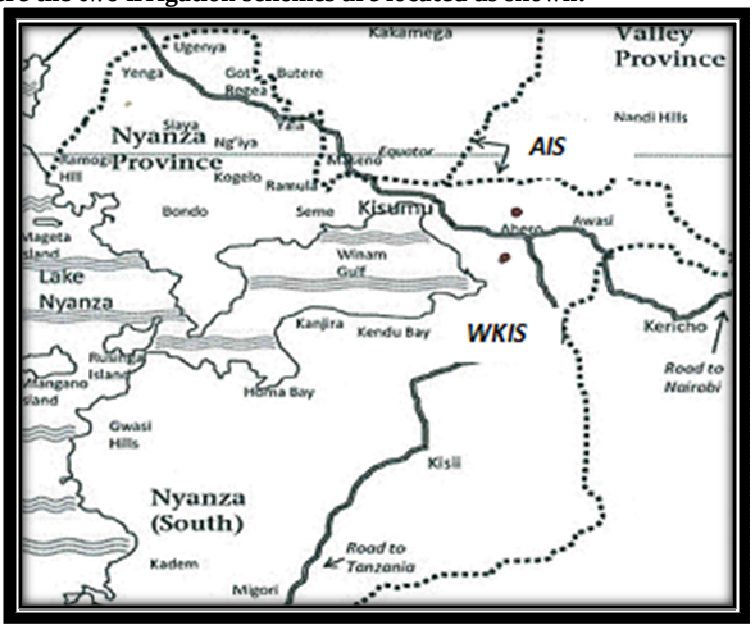
Source: Field survey data (2016)

Table 4.7b: Chi-Square Analysis of the Relationship between Farmers' Income from Rice and Participation in Rice Irrigation Management in Ahero and West Kano Schemes

Revenue from Rice (Kshs)	Ahero Irrigation Scheme			West Kano Irrigation Scheme		
	Active	Passive	Total	Active	Passive	Total
0-30,000	7 (9.1)	6 (3.9)	13 (13.0)	11 (11.4)	7 (6.6)	18 (18.0)
30,001-90,000	47 (43.3)	15 (18.7)	62 (62.0)	46 (45.6)	26 (26.4)	72 (72.0)
Over 90,000	6 (7.7)	5 (3.3)	11 (11.0)			
Total	60	26	86	57	33	90
	Calculated χ^2 = 13.023 Critical χ^2 at 0.05 significance level = 5.99 d.f = 2			Calculated χ^2 = 6.047 Critical χ^2 at 0.05 significance level = 3.84 d.f = 1		

Source: Field survey data (2016)
Note: Figures in brackets e.g. (9.1) are the expected values (calculated)

Kisumu County where the two irrigation schemes are located as shown:



AIS- Ahero irrigation scheme
WKIS- West Kano irrigation scheme