ISSN 2349-7807

International Journal of Recent Research in Commerce Economics and Management (IJRRCEM)
Vol. 8, Issue 4, pp: (80-85), Month: October - December 2021, Available at: www.paperpublications.org

INFLUENCE OF SOCIO-ECONOMIC FACTORS ON THE ADOPTION OF IRRIGATION TECHNOLOGIES AMONG SMALL-SCALE FARMERS IN NOGIRWET IRRIGATION SCHEME, BOMET COUNTY

Rono Reuben Kipngetich*, Kibett Joash Keino, Kibet Noah

Department of Agricultural Biosystems, Economics and Horticulture, University of Kabianga, Kericho, Kenya

*Corresponding author: Email address: rkrono@gmail.com

Abstract: **Previous studies show that most small-scale farmers acquire knowledge and adopt new agricultural technologies through contacts with extension services. Currently limited knowledge exists on the effect of socio-economic factors on the adoption of irrigation technologies among smallholder farmers in in Bomet County. To fill this knowledge gap, the study determined the influence of socio–economic factors on the adoption of irrigation technologies among smallholder farmers in Norgirwet Irrigation scheme in Bomet County. The Target population comprised of 400 small-scale farmers in Nogirwet Irrigation Scheme. The study adopted ex-post-facto research design. Simple random sampling technique was used to select a sample of 109 small-scale farmers. Data was collected using interview schedule and observation checklist. Data was analysed using frequencies, percentages, and Chi-square. The results revealed that 28% agreed that age played a significant role in adoption of irrigation technologies to a large extent, 55.1% to some extent and 16.8 were of contrary opinion. The results also showed that 4% agreed that gender played a significant role in adoption of irrigation technologies to a very large extent, 9% to a large extent, 26% to some extent, and 59% to a small extent. Only 9% were of contrary opinion. The results further revealed that 10.3% agreed that education played a significant role in adoption of irrigation technologies to a very large extent, 8.4% to a large extent, and 23.4% to some extent. 57.9% were of contrary opinion. The study recommends that relevant stakeholders, should come up with innovative irrigation solutions that will help boost production, more farmers need to be trained on the use of irrigation technologies as this intervention will help to cut the cost of production and help farmers to realize high-profit margins from their output.**

Keywords: **Socio-economic factors, Adoption, Irrigation technologies, Small-scale farmers.**

1. INTRODUCTION

Food security can simply be termed as the household to have an access to enough and nutritious food. Literature reveals that food security is influenced by factors such as adoption of new technologies and acquisition of knowledge. Studies have further shown that most small scale farmers acquire knowledge and adopt new technologies through contacts with extension services (Woods, 2012). All over the world, enough food is produced in order to attain the food security of a nation (Islam, 1995), however the number of people who are malnourished globally has been in the rise from 840 million to 925 million in 2010 (Food and Agriculture Organization, 1996), with approximately 98% living in third world countries (FAO, 2010).

Food insecurity in Kenya has increased in rural and in the urban areas. Approximately 51% and 38% of the rural and urban population respectively are not food secure (GOK, 2013). Bomet County like other parts of Kenya also experienced food shortage. The most important crops in the county are maize and beans, acting as both cash and subsistence crops (GoK, 2004). Food security is also a challenge to most households in Bomet County majority of who are small-scale farmers.

Successful production of crops relies on the proper use of inputs that will ensure that the environment is maintained as well as production of agriculture. These inputs are, cultivars adapted, population of plant, soil tillage, fertilizer application, weed, pest and disease control, harvesting, marketing and financial incentives. When soil moisture drops in the soil the production also drop because water is required in root development and also flowering, therefore soil moisture should be maintained for better production (Adu et al., 2014)

Modern irrigation technologies has been tested and it was found out to be suitable to the farmers that enjoy the economies of scale. For the famers with diseconomies of scale, who usually irrigate small farms with relatively small capital, such irrigation technologies tends to be expensive. This inadequate of simple, expensive and well adapted irrigation technologies that are suitable to the production conditions and the wants that the small scale farmers require in sub-Sahara Africa, is a common setbacks to the impacts aimed at food security in the entire continent (Brabben and Kay, 2000). Up to date variety of inexpensive, affordable irrigation options exist, including treadle pumps.

Water management is a decisive activity that targets to advance the status of water resources (Claudia, 2007). Water demand management on the other hand is defined with 5 elements: (1) decreasing the volume of water necessary to meet a particular chore; (2) accomplish the chore with less water or with water of low quality by varying the nature of the task; (3) decreasing losses from movement to the place that is required; (4) Change the time to off-peak periods; and (5) increasing the flexibility of the system to operate during periods of water scarcity. This definition is appropriate to users in both developed and developing countries. It also depicts how objectives of better use of water are interconnected with that of equality, protection of environment and participation of the public among others. Collectively, these objectives make demand of water management more of concept of governance than a set of techniques (David, 2006)

In small catchments like Norgirwet catchment, the degradation in water quality and water quantity is expected to increase as an impact of increased water demand. This impact is amplified by population increase and economic growth. Climate change and variability is expected to further aggravate this situation (Lamia *et al.*, 2015). Nogirwet is in the lower zones of Bomet County, which has the characteristic of low rainfall and clay soil, it is on this basis that irrigation technologies are adopted in Nogirwet.

For irrigation to function well the farmers are trained by the extension agents on technologies of irrigation; Because of this the farmers need to be educated on the technologies that work best, information on how to use, and come up with working demand for viable new technologies (Davidson *et al.*, 2001). The adoption of irrigation technologies by the farmers in Nogirwet is still low despite the efforts by extension to expose farmers to the technologies. Since limited knowledge exists on the role socio-economic factors play in the adoption of the irrigation technologies in Bomet County, the study determined their effects.

2. METHODOLOGY

2.1. Research Design

An ex-post-facto research design was adopted in the study. The term ex-post facto according to Landman (1988) is used to mean to an experiment of examining the effect of a naturally appearing treatment after it has occurred.

2.2 Sampling Procedure and Sample Size

Sarantakos (2005), defined sampling as choosing units of a study population that are to be included in the study in such a way that it will be a representative of the entire population. The sample size for this study will be calculated using Kothari's (2008) formula as follows:

$$\boldsymbol{n} = \frac{Z^2 \mathrm{P.q.N}}{e^2(\mathrm{N}-1) + Z^2 \mathrm{p.q}}$$

e where n= is the sample size for a finite population, q= sample size for a finite population, N= size of population which is the number of households, p= population reliability (or frequency estimated for a sample of size n), where p is 0.5 and a normal distribution of population p + q=1 and e = acceptable margin of error is 8% for this study.

z = 1.96 the standard variate at a given confidence level

Assuming 95% confidence level,

$$\boldsymbol{n} = \frac{Z^2 \mathrm{P.\,q.\,N}}{e^2(\mathrm{N}-1) + Z^2 \mathrm{p.\,q}}$$

$$\boldsymbol{n} = \frac{1.96^2 * 5 * 5 * 400}{0.0064(400-1) + 1.96^2 * 5 * 5}$$

$$\boldsymbol{n} = \frac{384.16}{2.5536 + 0.9604}$$

= 109

By applying this formula the sample size was 109.

2.3 Sampling procedure

Multistage sampling procedure was used, multistage sampling is the taking of samples in stages using smaller and smaller sampling units at each stage. In the first stage, Bomet County was purposively selected. In the second stage systematic random technique was used to pick 109 from the target population. The list of small scale farmers was obtained from extension staff. The assumption is that the list was prepared in a random number. A table of random numbers was used to determine the starting point and then from that point every 4^{th} number from the list was picked until the desired sample sized is achieved.

2.4. Data Collection Instruments

Two main tools of collection of data were; an interview schedule and an observation checklist. The interview schedule was used to collect information from the small scale farmers. It contained five sections. Section A collected information on farmers' characteristics. Section B to G collected information corresponding to the four objectives stated in chapter one. The observation checklist contained a list of items relating to the irrigation technologies, irrigation infrastructure and food security.

2.5 Data Analysis and Presentation

After collecting the data, it was inspected for accuracy and completeness. The data pieces was then numbered and coded before entering into a computer matrix using SPSS version 21. Objective one to five were analyzed using frequencies, percentages and mean. Hypothesis one to four were tested using Chi square test. The results were presented using tables, graphs and pie charts.

3. RESULTS AND DISCUSSION

3.1 Influence of age on adoption of irrigation technologies

Respondents were asked to indicate the influence of age on adoption of irrigation technologies and the results were presented in Table 3.1. Results show that 28% agreed that age played a significant role in adoption of irrigation technologies to a large extent, 55.1% to some extent and 16.8 were of contrary opinion.

Table 1: Influence of age on adoption of irrigation technologies

Responses	Frequency	Percent
To a small extent	18	16.8
To some extent	59	55.1
To a large extent	30	28.0
Total	107	100.0

Source: Author's Computation from Survey Data, 2020

Concerning age and adoption of technology Murekefu, (2013) established that older people engage in adoption of technology. Furthermore, age is considered to be an important factor that influences the probability of farmers' adoption of the new technologies since it is a primary Latent characteristic in adoption (Machuki, 2013). The current results are similar to the study of Harford (2009) who argued that age of the farmers tend to influence the adoption of new farming practice. He argued that younger farmers adopt farming practices that are less demanding cropping systems with low transactional cost associated with them. Furthermore, older farmers tend to be risk adverse and may avoid innovations in an attempt to avoid risk associated with the initiative.

Rukuni et al. (2006) argued that being older creates a conservative feeling among farmers and hence resistance to change. Also Baudron (2001), found that chances of participation in conservation farming increased with age because youths have little appreciation on the importance of agricultural activities in most rural set ups and will take marginal effort to expand these activities.Therefore there is a relationship between age of the farmer and adoption of Conservation Agriculture. Same results found by Mazimavi and Twomlow (2009), that there is a positive correlation of age and adoption of conservation practices in Zimbabwe. Also age was found to be positively influence adoption of sorghum in Burkina Faso (Adesina and Baidu-Forson, 1995). In contrast, age has been found to be either negatively correlated with adoption, or not significant in farmers' adoption decisions, in the study of adoption of Hybrid Cocoa in Ghana (Boahene et al., 1999).

3.2 Influence of Gender on adoption of irrigation technologies

Respondents were asked to indicate the influence of gender on adoption of irrigation technologies and the results were presented in Table 4.6. Results showed that 4% agreed that gender played a significant role in adoption of irrigation technologies to a very large extent, 9% to a large extent, 26% to some extent, and 59% to a small extent. Only 9% were of contrary opinion. The results means that gender played a significant role on the adoption of technology. This finding has been refuted by Doss and Morris (2001) in their study on factors influencing improved maize technology adoption in Ghana, and Overfield and Fleming (2001) studying coffee production in Papua New Guinea show insignificant effects of gender on adoption.

Table 2: Influence of Gender on adoption of irrigation technologies

	Frequency	Percent	Valid Percent	Cumulative Percent
Not at all	9	8.4	8.4	8.4
To a small extent	59	55.1	55.1	63.6
To some extent	26	24.3	24.3	87.9
To a large extent	9	8.4	8.4	96.3
To a very large extent	4	3.7	3.7	100.0
Total	107	100.0	100.0	

Source: Author's Computation from Survey Data, 2020

Semgalawe (2008) argued that gender of the household head determines access to technical information provided by extension agents. Due to social barriers, male extension agents tend to address male-headed households. Also, female-headed households, who are mainly widows, divorcees and unmarried women, have limited access to production resources such as land. However these findings contradict with those of Doss and Morris (2001) who found insignificant influence of gender on adoption in their study on factors influencing improved maize technology adoption in Ghana.

3.3 Influence of education level on adoption of irrigation technologies

Respondents were asked to indicate the influence of education level on adoption of irrigation technologies and the results were presented in Table 3.3. Results show that 10.3% agreed that education played a significant role in adoption of irrigation technologies to a very large extent, 8.4% to a large extent, and 23.4% to some extent. 57.9% were of contrary opinion.

Table 3: Influence of education level on adoption of irrigation technologies

	Frequency	Percent	Valid Percent	Cumulative Percent
Not at all	62	57.9	57.9	57.9
To a small extent	25	23.4	23.4	81.3
To some extent	9	8.4	8.4	89.7
To a large extent	11	10.3	10.3	100.0
Total	107	100.0	100.0	

Source: Author's Computation from Survey Data, 2020

Previous studies have shown that education is thought to reduce the amount of complexity perceived in a technology thereby increasing a technology's adoption. According to Ehler and Bottrell (2000), one of the hindrances to widespread adoption of IPM as an alternative method to chemical control is that it requires greater ecological understanding of the production system. These results are consistent with the expectation since education provides farmers with more information pathways (Faturoti *et al.*, 2006). Higher level of formal education equips farmers with more knowledge and skills hence facilitate the awareness of importance to adopt improved technologies.

Same results by Perservance et al. (2012) in the study of adoption and efficiency of selected conservation farming technologies found that educated people tend to reject agriculture activities for white color jobs in Madziva in Zimbabwe. Some authors have reported insignificant or negative effect of education on the rate of technology adoption (Khanna, 2001; Samiee, Rezvanfar, & Faham, 2009). Studying the effect of education on technology adoption, (Uematsu & Mishra, 2010) reported a negative influence of formal education towards adopting genetically modified crops. Since the above empirical evidence have shown mixed results on the influence of education and adoption of new technology, more study need to be done in order to come up with a more consistent result.

3.4 Chi-square test for the null hypothesis of socio-economic factors

Table 4 presents result of the Chi–Square test of the null hypothesis that socio-economic factors has no significance effect on adoption of irrigation technologies.

Table 4: Chi-Square test

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	24.470	6	.000
Likelihood Ratio	26.024	6	.000
Linear-by-Linear Association	7.489	1	.006
N of Valid Cases	107		

Source: Author's Computation from Survey Data, 2020

The results show statistical significance ($\chi 2 = 24.470$, df=6, p = 0.000) since the alpha value was set at 0.05. We therefore reject the null hypothesis (H0) which states that socio-economic factors has no significance effect on adoption of the irrigation technologies and conclude socio-economic factors significantly affect adoption of irrigation technologies.

4. CONCLUSIONS

The results for objective of this study on the socio-economic factors revealed that age influence adoption irrigation technologies. The results revealed that 28% agreed that age played a significant role in adoption of irrigation technologies to a large extent, 55.1% to some extent and 16.8 were of contrary opinion. The results also showed that 4% agreed that gender played a significant role in adoption of irrigation technologies to a very large extent, 9% to a large extent, 26% to some extent, and 59% to a small extent. Only 9% were of contrary opinion. The results means that gender played a significant role on the adoption of technology. The results further revealed that 10.3% agreed that education played a significant role in adoption of irrigation technologies to a very large extent, 8.4% to a large extent, and 23.4% to some extent. 57.9% were of contrary opinion. Therefore in conclusion, socio-economic factors significantly affect adoption of irrigation technologies.

4.1 Recommendations

The fact that the agricultural sector in Kenya contributes a lot to economic development is proof enough for those involved in the field to come up with appropriate measures for improvement. Since the smallholder households in Bomet County are engaged in agriculture as their main source of livelihood, the emphasis for increased income should be confined to the sector. Therefore, from the empirical results of this study, the following are the proposed policy recommendations:

1. Relevant stakeholders, county and national governments should come up with innovative irrigation solutions that will help boost production among small scale farmer households.

2. More farmers need to be trained on the use of irrigation technologies as this intervention will help to cut the cost of production and help farmers to realize high-profit margins from their output.

3. Finally, policymakers should come up with policy directives that encourage intensification of farm production that would eventually increase agricultural productivity and incomes among small-scale farmer households.

ACKNOWLEDGEMENTS

The paper is an extract based on the author's Msc. Work at the Department of Agricultural Extension and Education, University of Kabianga, Kenya. I would like to thank my university supervisors, anonymous reviewers and the editor for their helpful comments and suggestions on this article.

Conflict of interests

The authors declare they have no competing interests

REFERENCES

[1] Brabben, T. E., and Kay, M. (2000). *Treadle pumps for irrigation in Africa* (No. 1). Food & Agriculture Org..

[2] David, H. (2006). The growth in the social security disability rolls: a fiscal crisis unfolding. *Journal of Economic perspectives*, *20*(3), 71-96.

[3] Doss, C. R., & Doss, C. (2006). Analyzing technology adoption, challenges and limitations of micro studies. *Agricultural economics*, *34*, 207-219.

[4] Faturoti, B. O., Emah, G. N., Isife, B. I., Tenkouano, A., & Lemchi, J. (2006). Prospects and determinants of adoption of IITA plantain and banana based technologies in three Niger Delta States of Nigeria. *African Journal of Biotechnology*, *5*(14).

[5] Food and Agriculture Organization (1996). *World food summit*. Rome: Food and Agriculture Organization.

[6] Food and Agriculture Organization (2010). Gestión del riesgo de sequía y otros eventos climáticos en Chile. Food and Agriculture Organization of the United Nations (FAO). Representation in Chile.

[7] Islam, N. (Ed), (1995). Population and food in the early twenty-first century: meeting future food demands of an increasing population. Washington, DC. : Intl Food Policy Research Inst.

[8] Khanna, M. (2001). Sequential adoption of site-specific technologies and its implications for nitrogen productivity: A double selectivity model. *American journal of agricultural economics*, *83*(1), 35-51.

[9] Kothari, C. R. (2004). *Research methodology: Methods and techniques*. New Age International.

[10] Landman, K. A. (1988). The continuous-flow gravity thickener: Steady state behavior. *AIChE journal*, *34*(2), 239-252.

[11] Adu, G. B., Abdulai, M. S., Alidu, H., Nustugah, S. K., Buah, S. S., Kombiok, J. M., and Etwire, P. M. (2014). Recommended production practices for maize in Ghana. *Accra: AGRA/CSIR*.