DBA AFRICA MANAGEMENT REVIEW

VOLUME 12 NO 1

2022

EFFECT OF SUBSIDISED CREDIT FINANCING ON THE FINANCIAL PERFORMANCE OF SMALLHOLDER FARMERS IN KENYA: A CASE OF KIMIRA-OLUCH FARM IMPROVEMENT PROJECT

CHARLES M. RAMBO

A Quarterly publication of the Department of Business Administration,
Faculty of Business and Management Sciences
University of Nairobi

ISSN NO: 2224-2023

http://uonjournals.uonbi.ac.ke/ojs/index.php/DBAAMR
April 2022 Vol 12 No 1 Pgs 88-105

ISSN - 2224-2023

DBA Africa Management Review

Received Date
01/11/2021
Accepted Date
24/03/2022

EFFECT OF SUBSIDISED CREDIT FINANCING ON THE FINANCIAL PERFORMANCE OF SMALLHOLDER FARMERS IN KENYA: A CASE OF KIMIRA-OLUCH FARM IMPROVEMENT PROJECT

Charles M. Rambo[1]

Abstract

The Kimira-Oluch Smallholder Farm Improvement Project was initiated in 2003 to reduce poverty by increasing food security and income for about 3,000 households. The appraisal study conducted in 2010 revealed that the project had not achieved its productivity targets, primarily due to farmers' inability to access essential inputs and equipment. In response to the situation, a subsidised credit facility was introduced to support needy farmers. The study's purpose was to examine whether the intervention improved beneficiaries' financial performance, which was measured in terms of average annual sales. To achieve this, a quasi-experimental design and a mixed methods approach guided the research process. Data were sourced in October 2018 from 304 smallholder farmers, including 174 who accessed credit and 130 didn't. Key findings show that access to the credit facility was skewed in favour of male farmers; the amount of credit accessed significantly correlated with farmers' age, size of land and pre-intervention income level; while post-intervention annual sales realised by beneficiaries and non-beneficiaries were significantly different. Despite this, the intervention caused only a small effect size of about 23%, as indicated by Cohen's d statistic. The findings demonstrate that integrating subsidised credit facilities in smallholder irrigation projects improved food security and income. This implies that subsidised financing interventions remain important enablers of smallholder farmers and contributors to poverty reduction in rural settings. Consequently, the study advocates for the continuation of the subsidised credit facility for smallholder farmers in the project, and initiation of similar interventions in other developing countries.

Keywords: Credit, Financing, Financial Performance, Smallholder, Farmer, Irrigation

[1] Faculty of Business and Management Sciences, University of Nairobi, Kenya - *crambo@uonbi.ac.ke*

Introduction

Agriculture is the main source of livelihood in Kenya, contributing up to 30% of the National Gross Domestic Product (GDP) and providing direct and indirect employment opportunities to about 80% of the national workforce, mainly in rural areas (International Finance Corporation [IFC], 2014; Government of Kenya, 2018). In addition, the sector provides 70% of exports and 45% of government income. The sector is estimated to have a further indirect contribution of nearly 27% of GDP through linkages with manufacturing, distribution, and other related service sectors (Government of Kenya, 2018). Smallholder farmers account for the bulk of agricultural production in Kenya, with over 70% of crop and livestock produce attributed to them (Okech, Kiragu, Sing'ora, Ndonga, Olan'g & Kenyanito, 2017). In view of this, agricultural interventions seeking to increase smallholder farmers' productivity and returns are highly prioritised.

About 80% of Kenya's land mass is either Arid or Semi-Arid (ASAL), albeit with immense potential for agricultural production. In such areas sustainable crop production can be achieved better through efficient irrigation projects (Government of Kenya, 2018). Kenya's Vision 2030 recognises the importance of crop irrigation in national development. More specifically, irrigation is identified as an important strategy for improving food security, enhancing household income and reducing poverty in rural areas (Government of Kenya, 2018; Simiyu, 2010). In line with this assertion, Valipour (2015) explains that irrigation has a key role to play in poverty reduction in developing countries by improving production, creating employment opportunities and stabilising incomes. In relation to this, Ngenoh, Kirui, Mutai, Maina and Koech (2015) affirm that irrigation increases yield of most crops by between 100% and 400%; and it is predicted that by 2045; about 70% of global grain production will be realised through irrigation.

Smallholder irrigation projects are described as community-based, demand-driven farmer-managed irrigation initiatives (Simiyu, 2010; Gakundi, 1998). Based on the bottom-up approach to development, community members, particularly farmers are involved in all the stages of project establishment, including planning, capitation funding, implementation, operations and maintenance, management, monitoring and evaluation, among others (Gakundi, 1998). Simiyu (2010) further explains that under smallholder irrigation projects, farmers share water from the same source to irrigate their crops; and individuals decide on key farming activities, including the types of crops to grow, as well as when and how to grow them. Mendes and Paglietti (2015), also elaborates that in smallholder irrigation projects, the size of land allocated to individual farmers ranges between 0.2 and 2 ha, which is equivalent to 0.494 and 4.942 acres.

In Kenya, smallholder irrigation has been promoted by the Government in collaboration with various stakeholders to improve food security, nutrition, employment opportunities and income; thereby, reduce poverty in line with national development agenda (Clark, Harris, Biscaye, Gugerty & Anderson, 2015; IFC, 2014; Simiyu, 2010). As noted separately by Mboi (2018) and Ngenoh *et al.* (2017) smallholder irrigation practices are not new in Kenya's development agenda. The focus on smallholder irrigation started way back in the late 1970s through to early 1980s, when the Smallholder Irrigation Scheme Development Organisation (SISDO) was established by the Ministry of Agriculture, in collaboration with the Ministry of Finance. The purpose of SISDO was to manage a revolving fund to support the development of smallholder irrigation projects across the country. Even though SISDO used the cost-recovery approach to develop new

schemes using funds recovered from existing ones, the initiative failed due to mismanagement, political interference, corruption and under-capitation (Mboi, 2018; Ngenoh *et al.*, 2017; Simiyu, 2010). SISDO's breakdown left behind a financing void for upcoming smallholder irrigation projects such as Kimira-Oluch, with far-reaching implications on productivity, income and poverty levels.

The Kimira-Oluch Smallholder Farm Improvement Project (KOSFIP) was initiated in 2003 by the Government of Kenya in partnership with the African Development Bank (AfDB). A feasibility study conducted in early 2003 proposed a smallholder irrigation project to exploit the resource potential of the two river basins, namely, Awach Kibuon and Awach Tende. In this regard, AfDB provided a loan of US$ 33.5 million and a grant of US$ 1.7 million, while GoK contributed US$ 4.6 million and the community mobilised US$ 0.7 million to finance the KOSFIP (AfDB, 2006). The project's overriding goal was to reduce poverty by increasing food security and improving income for about 3,000 households (AfDB, 2006). This was achieved by implementing three sets of activities.

The first set was about developing irrigation infrastructural systems, establishment of management structures, including Irrigation Water User Associations (IWUA), and organising the scheme into 97 blocks, including 44 in Kimira and 53 in Oluch; in addition to mitigating environmental risks around the project. The second set of activities involved developing farmers' entrepreneurial and managerial skills through training; in addition to providing essential support in terms of market information, linkages and agricultural extension services. Farmers grew multiple crops, including tomatoes, cabbages, onions, beans, cowpeas, maize, rice, sorghum and fruits, among others. The third set of activities included setting up coordination, as well as monitoring and evaluation systems (Clark *et al.*, 2015; AfDB, 2006).

In 2010, the Lake Basin Development Authority (LBDA) conducted a review process, which among other findings, revealed that the project had not achieved its productivity targets, with key constraints identified as high poverty levels, inability to access essential farm inputs and equipment due to low capital base (LBDA, 2011). In response to the evaluation's recommendations, the Government in partnership with AfDB introduced a subsidised credit financing facility to support needy farmers in accessing necessary inputs and equipment, in order to improve productivity and income. The study was motivated by five years down the line, little has been documented in the academic circles about the value added by the intervention on the financial performance of beneficiary farmers. The resultant shortage of academic information about impact of the financing intervention on beneficiary farmers' financial performance is what motivated this study. The project was chosen because of the high poverty levels in Homa Bay County, and more particularly in the Kimira-Oluch community, where the project was situated (AfDB, 2006). The study was expected to generate information that would inform stakeholders, influence further collaboration and resourcing of the project to amplify its impact on the financial performance of smallholder farmers. This is likely to go a long way in countering the prevalence of poverty in the community as well as in the County.

Statement Of The Problem

Limited access to credit financing is a pervasive challenge to smallholder farmers, not only in Kenya, but also in other developing countries (Mboi, 2018; Okech *et al.*, 2017; IFC, 2014; Clark *et al.*, 2015; Irungu, 2013; Quartey, Undry, Al-hassan & Seshie, 2012). More specifically, Mboi (2018) noted that about 63% of registered smallholder irrigation

projects in Kenya operate below capacity due to various factors, including lack of seed funding; which in turn, limits their potential to contribute to food security and improve incomes. Along the same line of thought, Okech *et al.* (2017) observed that despite the important role of smallholder irrigation in Kenyan economy, investment in the sub-sector remains dismal; thereby, undermining its contribution to food security, employment and better incomes for rural populations. Okech *et al.* (2017) further argued that even though a number of commercial financial institutions have established agribusiness units, the share of funds designated for agribusiness activities, as a percentage of outstanding national credit, remains below 5%. On the same note, a study commissioned by IFC found that even though smallholders play a key role in increasing food supplies, they tend to have minimal or no access to formal credit financing; which in turn, limits capacity to invest in necessary inputs and technologies that would improve the returns (IFC, 2014).

Thus, the unmet need for credit financing by smallholder farmers remains a conspicuous challenge in the agricultural sector. In view of this, smallholder farmers often cite limited access to subsidised credit as the main factor behind sub-optimal productivity and low incomes. The financing gap undermines the potential of smallholder irrigation projects such as KOSFIP to realise their objectives of reducing poverty by improving household food security and income levels. Despite this, little is documented about effect of the credit financing initiative introduced by the Government and AfDB, in terms of beneficiaries' financial performance (Okech *et al.*, 2017; LBDA, 2011). This study responded to the information gap by determining the financing intervention's effect on farmers' financial performance, which was measured in terms of average annual sales. It distinguished itself from its predecessors in terms of the approach and design used. In this regard, the study used secondary information captured by the project's monitoring and evaluation system, to determine effect of the credit financing intervention on farmers' financial performance. This necessitated adoption of a quasi-experimental design to establish the difference in average annual sales before and after the intervention. The study's objective was to determine the difference between the average annual sales among beneficiaries and non-beneficiaries of the subsidised credit facility in the KOSFIP. The study sought to determine the truth value of the null hypothesis stating that: there is no significant difference in the post-intervention average annual sales between farmers in the experimental and control groups.

Literature Review

Smallholder irrigation projects are essential for increasing agricultural production, ensuring food security, creating employment opportunities, improving household incomes, and reducing poverty in rural areas. In view of this, developing smallholder irrigation projects and supporting farmers to realise their full potential through subsidised credit financing, is an important strategy for reducing poverty in developing countries (Mendes & Paglietti, 2015). Studies conducted in various settings have established a relationship between credit financing and the financial performance of smallholder farmers, including those practicing crop irrigation. For example, Mboi (2018) identified the level of funding as one of the factors influencing the financial performance and sustainability of smallholder irrigation schemes in Kirinyaga, Kenya. The study amplified the need for the Government and development partners to establish flexible credit facilities from where smallholders can access subsidised financing services to optimise productivity. A little earlier, Ansah (2017) found that access to credit financing was skewed in favour of experienced farmers with bigger households and farm sizes. Although access to input credit improved crop

yields, the intervention was found to have no significant effect on farmers' income primarily due to low crop yields. Thus, the intervention's effect was described as 'unsatisfactory'. In their study, Mdemu, Mziray, Bjornlund and Kashaigili (2017) identified lack of subsidised credit financing as the key factor influencing the financial performance of smallholder irrigation farmers in Tanzania. More explicitly, the study reported that lack of a suitable credit financing denied farmers timely access to essential inputs, equipment and transport to the market; thereby, affecting financial performance.

Irungu (2013) established a significant relationship between agricultural credit financing and the financial performance of smallholder farmers in Murang'a County, Kenya. More specifically, the study reported that limited access to credit financing had the highest negative effect on performance, ahead of factors such as family size and farm acreage. Based on the findings, the study hyped the importance of credit financing for smallholder farmers, as a strategy for reducing poverty among rural populations. As part of recommendations, the study urged the Government and sector players to initiate credit financing schemes that would respond to the financing needs of smallholder farmers; thereby, enhance productivity, profitability and financial performance.

A study conducted by Adebayo, Sanni and Baiyegunhi (2012) examined the impact of microcredit services provided by the United Nations Development Program on the performance of smallholder farmers in Nigeria. Even though the facility enabled farmers to access essential inputs, the analysis revealed lack of a significant effect on performance indicators such as crop yields, household food security and income. To support the findings, 37% of the beneficiaries noted that the credit facility was too little to cause a significant effect, 34% complained about high interest rates; while 15% claimed that the repayment period was too short. Quartey *et al.* (2012) also established a significant association between access to seed funding by rural smallholder farmers and output factors such as productivity level, quality of products, ability to meet market needs and level of income. Reportedly, Organisations providing credit facilities perceived smallholder farmers as 'high risk clients', which affected their chances of accessing credit financing.

Ashraf, Giné and Karlan (2009) examined impact of a credit facility provided by an NGO on the financial performance of smallholder farmers in Kenya. The results showed that farmers in the treatment group achieved higher crop yields and lower marketing costs than their counterparts in the control group. Nonetheless, the study found that the credit facility had no significant change on household income, meaning that the level of production was sub-optimal. However, among first time beneficiaries, the study revealed up to 32% improvement in household income, when compared to farmers in the control group. This demonstrated that providing subsidised credit facilities to smallholder farmers has the potential of boosting income.

Furthermore, Kohansal, Ghorbani and Mansoori (2008) identified limited access to credit financing as a key impediment to Iranian smallholder farmers, which also influenced the level of investments and income. Although the later varied positively with the amount of credit accessed, the study revealed lack of a significant change in income - a situation that was attributed to intervening factors such as diversion of funds to meet family consumption and limited knowledge about management of credit funds. In the same year, Mohamed and Temu (2008) established a significant association between access to formal credit financing by smallholder farmers and the intensity of agricultural technology adoption. More specifically, the relationship was found to

be significant at $\rho \leq 0.01$ error margin, which prompted rejection of the null hypothesis postulating lack of a significant difference between credit beneficiaries and non-beneficiaries in terms of the intensity of technology adoption. Based on the findings, the authors explained that formal credit transferred the purchasing power to smallholder farmers; thereby, enabling them to afford new production technologies. The authors asserted that the higher the technology adoption index, the higher the productivity and incomes. Nonetheless, the credit financing facilities were accessed by only a small proportion of farmers.

Limited access to subsidised credit financing was also identified by Grimm and Ritcher (2008) as a key factor constraining the productivity and financial performance of smallholder farmers in developing countries. More specifically, the study noted that in Africa, less than 10% of the population had access to credit financial services, and few financial products were available for smallholder irrigation farmers. More than a decade later, the situation has not improved in most African countries. The more the financial sector develops the more the smallholder farmers are pushed to lower echelons of clients ineligible for credit financing. Despite this, Grimm and Ritcher (2008) established a connection between access to credit financing by smallholder farmers and various positive outcomes, including higher returns in terms of crop yields and a continuous cash flow between farming seasons. To support the findings, the authors explained that credit financing services enabled farmers to invest in equipment, inputs and technology; which in turn, influenced productivity level. Based on the findings, the study emphasized the need to deepen financing services as a strategy for optimising the productivity of smallholder irrigation projects (Grimm & Ritcher, 2008).

A little earlier, Alila and Atieno (2006) established a significant relationship between access to formal credit by smallholder farmers and a number of performance indicators. More specifically, the authors noted that limited access to credit among smallholder farmers, particularly women, restricted the range of activities, the type of technology used and the scale of operations adopted by farmers. The authors further noted that although various institutions had invested in the financing of agricultural activities, the actual investment in the sector remained below the level of demand; and those operational were inaccessible to smallholder farmers due to stringent conditions. Similarly, Spio (2002) found that smallholder farmers who accessed credit and those who had not were significantly different in terms of productivity level, size of land cultivated, amount of input and income. However, the finding was attributed to both credit financing and farmers' pre-existing attributes. In this regard, the analysis revealed a difference of up to 40% in the productivity of credit financing beneficiaries and non-beneficiaries, of which 21% was directly linked to credit financing. The findings suggested that credit financing can increase the productivity and financial performance of smallholder farmers by up to 21%.

The extant literature reveals that credit financing is an indispensable component of projects promoting smallholder agricultural production. As investment in inputs increase so do the odds of farmers expanding production, realising higher returns, better food security, low prevalence of nutritional disorders, and better incomes. Notably though, accessing credit facilities by smallholder farmers remains a pervasive challenge in most developing countries, including Kenya. Thus, by providing the subsidised credit financing to smallholder farmers in the KOSFIP, the Government and AfDB set a valuable foundation for the project to achieve its objectives of reducing poverty and enabling farmers achieve a life of dignity

and prosperity. Even though academic studies conducted in various geo-political contexts suggest that providing subsidised credit facilities to smallholder farmers is likely to improve their financial returns, no such study had been conducted in the Kimira-Oluch community to evaluate the impact of KSFIP on farmers' financial performance. This information gap motivated the study.

Methodology

A quasi-experimental design was applied to guide the research process. The design was chosen because its demands, in terms of meeting random assignment criteria, are less costly compared to that of true experimental designs. The design was also chosen because it's less vulnerable to most validity threats associated with non-experimental designs, including history, maturation, testing, mortality and instrumentation (Fisher & Foreit, 2002). However, because the units are not randomly assigned to experimental and control groups, the design is vulnerable to selection bias (Fisher & Foreit, 2002). White & Sabarwal (2014) confirms that quasi-experimental designs have no restrictions of random assignment of elements into the experimental and control groups; however, they are able to control for many validity threats. This study applied the *non-equivalent control group design*, which according to Fisher & Foreit (2002), is the most frequently used under the quasi-experimental designs. The design has two groups, viz. experimental and control, but which are not randomly constituted. The design can be schematically illustrated as indicated below: -

Experimental group	**EO_1**	**X**	**EO_2**
Control group	**CO_1**		**CO_2**

In this study, the *experimental group* consisted of needy smallholder farmers who accessed subsidised credit provided by the Government of Kenya in collaboration with AfDB. EO_1 is the pre-intervention observation or measurement of the dependent variable among members of the experimental group. In this study, the dependent variable was the financial performance of smallholder farmers, which was measured in terms of average annual sales of farm produce. The investigator sourced information about average annual sales each smallholder farmer in the scheme from monitoring records maintained by LBDA, which is the agency tasked management of the irrigation project. The investigator captured information over a period of five financial years prior to the intervention, viz. 2007/08, 2008/09, 2009/10, 2010/11 and 2011/12. The information was aggregated and designated the 'pre-intervention average annual sales'.

More still, *X* is the intervention, which in this study, was the subsidised credit financing provided to needy smallholder farmers in the 2012/13 financial year. The intervention entailed training farmers on financial management, organising farmers into groups and issuing subsidised credit. These activities took the better part of 2012/13. EO_2 is the post-intervention observation or measurement of the dependent variable among members of the experimental group. Again, this involved sourcing information about average annual sales from the management's monitoring records over a period of five financial years after the intervention, namely, 2013/14, 2014/15, 2015/16, 2016/17 and 2017/18. The information was aggregated and designated the 'post-intervention average annual sales'. The *control group* consisted of smallholder farmers in the irrigation scheme who didn't access the credit facility initiated by the Government in collaboration with AfDB because they didn't meet eligibility criteria, covering various socio-economic indicators, including employment status, credit history, income level, type of housing, as well as ownership of land, farm equipment and livestock, among others. CO_1 indicates the first measurement of average

annual sales of farm produce in the control group, which coincided with the pre-intervention measurement in the experimental group; CO_2 represents the second measurement of the dependent variable, which was done concurrently with post-intervention measurement in the experimental group; the broken line shows that study elements, in this case, smallholder farmers were not randomly assigned into the experimental and the control groups; while the arrow signifies duration between the pre- and post-intervention measurements, which in this case was ten years. In measuring farmers' financial performance, the investigator also captured information on indicators such as farmers' gender, age, land size and pre-intervention income. It was assumed that the credit facility enabled all beneficiaries to access farm inputs, including seeds/seedlings, fertiliser, and labour.

Mixed methods approach was applied to source, process and analyse quantitative and qualitative information. The following publications provide detailed information about the methods applied in this study (Bowen, Rose & Pilkington, 2017; Creswell & Plano, 2011). The study targeted smallholder farmers, undertaking farming activities at KOSFIP in Homa Bay County. The project's management documents showed that about 3,000 farmers were involved in the irrigation scheme. The project was chosen because of the high poverty levels in the Kimira-Oluch catchment area (AfDB, 2006), lack of academic information on the impact of the project on farmers' income and wellbeing, as well as the need to inform stakeholders, influence further collaboration and resourcing of the project to amplify its impact in the community.

To sample the targeted participants, the irrigation scheme was grouped into primary and secondary clusters. Primary clusters included the two constituent schemes, namely, Kimira and Oluch; while secondary clusters included the blocks. Project records provided by the Management indicated that the irrigation scheme was organized into 97 blocks, including 44 in Kimira and 53 in Oluch. From each primary cluster, secondary clusters were sampled randomly from the project register and the owners contacted for interviews. Based on the population of 3,000 farmers, Fisher's formula was applied to obtain a representative sample, as follows:

$$n_i = \frac{p(1-p)}{\left[\left(\frac{\alpha}{Z}\right)^2 + p(1-p)/N_i\right]} = \frac{0.5(1-0.5)}{\left[\left(\frac{0.05}{1.96}\right)^2 + 0.5(1-0.5)/3000\right]}$$

$$= 340.551 \quad (1)$$

Where: n_i is the sample size, N_i is the population, p is the estimated population variance, which by default is set at 0.5. In addition, α is the error margin, which by default is set at 0.05, while Z is the confidence level, set at 95%. Notably, 95% confidence level is equivalent to 1.96 on the normal distribution curve (Fink, 1995). The sample size indicated in formula 1 was corrected for design effects using the correction factor in formula 2:

$$nf = \frac{ni}{1+\frac{ni}{Ni}} = \frac{340.551}{1+\frac{340.551}{3000}} = 305.834 \quad \text{.....(2)}$$

Where *nf* is sample size correction factor, n_i is the computed sample size: 340.551, N_i is the population: 3,000. The correction process obtained a sample size of 305.8 ≈ 306 farmers. The sample size was divided proportionately between the two constituent irrigation schemes based on the distribution of blocks; and to ensure equitable representation. The process obtained 139 (45.4%) farmers for Kimira and 167 (54.6%) for Oluch Schemes. Data were collected in October 2018, using a fact sheet to capture secondary information about annual sales of farm produce over a period of ten years, broken into two epochs, viz. 2007/08 to 2011/12, as well as 2013/14 to 2017/18. Besides, a survey questionnaire was used to source primary information from farmers, while an in-depth interview guide was used to source relevant information from the project's management, regarding changes in farmers' income, inherent challenges in the management of credit funds and measures initiated to support farmers. Data collection tools were pre-tested in September 2018 on a group of farmers, but whose blocks were later excluded from the main data collection.

Both quantitative and qualitative procedures were applied to process, analyse and interpret the information. Under quantitative analysis, techniques such as one-way *Analysis of Variance (ANOVA), independent samples t-test, Pearson's Correlation Co-efficient* and *Cohen's d* were applied to determine the relationship between access to subsidised credit financing and the financial performance of smallholder farmers at the Kimira-Oluch Irrigation Project. In addition, quantitative analysis was performed using the Statistical Package for Social Sciences and Microsoft Excel packages; while qualitative analysis followed three steps, involving coding and organising data; identification of themes, patterns and relations; as well as interpretation, which involved linking the findings to study's objectives. The qualitative data were used to corroborate and amplify the quantitative results. The following publications provide details about the procedures used to process and analyse the information (Dudovskiy, 2018; Durlak, 2009; Sawilowsky, 2009). Besides, the study complied with ethical principles of social science research, including respect for participants' rights to self-determination, voluntary participation and confidentiality (Dench, Iphofen & Huws, 2004).

Results

This section presents and provides explanations about data analysis outputs, hereafter referred to as the results. The section has been structured into three sub-sections, including access to the credit financing provided by the Government in collaboration with AfDB; pre-intervention average annual sales among farmers in the experimental and control groups; as well as post-intervention average annual sales among farmers in the experimental and control groups. Even though the study targeted 306 smallholder farmers, only 304 were successfully involved from onset to conclusion. Of this, 198 (65.1%) were males and 106 (34.9%) were females. The farmers had a mean age of 45.0 years, 95% Confidence Interval (CI) [44.4-45.67], with a range of 29 to 57 years. Whereas males indicated a mean age of 47.82 years, females reported a mean age of 39.80 years; thus, suggesting that male farmers were relatively older. The intervention involved providing basic training on financial management and providing credit financing to farmers established to be needy, judging from their background socio-economic background, including employment status, credit history, income level, type of housing, as well as ownership of land, equipment and livestock.

Details are provided in the following sub-sections. Farmers who accessed credit financing were assigned to the experimental group, while those who didn't were assigned to the control group.

Access to credit financing

Among the 304 farmers, 174 (57.2%) accessed credit financing in 2011 to purchase farm inputs, while 130 (42.8%) didn't. The 174 beneficiaries consisted of 113 (64.9%) males and 61 (35.1%) females; thus, suggesting that the credit facility was accessed by more men than women. Even though some key informants attributed the skewed situation to factors such as male domination of household investment decisions, low education level and negative attitude towards credit, particularly among female farmers, all the participants concurred that the scenario undermined the intervention's impact on poverty reduction. Consequently, key informants amplified the need to sensitise and build the capacity of female farmers to improve uptake and utilization the credit facility. Those who accessed credit financing stated an average age of 45.1 years, 95% CI (44.2-45.9). This suggests that the credit facility was accessed by people in the productive age bracket, which enhanced chances of optimal utilization and realisation of the project's goal of poverty reduction in the host community. The analysis focused on establishing the relationship between the amount of credit accessed by farmers and background attributes, such as gender, age, land size and pre-intervention income. For starters, Table 1 shows the difference in the average amount of credit accessed by farmers in relation to gender.

Table 1: Amount of credit accessed by gender

Gender	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Min	Max
					Lower Bound	Upper Bound		
Male	113	79,982.3	38,967.3	3,665.7	72,719.1	87,245.5	23,000	225,000
Female	61	57,926.2	33,372.5	4,272.9	49,379.1	66,473.3	20,000	199,500
Total	**174**	**72,250.0**	**38,479.9**	**2,917.2**	**66,492.2**	**78,007.8**	**20,000**	**225,000**

ANOVA	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	19271492365.4	1	19271492365.4	13.993	0.000***
Within Groups	236889882634.6	172	1377266759.5		
Total	**256161375000.0**	**173**			

**** shows significance at ρ<0.01 error margin*

The results in Table 1 show that the amount of credit accessed by farmers ranged between Kenya Shillings (KES) 20,000 and 225,000 depending on the level of established need, with a mean of KES 72,250, 95% CI (66,492-78,008). More specifically, male farmers accessed an average credit of KES 79,982.3, 95% CI (72,719.1-87,245.5), while their female

counterparts accessed an average of KES 57,926.2, 95% CI (49,379.1-66,473.3). Using the ANOVA technique, the analysis revealed that an average amount of credit accessed by male and female farmers varied significantly at 99% confidence level (F statistic = 13.993 & Sig. or ρ-value = 0.000). This implies that male farmers accessed relatively higher amounts of credit that their female colleagues, a situation that key informants attributed to factors such as inadequate sensitisation of women about the credit facility, its terms and conditions, application process and purpose; relatively lower educational attainment, in addition to specific constraints experienced by women household heads, including labour deficits and higher dependency.

Participants also cited negative attitude towards credit, as some women associated credit facilities with harassment in the event of failure to comply with repayment schedule. In this regard, some women cited the previous negative experiences with credit facilities provided by microfinance institutions as the reason for not applying for financing under the new credit facility. The skewed uptake of the credit facility was further linked to lack of prior experience with formal credit among women, as well as inadequate involvement of women in influential positions of the irrigation project's community-based structures.

Furthermore, Pearson's Correlation Coefficient was applied to establish the connection between the amount of credit accessed and farmers' age, land acreage and pre-intervention level of income. The results presented in Table 2 show that the analysis revealed a weak positive correlation between the amount of credit accessed and farmers' age; which however, was statistically significant at 95% confidence level. This implies that the older the farmer, the higher the amount of credit accessed; which in turn, suggests that age is one of the factors that determined one's access to the credit financing. Key informants attributed the result to the realisation that older farmers were likely to be more experienced in the business than their relatively younger colleagues.

Table 2: Correlation between amount credit accessed by farmers' attributes

		Farmers' age	**Amount of credit accessed**
Farmers' age	Pearson Correlation	1	0.177**
	Sig. (2-tailed)		0.019
	N	174	174
Amount of credit accessed	Pearson Correlation	0.177**	1
	Sig. (2-tailed)	0.019	
	N	174	304

	Land size in acres	**Amount of credit accessed**

Land size in acres	Pearson Correlation	1	0.643***
	Sig. (2-tailed)		0.000
	N	174	174
Amount of credit accessed	Pearson Correlation	0.643***	1
	Sig. (2-tailed)	0.000	
	N	174	174

		Pre-intervention income level	**Amount of credit accessed**
Pre-intervention income level	Pearson Correlation	1	0.738***
	Sig. (2-tailed)		0.000
	N	174	174
Amount of credit accessed	Pearson Correlation	0.738***	1
	Sig. (2-tailed)	0.000	
	N	174	174

***, *** show significance at ρ<0.05 and ρ<0.01 error margins, respectively*

The analysis also revealed a fairly strong positive correlation between the amount of credit accessed and the size of land owned by farmers; which was also statistically significant at 99% confidence level. This suggests that the higher the acreage the higher the amount of credit accessed by farmers, which is logical because as acreage increases the amount of inputs required for production also increases proportionally. The analysis further obtained a strong positive correlation between the amount of credit accessed and pre-intervention level of income; which was also statistically significant at 99% confidence level. Again, this suggests that the higher the level of pre-intervention income, the higher the amount of credit accessed by farmers. Participants noted that farmers with relatively higher pre-intervention incomes were perceived to have a greater potential to translate credit financing into profits than those with lower average incomes.

Pre-intervention sales among farmers in the experimental and control groups

The analysis involved comparison of average annual sales realised by farmers in the experimental and control groups. This enabled the investigator to establish the extent to which members of the two groups were homogenous at the baseline, so that variations noted in the post-intervention measurement of the dependent variable would validly be attributed to the intervention. In view of this, Table 3 shows average baseline values of annual sales recorded by farmers in both groups.

Table 3: Pre-intervention sales among farmers in the experimental and control groups

Group	n	Mean	SD	SE	95% CI for Mean		Min	Max
					Lower Bound	*Upper Bound*		
Experimental	174	76,206.9	11,351.6	860.6	74,508.3	77,905.5	57,000	105,000
Control	130	84,169.2	11,604.4	1,017.8	82,155.6	86,182.9	67,500	110,000
Total	**304**	**79,611.8**	**12,102.6**	**694.1**	**78,245.9**	**80,977.8**	**57,000**	**110,000**

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Diff	SE Diff	95% CI of the Diff	
									Lower	*Upper*
Pre-intervention gross annual sales	Equal variances assumed (1st row)	4.20.042**		-5.9	3020.000***		-7,962.3	1,328.6	-10,576.8	-5,347.9
	Equal variances not assumed (2nd row)			-5.9	274.70.000***		-7,962.3	1,332.8	-10,586.2	-5,338.5

***, *** show significance at ρ<0.05 and ρ<0.01 error margins, respectively. N-sample; SD-standard deviation; SE-standard error; Sig. – Levene's test of equal or unequal variances between groups; Sig. (2-tailed) – significance of difference between mean values for the two groups (ρ-value); and Diff – difference.*

The results in Table 3 show that farmers in the experimental group had average annual sales of KES 76,206.9, 95% CI (74,508.3-77,905.5). Those in the control group realised average annual sales of KES 84,169.2, 95% CI (82,155.6-86,182.9). The results further show that the Sig. value for Levene's test was 0.042, which implied that variances between the two groups were assumed not to be equal; hence, the results were read from the second row. In this regard, the analysis obtained a t-statistic of -5.9 with a ρ-value of 0.000, which suggested up to 99% chance that average annual sales achieved by farmers in the experimental and control groups were significantly different.

The results further implied that average annual sales were significantly lower among farmers in the experimental group than among those in the control group. This was affirmed by key informants, who noted that farmers in the

experimental group had lower pre-intervention sales than those in the control group. That is why they were targeted by the credit facility in the first place. Thus, farmers in the two groups were not homogenous in terms of average annual sales. Nonetheless, participants emphasised the importance of correct targeting in relation to the intervention's contribution to realisation of the irrigation project's goal of reducing poverty in the host community.

Post-intervention sales among farmers in the experimental and control groups

The analysis further focused on determining if there was any significant difference in the post-intervention average annual sales of irrigated farm produce between farmers in the experimental, and those in the control group. The purpose of this analysis was to determine if the provision of subsidised credit facility to needy farmers caused any significant effect on the productivity level and hence, the value of annual sales. In view of this, Table 4 presents results about difference in the post-intervention sales realised by farmers in both groups.

Table 4: Difference in post-intervention sales among farmers in both groups

Group	n	Mean	SD	SE	95% CI for Mean		Min	Max
					Lower Bound	*Upper Bound*		
Experimental	174	108,538.4	18,984.1	1,439.2	105,697.8	111,379.0	74,600	155,000
Control	130	104,492.6	15,081.6	1,322.7	101,875.5	107,109.7	81,365	136,500
Total	**304**	**106,808.3**	**17,510.8**	**1,004.3**	**104,832.0**	**108,784.6**	**74,600**	**155,000**

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Diff	SE Diff	95% CI of the Diff	
									Lower	*Upper*
Pre-intervention gross annual sales	Equal variances assumed (1st row)	4.6	0.032**	2.0	302	0.046**	4,045.8	2,020.0	70.7	8,020.8
	Equal variances not assumed (2nd row)			2.1	300.8	0.039**	4,045.8	1,954.7	199.1	7,892.4

*** shows significance at ρ<0.05 error margin*

The results presented in Table 4 show that farmers in the experimental group realised a mean post-intervention sales of KES 108,538.4, 95% CI (105,697.8-111,379.0); while those in the control group achieved an average sales of KES 104,492.6, 95% CI (101,875.5-107,109.7). The results further show that Levene's test for equality of variances was less than 0.05, meaning that equal variances were not assumed. Consequently, the results read from the second row showed that the analysis obtained a t-statistic of 2.1, with 300.8 degrees of freedom and a ρ-value of 0.039; thereby, suggesting up to 95% confidence level that the mean post-intervention annual sales realised by farmers in the experimental and control groups were significantly different. The results show change from a situation where farmers in the experimental group recorded sales that were significantly lower than that obtained by their counterparts in the control group, to a situation where farmers in the experimental group recorded higher average annual sales.

The analysis further focused on determining the standardised effect size caused by the intervention on average annual sales among farmers who accessed the credit facility. To achieve this, *Cohen's d* statistic of 0.23615 was computed from the independent sample t-test results. Based on the reference values set by Cohen (1977), the result suggests a small effect size of about 23%. This implies up to 23% chance that a farmer picked randomly from the experimental group is likely to have higher post-intervention average annual sales than one picked randomly from the control group. This suggests that the credit facility provided by the Government in collaboration with AfDB contributed to the improvement of productivity among poor farmers; thereby, enabling them to achieve higher sales and better income. This further shows that the intervention contributed to the realisation of the irrigation project's goal of reducing poverty in the host community.

Pursuant to the foregoing interpretations, key informants affirmed that farmers who accessed the credit facility recorded higher incomes from the sale of farm produce, which enabled their families to have a more reliable food supply, afford better clothing, meet school fees demands, initiate other commercial ventures, as well as acquire assets such as livestock, farm implements, bicycles and motorcycles, among others. In view of this, some participants indicated that the intervention enabled farmers to enter into a cash economy, in which they could purchase items that they hitherto could not afford.

Discussions And Conclusions

The purpose of the study was to examine whether providing a subsidised credit facility would improve the financial returns of smallholder irrigation farmers. The resultant information would inform stakeholders of KOSFIP about the intervention's effectiveness in enhancing performance and contributing to poverty reduction among the farmers. The study's outputs were also expected to inform investment decision-making processes concerning smallholder irrigation projects, in Kenya as well as in other developing countries; in addition to influencing further research around the subject. The study established that access to the subsidised credit facility was skewed in favour of male farmers. In this regard, a higher proportion of males than females accessed the credit facility. Besides, an average amount accessed by male farmers was significantly higher than that obtained by their female counterparts. Participants linked situation to factors such as inadequate sensitisation of women about the credit facility, low educational attainment among women, labour deficits and higher dependency in women headed households, negative attitude towards credit, lack of prior experience with formal credit among women, as well as inadequate involvement of women in influential positions of community-based

structures. More still, the amount of credit accessed significantly correlated with farmers' age, size of land owned and pre-intervention level of income.

The study also found a significant difference in the post-intervention annual sales realised by farmers in the experimental and control groups. Besides, there was change from a situation where farmers in the experimental group recorded significantly lower annual sales than their counterparts in the control group, to a situation where farmers in the experimental group recorded significantly higher annual sales. Higher returns placed beneficiaries in a better position to access basic needs for their families, acquire more production factors and initiate new commercial ventures to expand the scope of income generation. Despite this, the intervention caused only a small effect size of about 23%, as indicated by *Cohen's d* statistic.

The findings of this study demonstrate that integrating subsidised credit facilities in smallholder irrigation projects can increase needy farmers' productivity by enabling them to access necessary inputs and equipment; thereby, improving yields and income. This implies that subsidised financing interventions will continue to be important enablers of smallholder farmers to realise their full potential. Even through previous studies have amplified the need to link smallholder farmers with commercial financial institutions to enable them access credit facilities, as well as the need to sensitise such financial institutions to create customised financing products that respond to the needs of smallholder farmers, the implementation of such suggestions are increasingly becoming elusive in the contemporary financial markets that are rapidly evolving in response to market forces and technological advancement. As a result, most financial institutions continue to perceive smallholder farmers as high-risk clients when it comes to credit financing considerations. This reality leaves smallholder farmers in Kenya as well as in most developing countries with limited or no financing sources; which in turn, prevents them from realising their full potential in agricultural production. The more the smallholder farmers fail to optimise their production, the more the category of people living below the $1.90 mark continues to expand. This means that failure to provide realistic financing initiatives to smallholder farmers is likely to undermine poverty reduction efforts in rural settings.

This study revealed that government-driven financing initiatives such as that pilot-tested at KOSFIP can go a long way in changing the narrative by enhancing smallholder farmers' productivity and income; thereby, looping them into the cash economy. Government funded initiatives also have the advantage of annual re-financing through the national budgeting systems. This is a potential breakthrough to the perennial challenge of lack of appropriate credit facilities for such farmers. However, the study also revealed that Government driven financing initiatives are vulnerable to abuse and mismanagement. Hence, the focus should not only be on how establish subsidised credit financing initiatives, but also on how to safeguard them from mismanagement. Doing so will be critical for sustaining the benefits, enabling farmers to accumulate wealth and fight their way out of poverty. This calls for stringent management measures, involving all relevant government agencies responsible for ethics and good governance, including the public audit office, ethics and anti-corruption, criminal investigation and public prosecution. Equally important is the need to institute measures that would make such financing initiatives more responsive to the needs and circumstances of disadvantaged groups such as women.

References

Adebayo, C.O., Sanni, S.A., & Baiyegunhi, L.J.S. (2012). 'Microcredit Scheme Impact and Food Security Status of Beneficiaries in Kaduna State, Nigeria: A Propensity Score Matching Approach.' *African Journal of Agricultural Research*, 7(37), 5191-5197. http://dx.doi.org/10.5897/AJAR12.475

African Development Bank [AfDB] (2006). *Kimira-Oluch Smallholder Farm Improvement Project. Appraisal Report.* Tunis: Agriculture and Rural Development Department North, East and South.

Alila, P. & Atieno, R. (2006). *Agricultural Policy in Kenya: Issues and Processes.* A Paper Presented at the Future Agricultures Consortium Workshop, held from 20-22 March 2006, at the Institute of Development Studies.

Ansah, I.G.K. (2017). 'Effect of input credit on smallholder farmers' output and income: Evidence from Northern Ghana.' *Agricultural Finance Review*, 78(2), http://dx.doi.org/10.1108/AFR-05-2017-0032

Ashraf, N., Giné, X., & Karlan, D. (2009). 'Finding Missing Markets (And a Disturbing Epilogue): Evidence from An Export Crop Adoption and Marketing Intervention in Kenya.' *American Journal of Agricultural Economics*, 91(4), 973-990.

Bowen, P., Rose, R. & Pilkington, A. (2017). 'Mixed Methods- Theory and Practice. Sequential, Explanatory Approach.' *International Journal of Quantitative and Qualitative Research Methods*, 5(2), 10-27.

Clark, C., Harris, K.P., Biscaye, P., Gugerty, M.K. & Anderson, C.L. (2015). *Evidence on the Impact of Rural and Agricultural Finance on Clients in Sub-Saharan Africa: a Literature Review*. EPAR Brief No. 307 / Learning Lab Technical Report No. 2.

Cohen, J. (1977). *Statistical Power Analysis for the Behavioural Sciences*. New York: Routledge.

Creswell, J.W. & Plano, V.L.C. (2011). *Designing and Conducting Mixed Methods Research (2nd ed.)*. Thousand Oaks, CA: Sage.

Dench. S., Iphofen, R. & Huws, U. (2004). *An EU Code of Ethics for Socio-Economic #Research Report*. London: Institute for Employment Studies.

Dudovskiy, J. (2018). *The Ultimate Guide to Writing a Dissertation in Business Studies: A Step-by-Step Assistance*. Retrieved on 12/09/2020 from https://research-methodology.net/about-us/ebook

Durlak, J. (2009). 'How to Select, Calculate, and Interpret Effect Sizes.' *Journal of Paediatric Psychology* 34(9), 917-928. https://doi.org/10.1093/jpepsy/jsp004

Fink, A. (1995). *The Survey Kit: How to Sample in Surveys*. Thousand Oaks, CA: Sage Publications.

Fisher, A.A. & Foreit, J.R. (2002). *Designing HIV/AIDS Intervention Studies: An Operations Research Handbook.* New York: Population Council.

Government of Kenya (2018). *Kenya Climate Smart Agriculture Implementation Framework-2018-2027.* Nairobi: Ministry of Agriculture, Livestock, Fisheries and Irrigation

Grimm, J. & Ritcher, M. (2008). 'Financial Services for Developing Small-Scale Irrigation in Sub-Saharan Africa.' *Agriculture and Rural Development Notes*, 41, 1-4.

International Finance Corporation [IFC](2014). *Access to Finance for Smallholder Farmers: Learning from the Experiences of Microfinance Institutions in Latin America*. New York: IFC, World Bank Group.

Irungu, J.W. (2013). *Relationship between Agricultural Credit Financing and Financial Performance: A Case of Small Scale Farmers in Kiria Division in Muranga County.* A Research Project Report Submitted at the School of Business, University of Nairobi.

Kohansal, M.R., Ghorbani, M. & Mansoori, H. (2008). 'Effect of Credit Accessibility of Farmers on Agricultural Investment and Investigation of Policy Options in Khorasan-Razavi Province.' *Journal of Applied Sciences, 8, 4455-4459,* **https://doi.org/**10.3923/jas.2008.4455.4459

Lake Basin Development Authority [LBDA] (2011). *Kimira-Oluch Smallholder Farm Improvement Project: Appraisal Report.* Nairobi: LBDA.

Mboi, S.G. (2018). *Factors Influencing Sustainability of Smallholder Irrigation Projects in Kenya: A Case of Selected Irrigation Projects in Kirinyaga County.* A Research Project Report Submitted at the School of Open, Distance and e-Learning, University of Nairobi.

Mdemu, M.V., Mziray, N., Bjornlund, H. & Kashaigili, J.J. (2017). 'Barriers to and

Opportunities for Improving Productivity and Profitability of the Kiwere and Magozi Irrigation Schemes in Tanzania.' *International Journal of Water Resources Development*, 33(5), 725-739, http://dx.doi.org/10.1080/07900627.2016.1188267

Mendes, D.M. & Paglietti, L. (2015). *Kenya: Irrigation Market Brief.* Rome: Food and Agriculture Organisation.

Mohamed, K.S. & Temu, A.E. (2008). *Access to Credit and Its Effect on the Adoption of Agricultural Technologies: The Case of Zanzibar.* An Article Presented as A Poster at the Boulder-Bergamo Forum on Access to Financial Services: Expanding the Rural Frontier; held in September 18-20, at the Boulder Institute of Microfinance and the University of Bergamo, Italy.

Ngenoh, E., Kirui, L.K., Mutai, B.K., Maina, M.C. & Koech, W. (2015). 'Economic Determinants of the Performance of Public Irrigation Schemes in Kenya.' *Journal of Development and Agricultural Economics* 7(10), 344-352, http://dx.doi.org/ 10.5897/JDAE2015.0676

Okech, K., Kiragu, A., Sing'ora, B., Ndonga, S., Olan'g, P. & Kenyanito, L. (2017). *Bridging the Gap: The Role of Data in Deepening Smallholder Financing.* Nairobi: Alliance for a Green Revolution in Africa (AGRA).

Quartey, P., Undry, C., Al-hassan, S. & Seshie, H. (2012). *Agricultural financing and credit constraints: the role of middlemen in marketing and credit outcomes in Ghana.* Retrieved on 12/09/2020 from https://www.theigc.org/project/agricultural-financing-and-credit-constraints-the-role-of-middlemen-in-marketing-and-credit-outcomes-in-ghana/

Sawilowsky, S (2009). 'New Effect Size Rules of Thumb.' *Journal of Modern Applied Statistical Methods, 8(2): 467–474,* http://dx.doi.org/ 10.22237/jmasm/1257035100

Simiyu, J.A. (2010). A Better Understanding of the Smallholder Irrigation Subsector.Kenya Engineer. Retrieved on 21/08/2020 from https://www.kenyaengineer.co.ke/a-better-understanding-of-the-smallholder-irrigation-subsector/

Spio, K. (2002). *The Impact and Accessibility of Agricultural Credit: A Case Study of Small-Scale Farmers in the Limpopo Province of South Africa*. Unpublished PhD Thesis, University of Pretoria.

Valipour, M. (2015). 'Future of Agricultural Water Management in Africa.' *Archives of Agronomy and Soil Science*, 61(7), 907-927, https://doi.org/10.1080/03650340.2014.961433

White, H. & Sabarwal, S. (2014). *Quasi-Experimental Design and Methods, Methodological Briefs: Impact Evaluation 8*. New York: UNICEF Office of Research.