

Capacity Building and Empowerment of Communities Through Development of Irrigation Schemes in Kenya

Anita W. Wachira, Lilian M. Karimi, and Vincent Kabuti

ABSTRACT

The goal of this study was to explore the effect of Irrigations Schemes Development (as rooted in; Vision 2030, Kenya Big Four Agenda, ASTGS and National Irrigation Authority Strategic Plan 2019-2023) on capacity building and empowerment of communities. Specifically, the study sought to access the effect of irrigation scheme development on; Education and Training, Clean Water and Sanitation, Youth Access to Funds, Housing Type, Food Security, Job Diversity, Access to Health Care Services, Changing Demand, Irrigation Orientation and Water Harvest. Descriptive design was used as a road map of the study. A sample size of 395 respondents was drawn from a target population of 35,041 households living around the irrigation scheme in Mara Region, Tharaka-Nithi County-Kenya, subjected to a 95% confidence level. Convenience sampling was adopted to drum up participants. Primary data was collected using interview method. A semi-structured interview guide with Likert scale rating was used as a checklist. Descriptive and inferential statistics were employed to analyze the data. Study results indicated that Development of Irrigation Schemes contributed to capacity building and empowerment of Kenyan communities by; facilitating access to clean water and sanitation within homesteads (77%) enabling sufficient food and balanced diet throughout the year (197; 56%). Statistically, the study showed that infrastructure was significantly associated with capacity building ($p=0.03$). In addition, the irrigation scheme improved the lifestyle of the locals through access to health care services and comfortable housing. From the income earned from farming, out of 395, only 105 (30%) and 47 (12%) could afford to educate their families to secondary and tertiary level respectively. According to the study, an acre of irrigated land employees an average of eight people on a full-time basis. The study highlighted challenges in water storage and maintenance which can be addressed by involving Kenyan government agencies, County government agencies, the private sector and other stakeholders in the development and provision of sufficient water storage facilities. From the results finding there is need for comprehensive research within the irrigation scheme through agricultural research and development to address the concerns of the future effects of chemical use on the health of the locals. The study recommends that local authorities renew the engagement of agricultural extension workers. Additionally, to counter the bargaining power of middlemen, farmer welfare organizational structures should be operationalized.

Keywords: Capacity Building, Communities Development, Empowerment, Irrigation, Irrigation Schemes.

Published Online: November 20, 2022

ISSN: 2736-5522

DOI: 10.24018/ejsocial.2022.2.6.244

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I. INTRODUCTION

Capacity building is a systematic and integrated approach that facilitates continuous development, improvement and retention of human resource skills, knowledge, tools and other resources necessary for efficient and effective work performance (Mehdi, 2015). The essence behind capacity building is to bring sustainable development by transforming the lives of the community (UNDP, 2009) with the objective of empowering communities. According to World Health Organization (WHO, 2009), community empowerment is the process of enabling communities gain control over factors and decisions that shape their lives. Hence empowerment enables communities to; increase their assets, improve attributes and build capacities to access partnerships, gain networks and control. Countries like Ethiopia are testimonies when it comes to sustainable agriculture and food security through irrigation, where over 44,000 smallholder farmers are adopting farming practices that boost productivity and help them engage in more profitable value chains (Farm Africa, 2019).

Mati (2008) states that in Kenya, the success of irrigation is driven by new knowledge creation, the availability of markets for products grown, the existence of good governance structures within the scheme, and the availability of funding for infrastructure and development within the schemes. Supported by the Agriculture and Rural Development initiatives, Kenya's Vision 2030 aims at developing irrigation projects in Arid and Semi-Arid Lands (ASAL) covering 600,000-1,000,000 Ha within the First Medium Term, 119,000 Ha-159,000 Ha in the Second Medium Term Plan and 207,200 Ha in the Third Medium Term Plan. The goal of the social pillar is to improve the quality of life of Kenyans by investing in its people through the development of human and social welfare projects and programs. Water and Sanitation are some of the key drivers identified under this pillar. The construction of irrigation schemes aims at transforming the lives of Kenyans by supplementing rain and groundwater for crop growth and development. This in turn is expected to build capacity and empower communities around the schemes. Thus the specific objective of the study was to evaluate the effect of Irrigation Schemes in Mara Region, Tharaka Nithi County on capacity building and empowerment of immediate communities.

A. The Research Will Benefit

1. The attainment of the United Nations Sustainable Development Goals, in particular Goal 2 (Zero Hunger), Goal 4 (Quality Education), Goal 6 (Clean Water & Sanitation), and Goal 11 (Sustainable Cities & Communities).
2. The African 2063 Agenda's aim is to achieve the goals of creating a high standard of living, achieving quality life and well-being for African Nations and their citizens, and ensuring a healthy and well-nourished citizenry.
3. Attainment of Kenya's Vision 2030 economic pillar (through economic agricultural development programmes such as Irrigation Projects) and the social pillar (through building a just and cohesive society with social equity in a clean and secure environment).
4. The Big Four Agenda which is founded on the four pillars of Food Security, Affordable Housing, Universal Health Care, Manufacturing, and Job Creation.

II. LITERATURE REVIEW

Kenya's Vision 2030 is anchored on three pillars: economic, social, and political. The main goal of Vision 2030 is to make Kenya "a globally competitive and prosperous country with a high quality of life by 2030" transforming Kenya into an industrialized, middle-income country (ROK, 2014). As per the country's long-term development blueprint, the Social Pillar aims at improving the quality of life of Kenyans by investing in its people. This pillar targets a cross-section of human and social welfare projects and programmes. The key drivers identified are Education and Training, Health, Water and Sanitation, Environment, Housing and Urbanization, and Gender, Youth, Sports, and Culture.

Designed to accelerate the achievement of the Third Medium Term Plan (MTP III) towards 2030, the Big Four Agenda focuses on manufacturing; food and nutrition security; affordable and universal health care; and affordable housing. Agenda 2 of the Big Four, centers on food and nutrition security, where the government seeks to deliver 100% on food security and nutrition commitment by increasing large-scale production of staple foods (maize, potatoes, and rice) that will be grown under irrigation. To achieve this, the government intends to employ the strategies of; Formulating annual budget revisions that may divert money from irrigation projects; Fertilizer subsidy allocations; Developing and implementing policies on water use and management in the irrigation schemes to ensure water is available for irrigation throughout the year; Constructing water storage facilities in the irrigation schemes; Providing supporting amenities to irrigation such as electricity as well as improving the road network; and Supplying and distributing mechanisms of fertilizer provision to farmers.

Agenda 3 of the Big Four centers on affordable Universal Health Care (UHC), where the Kenyan government aims to achieve health for all its citizens by the year 2022 through the strategies of Amending legislation on health insurance reforms, particularly the review of the National Hospital Insurance Fund (NHIF) Act 9 of 1998 to align it with the UHC Agenda; Implementing managed medical equipment services (MMES); Implementing the Linda Mama Programme which aims at providing free maternity services through NHIF in all public and selected Faith-Based health facilities across the country; Enrolling residents into the NHIF scheme through County Government community-based model initiatives. By embarking on the provision of UHC, the government will be able to build on local capacity and thus empower the local community.

In order to achieve the fourth agenda of the Big Four on affordable housing (ROK, 2018), the Kenyan government intends to facilitate the provision of 500,000 housing units by 2022, by employing the strategies of: Designing affordable housing plans and quality assurance; Employing private sector modes of financing of the project; Standardizing of documentation and processes by bringing all institutions/agencies involved in the construction industry under one-stop shop; Standardizing of building materials, and Standardizing of

housing units. Hence transforming the community's lives through better housing.

With regard to the Agricultural Sector Transformation and Growth Strategy (ASTGS), the Kenyan government formulated this agricultural strategy in order to meet the theme of “transforming agriculture to grow the economy. According to the ASTGS (2019), ‘agricultural transformation’ refers to a decades-long process characterized by four paradigm shifts which include: Modernization of on-farm production, the shift of the value in the value chain, the shift of farmers out of farming and change demand. As such, the ASTGS has prioritized three anchors to drive this transformation. The first anchor entails increasing small-scale farmer, pastoralist, and fisher folk incomes by 40% by shifting nationwide subsidy programs to focus on empowering 1.4 million registered high-needs farmers so that they may be able to access a wide range of inputs (seeds, crop protection, fertilizer, equipment) from a variety of private and public providers, using e-vouchers with digital service delivery (Ministry of Agriculture, Livestock, Fisheries & Irrigation, 2019).

The second anchor (increase agricultural output and value add) aims at expanding agricultural GDP from KES 2.9 trillion to KES 3.9 trillion and to grow the contribution of agro-processing to GDP by KES 130 billion. One of its drivers will be to unlock 50 new large-scale private farms (>2,500 acres each) with 150,000 acres under sustainable irrigation from existing projects with government-provided infrastructure and protected land ownership. Anchor 3 (to increase household food resilience) aims at reducing the number of food-insecure Kenyans in the Arid and Semi-Arid Lands (ASAL) regions from 2.7 million on average to zero while reducing the cost of food and improving nutrition to protect households against environmental and fiscal shocks.

According to the National Irrigation Authority's (NIA) Strategic Plan of 2019-2023, two of the main roles of NIA is to facilitate the competitiveness of the sector in Kenya through:

- i. Providing an effective framework for sustainable irrigation project design and implementation;
- ii. Providing mechanisms for strengthening (capacity building) and provision of irrigation development services for farmers;

The attainment of the above roles by NIA will lead to the achievement of the social pillar through local community empowerment.

A. Operational Framework

Drawn from literature, the Operational Framework, Fig. 2 shows the parametrical relationship of capacity building and empowerment of communities that accrue due to the development of irrigation scheme.

Fig. 3 reflects the analysis of the key indicators and resultant parameters under study.

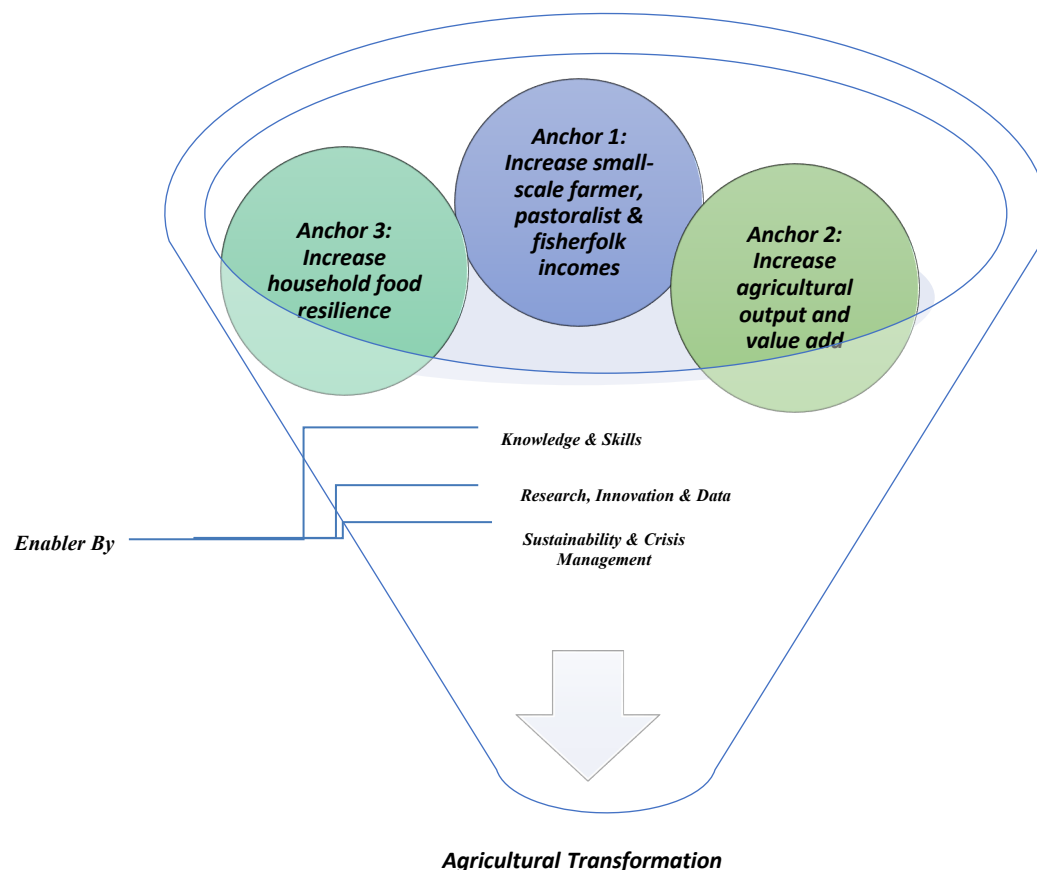


Fig. 1. The Agricultural Sector Transformation & Growth Strategy at Play.

$$n = \frac{35,041}{1+35,041(0.05)^2} n = 395 \quad (2)$$

The study adopted convenience sampling to drum up participants as they were readily available. Primary data was collected using an interview guide checklist that was semi-structured. Unlike questionnaire method where the respondent fills-in the data themselves, with interview method, the information is obtained through inquiry and recorded by enumerator. This was key as illiteracy was assumed to be high in the in Mara Region (Tharaka Nithi) Irrigation Scheme. In order to measure attitudes directly, Likert scale rating was used which assumes that the strength/intensity of an attitude is linear and is on a continuum from strongly agree to strongly disagree (Saunders *et al.*, 2015). The other group of respondents were the General Managers and employees in management positions who were the head of departments. The sampling technique used was purposive sampling technique. According to Saunders (2012) is a sampling technique in which the researchers rely on their own judgment when choosing members of population to participate in the study. This technique was chosen by the researcher because it helped in answering the research questions satisfactorily hence achieving the research objectives.

The data collection instrument was subjected to both tests of validity (content) and reliability. To measure reliability, Cronbach's alpha (α) measure was used and an alpha score of more than 0.7 was deemed acceptable (Saunders *et al.*, 2015). The descriptive statistics employed included measures of central tendency, measures of variance and frequency tables and percentages while inferential statistics was used for the purpose of analysis of data (the sample) in order to make predictions, generalizations and inferences about a larger set of data (the population). Pearson correlation coefficient and regression analysis was the main inferential statistics of interest. Other inferential statistics included factor loading and p -value for statistical significant testing. The regression analysis was carried out to identify the magnitude of the impact of the development of irrigation schemes on capacity building and empowerment. The regression model adopted took the form of (3).

$$Y = \beta_0 + \beta_1 X_1 + e \quad (3)$$

Where:

Y = Capacity Building & Empowerment

β_0 = Constant

β_i = Coefficients of variables

X_1 = Development of Irrigation Schemes

e = Error term

Ethical principles such as informed consent, confidentiality, and anonymity of the respondents were upheld.

IV. RESULTS AND FINDINGS

The research yielded a response rate of 90% (355 out of 395 respondents) of which, 58% (205) were male and 42% (150) were female. The majority of the respondents (162; 46%) in the irrigation scheme fell within the age category of 36-53 years. Two hundred and thirteen households (60%) have between 4-6 persons living in the household while the 109 (31%) respondents had children aged between 1-5 years. Eighty-five percent of the land under irrigation is personally owned while 15% of the land is leased (Fig. 4). Assessment of farming demographics indicated that 131 (37%) of the farmers had been farming for between 3-4 years. A total of 319 (91%) of the farmers worked on their farms without any other employees with only 26 (8%) reporting between 1-3 employees on the farm.

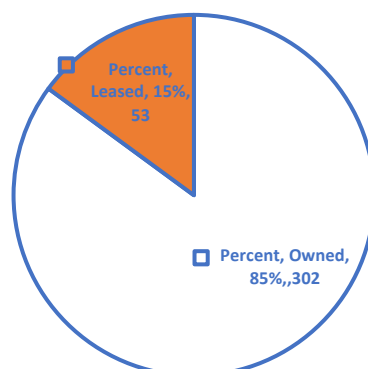


Fig. 4. Land Ownership.

Out of the 355 respondents, 94% (333) indicated that they have two seasons of planting in a year. The annual gross income from the irrigation activities for most of the farmers is less than Ksh. 100,000 (340; 97%). Two hundred and thirty-two (66%) respondents indicated that they sell their produce to brokers, ninety-seven (28%) respondents sell their produce to open markets while only twenty-six (<1%) sell to processors. Additionally, the channels for product marketing awareness highlighted that brokers were most dominant at 42%, face-to-face and phone calls at 28% while posting products through social media accounted for 9%.

A. Housing Type/Drinking Water/Sanitation Descriptive Results

The majority of the respondents (238, 67%) indicated that irrigation has enabled them to construct semi-permanent homes. (Fig. 5) Electricity (183 farmers; 52%) was identified to be the main source of lighting, while wood was the most common source of home fuel (311, 88%).

In 2010, the United Nations General Assembly explicitly recognized the human right to water and sanitation. From the results, 275 (77%) of the farmers and their families have access to clean drinking water free from contamination indicating the attainment of Sustainable Development Goal Target 6.1 which calls for universal and equitable access to safe and affordable drinking water. Of the framers interviewed, 300 (85%) have access to clean toilets, reducing the risk of transmission of diseases such as cholera, diarrhea, dysentery, hepatitis A, typhoid, and polio that can be linked to contaminated water and poor sanitation. The majority of the respondents (339; 95%) use pit latrines while only 16 (5%) have flush toilets.

B. Education & Training Descriptive Results

The income earned from Mara Region (Tharaka Nithi) Irrigation Scheme enables the farmers (220; 62%) to educate their dependents to the primary school level. However, only 105 (30%) and 47 (13%) of the farmers are able to educate their dependents up to secondary school and tertiary level respectively. Thus, social progress through education has not been entirely attained. The irrigation scheme has been an enabler for agricultural interventions as indicated by the 138 (39%) respondents who are able to provide a balanced meal for their families throughout the year.

C. Job Diversity Descriptive Results

A major success of the irrigation scheme is that it has led to job diversity through the creation and job diversity (206; 59%), consequently empowering locals. Jobs created through farming activities in the scheme include tilling the land, harvesting, planting, and weeding. On average this equates to 8 jobs per one acre of irrigated land. Other related jobs that have emerged from the development of the irrigation scheme include transporting the produce to the market, maintaining the water canals, selling products in the various markets, marketing the products, and managing the scheme.



Fig. 5. Capacity Building & Empowerment—Housing, Culture, Water & Sanitation and Education.

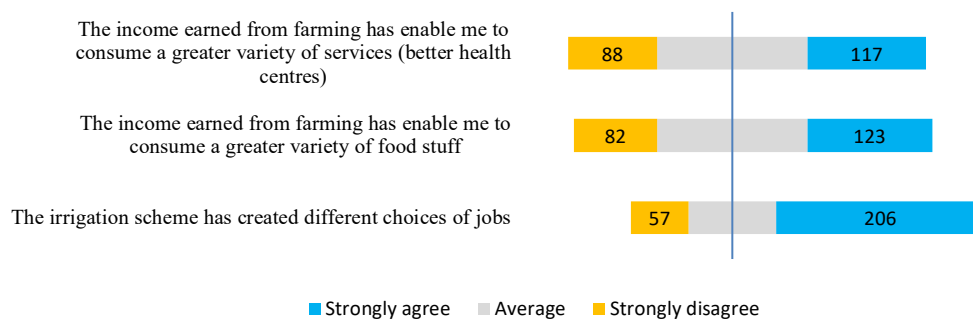


Fig. 6. Capacity Building & Empowerment – Job Diversity and Changing Demand.

The Irrigation Scheme also has a multiplier effect on the region such as teaching jobs in various institutions, and business creation, especially for middlemen, health institutions, financial institutions, and unions. Additionally, the income earned from farming has enabled farmers to improve their diet by providing a greater variety of foodstuff and nutrition and access to better health care services.

D. Health Care Services Descriptive Results

Access to universal health coverage was noted as a major success of the irrigation scheme as majority (231; 66%) strongly agreed they have access to affordable universal health coverage through NHIF membership. Despite most of the respondents having access to medical care, it was noted that only 143, which accounts for 40% of the farmers, had registered their families and themselves with the National Hospital Insurance Fund (NHIF). National Hospital Insurance Fund is a Kenyan state parastatal under the Ministry of Health that provides public health insurance. Majority of the farmers (158; 45%) do not have sufficient water storage indicating that water management is of concern within the area. Regardless, the households (231; 65%) do not suffer from water-borne diseases. This can be attributed to the access to clean water.

E. Development of Irrigation Schemes and Capacity Building & Empowerment

Regarding the implications of the National Irrigation Authority (NIA) operations on the livelihood of the farmers, public education was identified as a major gap. Two hundred and thirty-one (65%) of the respondents do not understand the legal frameworks of the irrigation scheme while in terms of sustainable irrigation management, 261 (74%) felt that the capacity of existing community water pans and small dams has not increased. Respondents (204; 57%) were of the view that despite their existence, farmers' societies/welfare associations/organizations are inactive. However, the Irrigation Scheme in Mara Region - Tharaka Nithi, has led to sustainable irrigation development as resolutions following social forums are implemented (198; 56%).

F. Inferential Results

Factor loading was used where variables with higher loadings (>0.4) were deemed to have a positive effect on the capacity building and empowerment of the respondents.

Results indicated that irrigation farmers are able to educate their family up to primary school (0.5247) from the irrigation earnings but drastically drop when transitioning to secondary education (0.3978). Sanitation had a low score in the factor loading of between 0.1248 and 0.2822 thus indicating no commonality with other variables hence no shared variance.

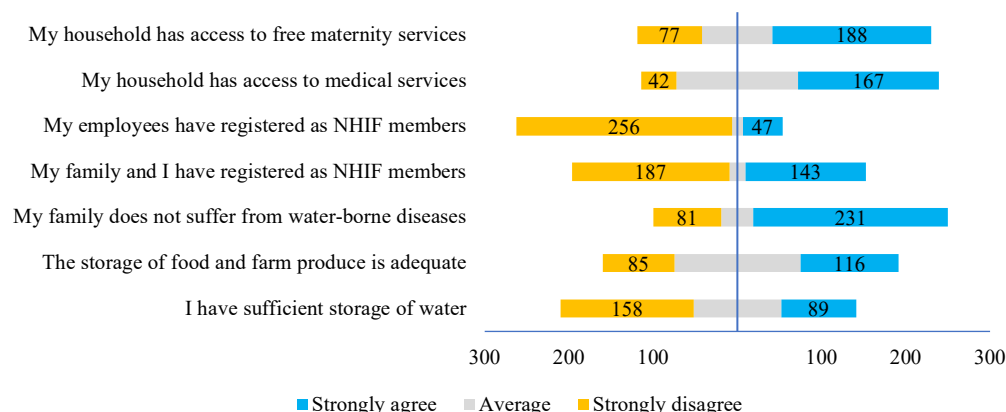


Fig. 7. Capacity Building & Empowerment – Health Care.

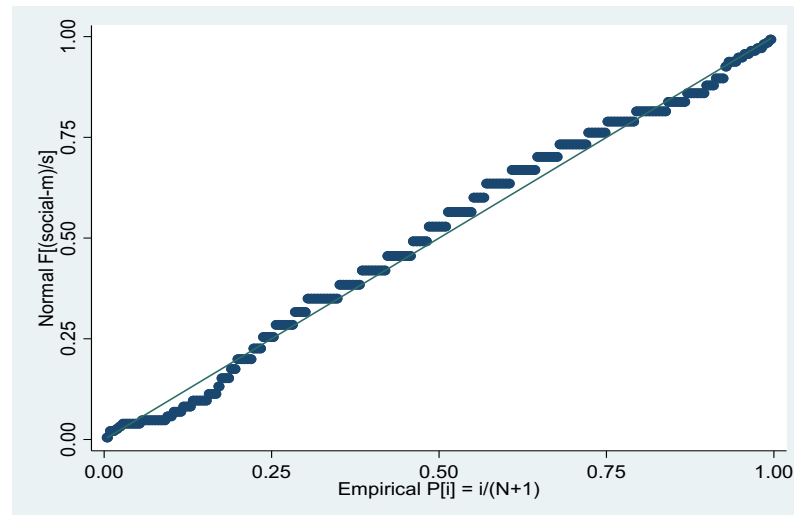


Fig. 8. Line of Best Fit Distribution for Measures for Development of Irrigation Schemes.

Food and nutrition and affordable UHC had most of the factor loadings >0.4 , thus indicating the covariates explain communality (shared variance) within the independent variables measuring Big Four Agenda. ASTGS was anchored on job diversity and changing demands. Factor loadings clearly highlight that job diversity has not been achieved (0.2661) but changing demands on a variety of foods and services due to income earned has had a social impact on the farmers (loadings >0.4). NIA Strategic Plan social impact was measured through irrigation management and development, water harvesting and storage, irrigation research, and governance. Respondents were not aware of legal frameworks under irrigation (factor loading >0.4) and did not report success in working with government agencies (0.3507) or achievement of resolutions through social forums (0.392). The findings also highlight welfares and social organizations are not active in irrigation sustainability (0.3506).

The cumulative sum of scores was fitted on a standardized normal curve and fell on a straight line, thus linear regression model could be employed (Fig. 8) and later aided in the expression of a linear regression equation.

The output of the ANOVA test highlights statistical significance in independent variables measuring the Development of Irrigation Schemes with a significance F-statistic (thus indicating a variation in group means; $F=9.361$, $p<0.005$). Utilized were the post ad hoc tests which were used to identify the variables with mean differences as highlighted in the coefficient Table I.

Assessment of development of irrigation schemes (as envisioned in Vision 2030, Big Four Agenda, ASTGS and NIA Strategic Plan) explained 36% of variability of capacity building and empowerment ($R^2=0.355$).

The regression model explains the impact of irrigation scheme development on capacity building and empowerment of communities. The development of irrigation schemes was assessed through a regression model with standardized covariates (Table II).

TABLE I: ANALYSIS OF VARIANCE (ANOVA) - DEVELOPMENT OF IRRIGATION SCHEMES

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	14.165	12	1.180	9.361	0.000 ^b
Residual	24.085	191	0.126	—	—
Total	38.250	203	—	—	—

TABLE II: SUMMARY OF REGRESSION MODEL OUTCOME ON IRRIGATION SCHEMES DEVELOPMENT

Coefficients					
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.014	0.210		4.816	0.000
Education & Training	0.037	0.014	0.167	2.697	0.008
Clean Water & Sanitation	0.012	0.026	0.033	0.478	0.633
Youth Access to Funds	0.000	0.015	-0.002	-0.027	0.979
Housing Type	0.000	0.020	0.001	0.014	0.989
Food Security	0.107	0.023	0.300	4.658	0.000
Health Care Services- UHC	0.033	0.012	0.191	2.785	0.006
Changing Demand	0.076	0.020	0.281	3.901	0.000
Irrigation Orientation	-0.001	0.019	-0.004	-0.054	0.957
Water Harvest	0.085	0.020	0.313	4.342	0.000

Dependent Variable: output

The linear regression equation developed denoted (4).

$$E(Y|x) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_n X_n \quad (4)$$

where;

Y is the outcome variable (capacity building & empowerment) given $x_{1...n}$ (independent variables measuring Y), β is the coefficient;

$$E(Y|x) = 1.014 + 0.167 \text{ Education and Training} + 0.033 \text{ Clean Water \& Sanitation} - 0.002 \text{ Youth Access to Funds} + 0.001 \text{ Housing Type} + 0.300 \text{ Food Security} + 0.191 \text{ UHC} + 0.281 \text{ Changing Demand} - 0.004 \text{ Irrigation Orientation} + 0.313 \text{ Water Harvest}$$

According to the model the one-unit change in the Development of Irrigation Schemes contributes to 0.167 units of Education and Training, 0.033 units of Clean Water & Sanitation, -0.002 units of Youth Access to Funds, 0.001 units Housing Type, 0.300 units Food Security, 0.191 units UHC, 0.281 units Changing Demand -0.004 units Irrigation Orientation and 0.313 units Water Harvest. The model showed an inverse effect as a result of the development of irrigation schemes on Youth Access to Funds and Irrigation Orientation. Study results showed that youth cannot easily access funds and do not have the collateral necessary to access loans. Further, youth found it difficult to own or lease land for farming. This contributed to the negative impact (-0.002) co-efficient in the regression. With regard to Irrigation Orientation, the results showed that there is a minimal collaboration between the farmers and the government in the formation and organization of social forums resulting in the negative impact (-0.004) co-efficient in the regression.

In terms of significance, Education and Training ($p=0.008$), Food Security ($p<0.005$), Accessible UHC ($p=0.006$), Changing Demand ($p=0.000$) and Water Harvesting ($p=0.000$) were statistically significant as their p -values were less than 0.05 ($p<0.005$).

V. RECOMMENDATIONS

The study highlighted challenges in water storage and maintenance especially during the dry season which results in adverse effects on sustained crop production. This challenge may be addressed by involving the Kenyan government agencies such as the National Irrigation Authority (NIA), Tana and Athi Rivers Development Authority (TARDA), County government agencies, the private sector and other stakeholders in the development of sufficient and reliable water supply as well as provision of storage facilities.

Respondents voiced concerns regarding lack of regular soil testing, strong bargaining power of middlemen which in-turn reduces the farmers' profit margin and lack of climate change resilient seeds. Therefore, there is need for comprehensive research within the irrigation scheme through agricultural research and development to address the concerns of the future effects of chemical use on the health of the locals. Thus, local authorities should renew the engagement of agricultural extension workers. To counter the bargaining power of middlemen, farmer welfare organizational structures should be operationalized.

VI. CONCLUSIONS

According to the findings, investment in water irrigation schemes contribute to capacity building and the empowerment of Kenyan communities. Specifically, development of irrigation schemes facilitates access to clean water and sanitation within the homestead (77%) as well as sufficient food and balanced diet throughout the year (197; 56%). A statistical analysis denoted that infrastructure was significantly associated with capacity building ($p=0.03$) by enabling easy transportation of inputs such as seedlings and fertilizers and easy accessibility to the market. In addition, the irrigation scheme has greatly improved the lifestyle of the locals through access to health services and comfortable housing. However, despite a majority (220; 62%) strongly agreeing to be able to educate children to the primary school level, only 105 (30%) and 47 (12%) can afford to educate their families to secondary and tertiary level respectively from the income earned from farming, the assessment highlighted gaps in education. A major success of the irrigation scheme is that it has led to job creation and diversity as one acre of irrigated land is able to directly employ eight people. Additionally, various job types have spurned from the development of irrigation schemes thereby leading to capacity building and empowerment of local communities.

FUNDING

The authors would like to acknowledge the financial support that was offered by family and friends during the study period.

CONFLICT OF INTEREST

The authors of the paper declare that there is no form of conflict of interest.

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