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RESOURCE STEWARDSHIP AND CLIMATE SMART AGRICULTURE IN LAIKIPIA COUNTY, KENYA

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ABSTRACT

Objective: To examine the extent to which resource stewardship influences the performance of climate-smart agriculture projects in Laikipia County, Kenya.

Theoretical Framework: The study was anchored on the Stewardship theory that envisages that unsupervised managers, will derive their satisfaction from the organization's success hence, remain accountable stewards. Judicious stewardship is the only way to achieve food security in a healthy ecology.

Method: A concurrent mixed method approach that adopted the descriptive cross-sectional survey and correlational design was employed to study two World Bank-sponsored Kenya Climate Smart Agriculture projects. Stratified and Simple random sampling were employed to get a sample of 225 small-scale farmers and purposeful sampling identified four key informants. Data was collected using questionnaires and interview guide and analyzed using descriptive, inferential, and content data analysis techniques.

Results and Discussion: The respondents' opinions on resource stewardship had a composite mean and standard deviation of 3.47 and 1.138 respectively. The relationship between resource stewardship and the performance of climate-smart projects had a weak linear correlation of (r= -0.007) and p-value (p=0.923>0.05) indicating a weak and insignificant relationship. Despite the portrayed confidence in resource stewardship, stewardship is not a quick-fix approach hence, detested in the use of resources.

Research Implications: Consequently, it is vital to have policies that enforce, promote, and subsidize activities that stimulates stewardship in food production.

Originality/Value: This study contributes to the literature by providing reliable and triangulated empirical data through authentic methodology enhancing suitability for data generalisability and replicability. The relevance and value of this research are evidenced by the need to promote food security in pursuance of the achievement of sustainable development goals.

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ADMINISTRAÇÃO DE RECURSOS E AGRICULTURA CLIMATICAMENTE INTELIGENTE NO CONDADO DE LAIKIPIA, QUÊNIA

RESUMO

Objetivo: Examinar até que ponto a administração de recursos influencia o desempenho dos projetos de agricultura climaticamente inteligente no condado de Laikipia, Quênia.

Estrutura Teórica: O estudo foi ancorado na teoria da administração que prevê que os gerentes não supervisionados obterão sua satisfação com o sucesso da organização e, portanto, permanecerão administradores responsáveis. A administração criteriosa é a única maneira de alcançar a segurança alimentar em uma ecologia saudável.

Método: Uma abordagem de método misto simultâneo que adotou a pesquisa descritiva transversal e o projeto correlacional foi empregada para estudar dois projetos de agricultura inteligente climática do Quênia patrocinados pelo Banco Mundial. A amostragem aleatória estratificada e simples foi empregada para obter uma amostra de 225 pequenos agricultores e a amostragem intencional identificou quatro informantes-chave. Os dados foram coletados por meio de questionários e guias de entrevista e analisados por meio de técnicas descritivas, inferenciais e de análise de dados de conteúdo.

Resultados e Discussão: As opiniões dos entrevistados sobre a administração de recursos tiveram uma média composta e um desvio padrão de 3,47 e 1,138, respectivamente. A relação entre a administração de recursos e o desempenho de projetos inteligentes em relação ao clima teve uma correlação linear fraca de (r= -0,007) e um valor de p (p=0,923>0,05), indicando uma relação fraca e insignificante. Apesar da confiança retratada na administração de recursos, a administração não é uma abordagem de solução rápida, portanto, detestada no uso de recursos.

Implicações da pesquisa: Consequentemente, é vital ter políticas que reforcem, promovam e subsidiem atividades que estimulem a administração na produção de alimentos.

Originalidade/valor: Este estudo contribui para a literatura ao fornecer dados empíricos confiáveis e triangulados por meio de uma metodologia autêntica que aumenta a adequação para a generalização e replicabilidade dos dados. A relevância e o valor desta pesquisa são evidenciados pela necessidade de promover a segurança alimentar em busca da realização das metas de desenvolvimento sustentável.

Palavras-chave: Projetos de Agricultura Inteligente em Relação ao Clima, Planejamento de Capacidades, Projetos Agrícolas, Pequenos Agricultores, Ecologia Saudável.

ADMINISTRACIÓN DE RECURSOS Y AGRICULTURA CLIMÁTICAMENTE INTELIGENTE EN EL CONDADO DE LAIKIPIA, KENIA

RESUMEN

Objetivo: Examinar en qué medida la administración de los recursos influye en el rendimiento de los proyectos de agricultura climáticamente inteligente en el condado de Laikipia, Kenia.

Marco Teórico: El estudio se basó en la teoría de la administración, según la cual los gestores no supervisados obtienen su satisfacción del éxito de la organización y, por tanto, son administradores responsables. Una administración juiciosa es la única manera de lograr la seguridad alimentaria en una ecología sana.

Método: Para estudiar dos proyectos de agricultura climáticamente inteligente en Kenia patrocinados por el Banco Mundial se empleó un método mixto concurrente que adoptó el diseño de encuesta transversal descriptiva y correlacional. Se emplearon el muestreo aleatorio estratificado y el muestreo aleatorio simple para obtener una muestra de 225 pequeños agricultores, y el muestreo intencional permitió identificar a cuatro informantes clave. Los datos se recogieron mediante cuestionarios y una guía de entrevista, y se analizaron mediante técnicas de análisis de datos descriptivos, inferenciales y de contenido.

Resultados y Discusión: Las opiniones de los encuestados sobre la administración de los recursos tenían una media compuesta y una desviación típica de 3,47 y 1,138 respectivamente. La relación entre la gestión de los recursos y el rendimiento de los proyectos climáticamente inteligentes presentaba una débil correlación lineal de (r= -0,007) y un valor p (p=0,923>0,05) que indicaba una relación débil e insignificante. A pesar de la confianza mostrada en la gestión de los recursos, ésta no es una solución rápida, por lo que se detesta en el uso de los recursos.

Implicaciones de la Investigación: En consecuencia, es vital contar con políticas que impongan, promuevan y subvencionen actividades que estimulen la administración en la producción de alimentos.

Originalidad/Valor: Este estudio contribuye a la literatura proporcionando datos empíricos fiables y triangulados a través de una metodología auténtica que mejora la idoneidad para la generalizabilidad y replicabilidad de los datos. La pertinencia y el valor de esta investigación se ponen de manifiesto por la necesidad de promover la seguridad alimentaria en pos de la consecución de los objetivos de desarrollo sostenible.

Palabras clave: Proyectos de Agricultura Climáticamente Inteligente, Planificación de Capacidades, Proyectos Agrícolas, Pequeños Agricultores, Ecología Saludable.

1 INTRODUCTION

Soon after the resources are procured, the determining factor on whether they would result in functional food security projects depends on the stewardship of resources. Appreciating the fact that, resources are scarce, policies are fundamental to enhance judicious resource stewardship (Chen et al., 2021). The policies ensure competent and practical development of the food security projects' resources with the view of identifying opportunities and risks well in advance, proactively optimizing the opportunities and mitigating the risks. Consequently, guaranteeing maximum food production in a healthy ecology. Resource stewardship involves economic growth, social inclusion, environmental protection, ethical practices, and efficient use of resources.

Resource stewardship evokes efficient use, development, and protection of the resources geared towards performing food security projects, economy, and healthy ecology. Nonetheless, uncontrolled resource utilization results in overgrazing, over-cropping, deforestation, charcoal burning, forest fires, and invasion of gazetted riparian land. Hence, further threatening the ecology and the consequence is climate crisis, soil degradation, and water depletion. In addition, the unharvested rainwater leads to floods, land and property destruction, further aggravating the situation that opposes effectual food security projects.

Different studies conducted globally highlight the importance of resource stewardship in food production. A study by Cockburn et al. (2019) measured socio-ecological factors in resource stewardship in South Africa. The methodology and concept differentiated the study from this study as the focus was on stewardship practitioners and employed the survey research design. Moreover, the study found that policy-driven stewardship was the most effective method of achieving stewardship in South Africa's food security projects. Schimmelpfennig (2019), measured the efficacy of technology in promoting stewardship of resources in the USA rice production. The methodology, concept, and context differentiated the study from this study as the study employed a survey, America is a developed country, and the study focal point was on a single crop; rice. However, the study found that technology (precision agriculture's information system) improved resource stewardship in food production projects in America. Nonetheless, Cockburn et al. (2019) and Schimmelpfennig (2019) found that stewardship in food production was fundamental in ecology-conscious farming. Therefore, stewardship is fundamental in food production but, it is likely to be influenced by policies, technology, and socio-ecological factors.

2 THEORETICAL FRAMEWORK

The proponent of Stewardship theory was Donaldson, L., and Davis, J. H. (Donaldson & Davis, 1991). The theory envisages that unsupervised managers, will derive satisfaction from the organization's success and be accountable stewards of the organization's assets. Therefore, intrinsic rewards, such as trust and job stability motivate accountability amongst the managers and for them to serve the corporation wholeheartedly and with not their selfish interests. Hence, the principles of the theory are to endeavor to safeguard the organization and operate as a going concern.

Therefore, there must be structures to ensure harmony between the stakeholders. This theory agrees with this study as when the food security projects are doing well, the project managers will be motivated to be good stewards in utilizing the resources. Consequently, the ecology would remain healthy, and agricultural production would be sustainable. This implies that, if the food security project managers act on the contrary, and fail to be good stewards, the resources will be destroyed, threatening equitable generational food production. Nonetheless, the theory fails to appreciate other stewardship influencing factors, over and above the behavioural aspects. The theory ignored factors such as skills, socioeconomic and technology, which are fundamental in any phenomenon.

2.1 EMPIRICAL LITERATURE

Assigning the right tasks, budget, equipment, and supplies to the food security projects is instrumental for the performance of food security projects. Consequently, it ensures a stable, sustainable, self-replenishing, and healthy ecology. However, the contrary leads to a crisis in projects, such as post-harvest loss contributing to methane and carbon dioxide, hence the climate crisis (Holman et al., 2017). Which in return, causes heat and drought stress and water depletion globally. Subsequently, a progressive decrease in agricultural and forest areas is expected to heighten by the year 2050. Hence, the need to utilize the resources sustainably in food production to avert the ecological crisis at the expense of short-term gains (El Bilali et al., 2021). This calls for a conceited effort by all stakeholders including consumers. A study by Duvaleix et al. (2020) employed case studies to investigate pig and olive oil farming in Western France and Greece and investigated ecological stewardship in the form of public labels. This differentiated the study from this study in the following ways: methodology as it used a case

study, concept as it focused on labels, and context as it focused on developed countries. However, found that to promote environmentally friendly practices in agriculture, quality labels, and producer organizations should focus on enforcing farmers to guarantee the adoption of environmentally friendly agriculture. This primes the need for policy to promote soil and water management by ensuring food security projects focus on agroforestry (Holman et al., 2017). Lack of policies would reinforce the status quo of a regressive climate crisis.

The agriculture industry is a major contributor to the climate crisis. Inefficiency in water utilization in agriculture leads to 75%-90% of freshwater withdrawal (Kay et al., 2022). In addition, politically powerful companies and countries take land from poor countries for the production of biofuels, while, intellectual property rights promote unequal access to agricultural inputs hence, widening the gap between poor and rich farmers (Korthals, 2016). Hence, the need for inclusivity in resource stewardship and circular economy (Zhang & Tang, 2023). Inclusivity pools skills and ownership of the initiatives. Gender inclusivity in utilization of resources for agricultural production, attracts women skills which are fundamental, appreciating that women are affected by the unexpected outcome of poor stewardship of resources in agriculture (Phiri et al., 2022). In addition, the New Environmental Governance is focusing on the need for inclusivity of land managers in voluntary stewardship to ensure a healthy ecology (Lawson, 2019). Inclusivity widens the scope of stakeholders.

Appreciating that the sustainability of food security projects requires judicious resource stewardship, there is a need for a global multi-stakeholder approach to develop acceptable resource stewardship in agricultural principles and practices. There is a need to train farmers on ecologically friendly agriculture to conserve soil and water and recycle nutrients (Kiełbasa et al., 2018). The practices would improve soil management and manage contributors of global warming for excellence in food production (Minasny et al., 2017). Failure to manage water, soil, and industrial waste has led to cadmium contamination and acidification of agricultural soil. Consequently, toxicity absorbed from the soil into the food threatens food safety and human health (Wang et al., 2019). Consequently, caution should be taken to avert water pollution by agricultural activities (Stoyanova & Harizanova, 2019). This translates to, food security projects going beyond an abundance of food, to a clean bill of health on accessible safe and quality food that is accessible for human consumption.

Improved resource stewardship mitigates food poisoning, and climate change and enhances a conducive environment for food production. However, skills deficiency may lead to resources mismanagement. A study by Alemu (2019) measured the farmers' disposition on

natural resource management. The study methodology was survey design, which differentiated it from this study. All factors considered; the study found that the farmers lacked skills to facilitate their efficient stewardship of the water resources. This was supported by Bikuba and Kayunze (2019) measured community involvement in irrigation projects. Purposive sampling differentiated the study from this study. However, the study found that the community lacked skills and there was inadequate involvement in decision-making about water resource stewardship. These factors frustrated the efficacy of food security projects. It appears that capacity building of farmers would alleviate poverty, ignorance, and illiteracy. Hence, promotes the efficacy of food security projects, more so in economically developing nations.

Efficiency and effectiveness in resource utilization are fundamental for sustainable food security. This involves, water resource protection (Makanda et al., 2022) which demands judicious planning of resources. Akuno and Wanyoike (2020) employed descriptive research design and measured stewardship of resources through risk and schedule planning. The study was differentiated from this study by the concept as it focused on wildlife and conservation. Moreover, the study found that a resource plan and regular monitoring are critical for effective stewardship. However, poverty, lack of alternative livelihood, and land scarcity lead to increasing and unprofitable land fragmentation. Consequently, the reduced capacity of food security projects to manage soil and labor resources and hindering the performance of food security projects (Wekesa et al., 2018). In addition, semi-arid and arid land have harsh climatic and biophysical conditions. Therefore, to guarantee improved food production in the land that is frequented by drought, water and soil stewardship are important. In addition, water harvesting, introduction of drought-tolerant cereals, and enhancement of soil cover are ultimate (Brandt et al., 2017). However, diversity in communities' socio-cultural practices should be factored in when developing resource stewardship policies.

Diversity in communities' socio-cultural practices, informs on the need to have tailored policies for specific communities. A study by Oremo et al. (2019) measured small-scale farmers' disposition on water stewardship during irrigation. The study methodology and concept involved multi-stage sampling technique and focused on irrigation alone, which differentiated the study from this study. Moreover, the study found that socio-cultural factors and water scarcity influenced water stewardship. Therefore, there is a need to review the Water Act 2016 (Dirwai et al., 2021). The review of the Water Act 2016, would support the changes that came with devolution and accommodate diversity in communities, more so, in water

stewardship-related issues. In addition, equality in the allocation of resources by the Government would promote resource stewardship.

Marginalization of rural arable land has led to food security projects failing to access social services such as markets, extension services, roads, and electricity. Some parts of Laikipia are marginalized from development. This has led to financial constraints and poor design of extension programs. Subsequently, small food security projects have developed a risk-averse perception. This has limited them from embracing technology. Failure to effectively embrace technology reduced their capacity to steward the available meager resources in their projects. Lack of extension programs deprives the farmers of the opportunity to acquire skills (Stefanovic et al., 2017). Therefore, marginalization has a role in reducing efficiency in the stewardship of limited resources. Consequently, the need to empower, and develop capacity for food security projects to prudently steward the scarce resources.

3 MATERIALS AND METHOD

The main objective of this study was to examine whether resource stewardship promotes climate-smart agriculture projects in Laikipia County, Kenya. The research question was to what extent does resource stewardship influence climate-smart agriculture projects in Laikipia County, Kenya? The concurrent multi-methodology approach was preferred to allow the collection of quantitative and qualitative data. Hence, a cross-sectional survey and correlational design were employed. This study unit of analysis was two World Bank-sponsored Climate Smart Agriculture dam projects namely, the Kariunga-Mutirithia-Naibor project (Segera Ward) with 300 small-scale farmers and the Ndathimi Dam project (Karaba ward), with 212 small-scale farmers respectively.

The study employed the Yamane (1967) formula to calculate the required sample size and stratified and simple random sampling were used to determine 130 small-scale farmers from the Kariunga-Mutirithia-Naibor dam water project and 91 small-scale farmers from the Ndathimi Dam water project. Also, four key informants purposefully sampled included: the County Government, the Ministry of Agriculture, Livestock and Fisheries officer and the two project managers. The questionnaires assisted in soliciting information from 203 small-scale farmers. The interview guide prompted the researcher while collecting information from the four key informants and the observation guide had questions that prompted the researcher in observing the projects.

4 RESULTS AND DISCUSSIONS

Resource stewardship, the independent variable and performance of climate-smart agriculture projects were assessed through various aspects, which included economic growth, social inclusion, environmentally friendly practices, ethics and efficiency in utilization of resources. Respondents were asked to indicate their opinion on a Likert scale weight of 1-5. Where: 1= strongly disagree, 2= disagree, 3= neutral, 4= agree, and 5 strongly agree. Table 1 highlights the results.

Table 1

Resource Stewardship and Performance of Climate-smart Agriculture Projects

Item	Statement	SD(1) F %	D(2) F %	N(3) F %	S(4) F %	SA F %	TOTAL F %	M	SD
RS1	Economic growth is considered during resource utilization for production.	17 (8.4%)	12 (5.9%)	35 (17.2%)	81 (39.9%)	58 (28.6%)	**203 100%**	**3.74**	**1.179**
RS2	There is social inclusion in project resources stewardship	22 (10.8%)	14 (18.7%)	38 (6.9%)	76 (37.4%)	53 (26.2%)	**203 100%**	**3.61**	**1.247**
RS3	The project appreciates environmentally friendly activities during food production.	7 (3.4%)	42 (26.1%)	53 (20.7%)	77 (37.9%)	24 (11.9%)	**203 100%**	**3.34**	**1.043**
RS4	Ethics are observed in resource utilization.	7 (3.4%)	42 (26.1%)	53 (20.7%)	77 (37.9%)	24 (11.8%)	**203 100%**	**3.34**	**1.043**
RS5	Farmers efficiently utilize resource	16 (7.9%)	38 (23.6%)	48 (18.7%)	69 (34.0%)	32 (15.8%)	**203 100%**	**3.31**	**1.176**
Composite mean and composite Standard Deviation								**3.47**	**1.138**

Table 1 presents results for each line item measuring the degree to which resource stewardship influenced the Performance of Climate-smart Agriculture Projects. A Lower item mean compared to the composite mean translates to a negative opinion on the tested item, while a lower standard deviation compared to the composite standard deviation translates to respondents' convergence in opinion.

Statement RS1, economic growth was considered during resource utilization for production, 17(8.4%) strongly disagreed, 12(5.9%) disagreed, 35(17.2%) were neutral, 81(39.9%) agreed and 58(28.6%) strongly agreed, averaged to 3.74 versus 3.47 as a composite mean indicating that economic growth was accorded consideration when resources were being utilized. Raymond et al. (2016), found that agri-environmental schemes failed to promote food production in tandem with ecological consciousness. A line standard deviation of 1.179 versus 1.138 as a composite standard deviation inferred divergence in responses. Food systems were associated with climate change, ecosystem degradation, and resource scarcity. Hence, there was a need to utilize the resources sustainably in food production considering food security and economic growth (El Bilali, Strassner & Hassen, 2021).

Statement RS2, there was inclusion in project resources stewardship, 22(10.8%) strongly disagreed, 14(18.7%) disagreed, 38(6.9%) were neutral, 76(37.4%) agreed and 53(26.2%) strongly agreed, averaged to 3.61 versus 3.47 as composite mean showed that project resources stewardship involved inclusion of everyone in the project. The findings supported that there was a need for gender inclusivity in utilization of resources for agricultural production, since, women have skills which were fundamental and they were affected by the unexpected outcome of poor stewardship of resources in agriculture (Phiri et al., 2022). A line standard deviation of 1.247 versus 1.138 as a composite standard deviation implied that respondents had divergent opinions. The findings contrasted the New Environmental Governance focusing on the inclusivity of land managers in voluntary stewardship to ensure a healthy ecology (Lawson, 2019).

Statement RS3, the project appreciates environmentally friendly activities during food production, 7(3.4%) strongly disagreed, 42(26.1%) disagreed, 53(20.7%) were neutral, 77(37.9%) agreed and 24(11.9%) strongly agreed, averaged to 3.34 versus 3.47 as composite mean, meant that some of the projects' activities were not environmentally friendly. The findings supported there was a need to train farmers on environmentally friendly agriculture to enhance efficiency in production and heighten the recycling of nutrients (Kiełbasa, Pietrzak, Ulén, Drangert & Tonderski, 2018). A line standard deviation of 1.043 versus 1.138 as composite standard deviation meant convergent opinions of the respondents. This supported Duvaleix et al. (2020) who found that quality labels were required to encourage farmers to adhere to environmentally friendly practices.

Statement RS4, ethics were observed in resource utilization, 7(3.4%) strongly disagreed, 42(26.1%) disagreed, 53(20.7%) were neutral, 77(37.9%) agreed and 24(11.8%) strongly agreed,

averaged to 3.34 versus 3.47 as composite mean, indicated that ethics were not observed during resource utilization. This was in line with the countries with industrialized agriculture exposing livestock to water, land, and air pollution. In addition, politically powerful companies and countries take land from poor countries for the production of biofuels. Intellectual property rights promote unequal access to agricultural inputs hence, widening the gap between poor and rich farmers (Korthals, 2016). Item standard deviation of 1.043 versus 1.138 as composite standard deviation implied, convergence in the responses. The findings supported that caution should be taken to avert water pollution by agricultural activities (Stoyanova & Harizanova, 2019).

Statement RS5, farmers efficiently utilize resources, 16(7.9%) strongly disagreed, 38(23.6%) disagreed, 48(18.7%) were neutral, 69(34.0%) agreed and 32(15.8%) strongly agreed, averaged to 3.31 versus 3.47 as composite mean showed that farmers failed to utilize resources efficiently. This was contrary to recommendations that water resource protection played a great role in promoting sustainable production (Makanda et al., 2022). Item standard deviation of 1.176 versus 1.138 as composite standard deviation meant that the responses were divergent. This supported Cockburn et al. (2019) who found there was a need for individuals utilizing resources for production purposes to consider societal and ecological needs.

The key informants had the following to say about resource stewardship in the food security projects.

> The driving factor of the Kariunga-Mutirithia-Naibor Dam Project and Ndathimi Dam Project was the stewardship of resources. As the project sponsors instilled the need for climate-smart agriculture, hence, the project members emphasize the need to conserve the environment, through resource stewardship. (Respondent A)
>
> Stewardship was critical in the project as the resources were scarce and the needs were overwhelming. However, conservation of the environment appeared to have minimal effect as the larger Laikipia County experienced overgrazing and pumping water directly from the river. (Respondent B)
>
> Stewardship was not a choice in the Kariunga-Mutirithia-Naibor Dam Project and Ndathimi Dam project, as the area was arid and semi-arid land. Hence, the need to embrace and protect the little available resources. However, much could be achieved as the larger Laikipia County did not adhere to environmental stewardship. (Respondent C)
>
> The project members owned the project, hence, to preserve it for posterity, stewardship was not a choice. (Respondent D)

The study observed that the dams and the drip irrigation systems set the projects apart from other farmers as minimal land and water were utilized to generate optimum return on

investment. However, this differentiated the project from the larger Laikipia County farmers who were overgrazing and pumping water directly from the river. The interview and the researcher's observation confirmed that the project members were positive about resource stewardship. The land and water were well utilized due to the available technology.

4.1 CORRELATION ANALYSIS BETWEEN RESOURCE STEWARDSHIP AND PERFORMANCE OF CLIMATE-SMART AGRICULTURE PROJECTS ANALYSIS

To examine resource stewardship's relationship with the Performance of Climate-smart Agriculture Projects, Pearson's Correlation Coefficient was adopted to evaluate the association at a 0.05 level of significance. The values of correlational analysis range from negative one to positive one. Where positive one and negative one infer perfect-positive and perfect-negative correlation respectively, while zero implies no correlation. The modular values 0.001 to 0.250, 0.251 to 0.500, and 0.501 to 0.750 imply weak, moderately-strong and very strong correlation respectively. Table 2 details the correlation results.

Table 2

Correlation Analysis between Resource Stewardship and Performance of Climate-smart Agriculture Projects Correlations

Variables		Resource Stewardship	Performance of Climate-smart Agriculture Projects
Resource Stewardship	Pearson Correlation	1	-0.007**
	Sig. (2-tailed)		0.923
	n	203	203
Performance of Climate-smart Agriculture Projects	Pearson Correlation	0.007**	1
	Sig. (2-tailed)	0.923	
	n	203	203

**Correlation is significant at 0.05 level of significant (2-tailed)

Table 2 details a negative weak linear correlation linking resource stewardship and the Performance of Climate-smart Agriculture Projects (r= -0.007), indicating an insignificant relationship as the level significance was less than the probability value (p=0.923>0.05). This indicates the presence of a negative weak inconsequential association between resource stewardship and the Performance of Climate-smart Agriculture Projects leading to failure to reject the null hypothesis. Therefore, the research concluded that resource stewardship had no the consequential association with the Performance of Climate-smart Agriculture Projects. The

findings conflicted with Schaiblea et al. (2015), who found higher revenue was realized by farmers who participated in stewardship.

4.2 REGRESSION ANALYSIS OF RESOURCE STEWARDSHIP AND PERFORMANCE OF CLIMATE-SMART AGRICULTURE PROJECTS

Demonstrating whether resource stewardship significantly predicted Performance of Climate-smart Agriculture Projects was the justification of employing the simple regression model.

4.2.1 Regression model

The following statistical model was used to test the null hypothesis.

Performance of Climate-smart Agriculture Projects = resource stewardship

$$Y = \beta_0 + \beta_1 X_1 + \varepsilon \qquad (1)$$

where:

Y = Performance of Climate-smart Agriculture Projects

X_1 = resource stewardship

β_0 = Constant term

β_1 = Beta coefficient

ε = Error term

Regression results were detailed by Table 3.

Table 3

Regression Analysis on Resource Stewardship and Performance of Climate-smart Agriculture Projects

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.007[a]	0.000	-0.005	0.52373

ANOVA

Model		Sum of Squares	Df	Mean Square	F	Sig
1	Regression	0.003	1	0.003	0.009	0.923[b]
	Residual	55.134	201	0.274		
	Total	55.136	202			

Regression Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.838	0.168		16.905	0.000
	Resource Allocation	-0.005	0.047	-0.007	-0.097	0.923

Predictors: (constant), Resource Stewardship
Dependent Variable: Performance of Climate-smart Agriculture Projects

Table 3 presents the model summary, it highlights a weak negative correlation coefficient r= -0.007, linking resource stewardship and the Performance of Climate-smart Agriculture Projects. Also, the relationship was evident with a coefficient of determination R^2 = 0.000, translated to variations in the performance of small-scale food security projects farmers could not be explained by resource stewardship. The F statistics F (1,201) = 0.009 was less than the critical value (3.888) thus the model failed in goodness of fit. The association was inconsequential given the level of significance less than the probability value (p= 0.923 > 0.05). The findings conflicted with the findings by Schaiblea et al. (2015) who found participating in stewardship programs helped farmers to invest less in food production than those who did not hence, benefiting from higher revenue.

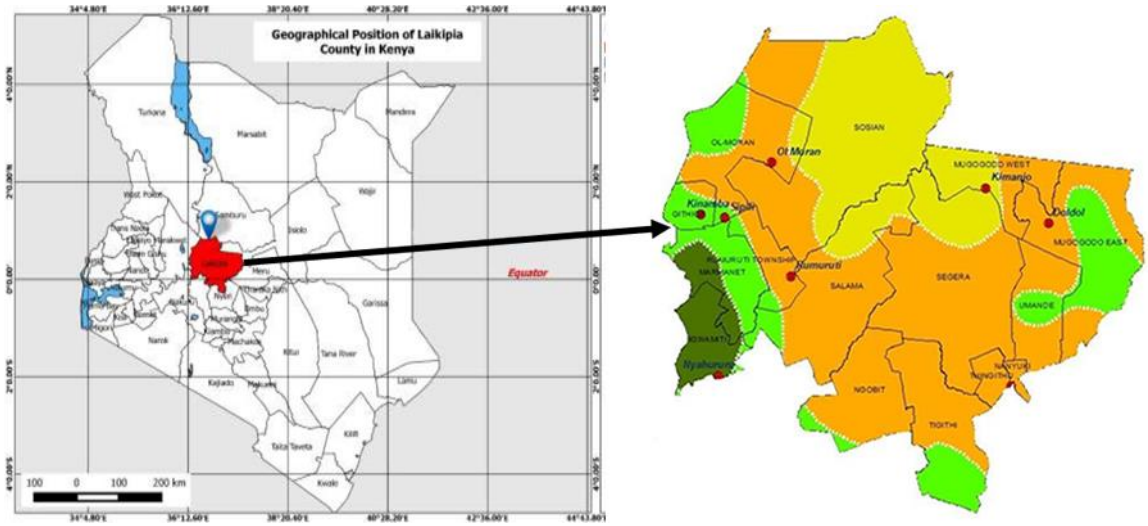
Table 3 presents the ANOVA results indicating, that F statistics (1,201) = 0.009 was not significant at P-value 0.923 > 0.05. This inferred that the predictor coefficient was at minimum not equal to zero. Hence, the regression model failed to predict the Performance of Climate-smart Agriculture Projects after the use of resource stewardship. The findings contradicted the findings by Schimmelpfennig (2017) who found that farmers who practiced precision agriculture for resource stewardship could sometimes benefit from more revenue than those who did not practice precision agriculture. Hence, farmers must appreciate resource stewardship may lead to extra costs, but it promotes sustainable agriculture.

The constant term's coefficient of (βo =2.838; P < 0.05), and resource stewardship (β_1 = -0.005, P-value 0.000 < 0.05) were statistically inconsequential. Therefore, negative insignificant

influence of resource stewardship on the Performance of Climate-smart Agriculture Projects. The regression model for stewardship was $Y=2.838 + (-0.005X_1)$, indicating that for each unit of resource stewardship, the Performance of Climate-smart Agriculture Projects was negatively and linearly related. The findings were contrary Carmichael et al., (2023) who found in Canada, farmers employed climate-friendly technology, as opposed to the rampant disposition that food systems require transformation to be climate-friendly.

Figure 1

Map of Kenya and Laikipia County where the study was conducted



Source: (GOK., 2017).

5 CONCLUSIONS

Currently, resource stewardship may not influence the performance of climate-smart agriculture projects, but it is fundamental for equitable inter-generational resource availability and sustainability of food production. Consequently, it is needful that farmers are trained and agricultural policies and infrastructure put in place to guarantee enforcement of resource stewardship in food security projects. In addition, the government should invest in public goods that promote resource stewardship such as dams and afforestation. Green economy and big data are potential factors to consider in resource stewardship. To guarantee resource stewardship in the current and recent future. The government should invest in agricultural infrastructure and training of farmers, to reap its benefit and for the posterity of food projects in the long term.

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REFERENCES

Akuno, E.A. & Wanyoike, D. (2020). Influence of Project Resource Planning on Performance of Elephant Conservation at TSAVO National Park, Kenya. *The International Journal of Business Management and Technology*, *4*(2), 273-281. https://www.theijbmt.com/archive/0932/1841505477.pdf

Alemu, M. D. (2019). Farmers' Perception and Indigenous Knowledge for Natural Resources Management, Abo-Wonsho Woreda, Southern Ethiopia. *Agricultural Sciences*, *10*(11), https://www.scirp.org/journal/paperinformation.aspx?paperid=96217

Bikuba, J. R. & Kayunze, K. A. (2019). Enhancing community participation to improve sustainability of irrigation projects in Geita District, Tanzania. *Journal of Agricultural Extension and Rural Development*, *11*(10), 169–175, https://doi.org/10.5897/JAERD2019.1066

Brandt, P., Kvakić, M., Butterbach-Bahl, K., & Rufino, M. C. (2017). How to target climate-smart agriculture? Concept and application of the consensus-driven decision support framework "target CSA". *Agricultural Systems*, *151*, 234-245. https://doi.org/10.1016/j.agsy.2015.12.011

Chen, S., Cao, Y. & Li, J. (2021). The Effect of Water Rights Trading Policy on Water Resource Utilization Efficiency: Evidence from a Quasi-Natural Experiment in China. *Sustainability*, *13*, 5281. https://doi.org/10.3390/su13095281.

Cockburn J, Cundill G, Shackleton S & Rouget M. (2019). The meaning and practice of stewardship in South Africa. *South Africa Journal of Science*, *115*(5/6), Art. #5339, 10 pages. https://doi.org/10.17159/sajs.2019/5339

Carmichael, J., Cran, A., Hrvatin, F., & Matthews, J. (2023). We are stewards and caretakers of the land, not exploiters of resources": A qualitative study exploring Canadian farmers' perceptions of environmental sustainability in agriculture. *PLoS One*, *18*(8), e0290114, 15 Aug 2023. doi: 10.1371/journal.pone.0290114.

Dirwai, T. L., Kanda, E. K., Senzanje, A. & Busari, T. I. (2021). Water resource management: IWRM strategies for improved water management. A systematic review of case studies of

East, West and Southern Africa. *PLoS ONE*, *16*(5), e0236903. https://doi.org/10.1371/journal.pone.0236903

Donaldson, L. & Davis, J. H. (1991). Stewardship Theory or Agency Theory: CEO Governance and Shareholder Returns. *Australian Journal of Management*, *16*(1). https://doi.org/10.1177/031289629101600103.

Duvaleix, S., Lassalas, M., Latruffe, L., Konstantidelli, V. & Tzouramani, I. (2020). Adopting Environmentally Friendly Farming Practices and the Role of Quality Labels and Producer Organisations: A Qualitative Analysis Based on Two European Case Studies. *Sustainability*, *12*, 10457. doi:10.3390/su122410457

GOK. (2017). *National Food and Nutrition Security Policy Implementation Framework 2017-2022*. Nairobi, Ministry of Agriculture, Livestock and Fisheries. http://extwprlegs1.fao.org/docs/pdf/ken170761.pdf

El Bilali, H., Strassner, C. & Hassen, B. T. (2021). Sustainable Agri-Food Systems: Environment, Economy, Society, and Policy. *Sustainability*, *13*, 6260. https://doi.org/10.3390/su13116260

Holman, I. P., Brown, C., Janes, V., & Sandars, D. (2017). Can we be certain about future land use change in Europe? A multi-scenario, integrated-assessment analysis. *Agricultural Systems*, *151*, 126–135. https://doi.org/10.1016/j.agsy.2016.12.001

Kay, M., Cetin, O., Çapar, G., Yeşim, A. & Tolga, P. (2022). *Improving agricultural water use efficiency and productivity in the Middle East*. Turkish Water Institute.

Kiełbasa, B., Pietrzak, S., Ulén, B., Drangert, J. & Tonderski, K. (2018). Sustainable agriculture: The study on farmers' perception and practices regarding nutrient management and limiting losses. *Journal of Water and Land Development*, *36*. DOI:10.2478/jwld-2018-0007

Korthals, M. (2016). *Agricultural Ethics*. Encyclopedia of Global Bioethics. DOI:10.1007/978-3-319-09483-0_14

Lawson, A. (2019). A conceptual framework for exploring voluntary stewardship programs for land managers as a tool of New Environmental Governance, *Australasian Journal of Environmental Management*, *26*(2), 137-155. DOI: 10.1080/14486563.2019.1599741

Makanda, K., Nzama, S. & Kanyerere, T. (2022). Assessing the Role of Water Resources Protection Practice for Sustainable Water Resources Management: A Review. *Water* 2022, *14*, 3153. https://doi.org/10.3390/w14193153

Minasny, B., Malone, B. P., McBratney, A. B., Angers, D. A., Arrouays, D., Chambers, A., Chaplot, V., Chen, Z. S., Cheng, K., Das, B. S., Field, D. J., Gimona, A., Hedley, C. B., Hong, S. Y., Mandal, B., Marchant, B. P., Martin, M., McConkey, B. G., Mulder, V. L., & Winowiecki, L. (2017). Soil carbon 4 per mille. *Geoderma*, *292*, 59–86. ISSN 0016-7061

Oremo, F., Oguge, N. & Mulwa, R. (2019). Knowledge, Attitude and Practice in Water Resources Management among Smallholder Irrigators in the Tsavo Sub-Catchment, Kenya. *Resources*, 8(3), 130. DOI: 10.3390/resources8030130.

Phiri, A. T., Toure, H. M. A. C., Kipkogei, O., Traore, R., Afokpe, P. M. K. & Lamore, A. A. (2022). A review of gender inclusivity in agriculture and natural resources management under the changing climate in sub-Saharan Africa, *Cogent Social Sciences*, *8*(1), 2024674, DOI: 10.1080/23311886.2021.2024674

Raymond, C., Reed, M. S., Bieling, C., Robinson, G. & Plieninger, T. (2016). Integrating different understandings of landscape stewardship into the design of agri-environmental schemes. *Environmental Conservation*, *43*(4), 350–358. http://dx.doi.org/10.1017/S0376892916000031X

Schaiblea, G. D., Mishra, A. K., Lambert, D. M. & Panterov, G. (2015). Factors influencing environmental stewardship in U.S. agriculture: Conservation program participants vs. non-participants. *Land Use Policy*, *46*(2015), 125–141. http://dx.doi.org/10.1016/j.landusepol.2015.01.018

Schimmelpfennig, D. (2017). Crop Production Costs, Profits, and Ecosystem Stewardship with Precision Agriculture. *Journal of Agricultural and Applied Economics*, *50*(1). DOI:10.1017/aae.2017.23

Stefanovic, J. O., Yang, H., Zhou, Y., Kamali, B. & Ogalleh, S. O. (2017) Adaption to climate change: a case study of two agricultural systems from Kenya, International Journal of Agricultural Resources, *Governance and Ecology*, *13*(2). https://doi.org/10.1080/17565529.2017.1411241.

Stoyanova, Z. D. & Harizanova, H. (2019). Impact of Agriculture on Water and Pollution. *AGROFOR International Journal*, *4*(1). DOI:10.7251/AGRENG1901111S.

Wang, P., Chen, H., Kopittke, P. M., & Zhao, F. J. (2019). Cadmium contamination in agricultural soils of China and the impact on food safety. *Journal of Environmental Pollution*, *249*, 1038–1048. DOI: 10.1016/j.envpol.2019.03.063

Wekesa, B. M., Ayuya, O. I., & Lagat, J. K. (2018). Effect of climate-smart agricultural practices on household food security in smallholder production systems: Micro-level evidence from Kenya. *Agriculture and Food Security*, *7*(1), 1–14. https://doi.org/10.1186/s40066-018-0230-0

Zhang, H. G. & Tang, X. Y. (2023). Study on optimized combination and utilization model of agricultural and animal husbandry resources in mountain ecotone. *IOP Conference Series: Earth and Environmental Science*, 346, 012031. doi:10.1088/1755-1315/346/1/012031