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INDIGENOUS LEAFY VEGETABLES AND SUSTAINABILITY OF RURAL ECONOMIES OF ELGEYO-MARAKWET COUNTY IN KENYA

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ABSTRACT
The study investigates the contribution of Indigenous Leafy Vegetables to food sustainability and rural economies in Elgeyo-Marakwet County, Kenya. The specific objectives were to assess the contribution of ILVs in sustainable food systems and explore their role in strengthening rural economic resilience. Anchored on Agroecology Theory, the study actually aimed at 320 members of both the Marakwet and Sengwer communities through the application of purposive sampling targeted at those households engaging in ILV farming and trade. Data were collected using semi-structured questionnaires, describing the role of ILV in sustaining agriculture and income stability among rural dwellers. Findings indicate that ILVs are one of the most nutritious foods contributing to food sustainability and rural economic stability, as they require less input to produce and are perfectly adapted to local agroecological practices. However, poor market access and inadequate infrastructure, accompanied by low commercialization potential, limit the economic and sustainability impact of these ILVs. Policies are therefore recommended to support market linkages, value chains, and improvement of infrastructure that would enhance the role of ILVs in food sustainability and rural economies.
Keywords: *Indigenous Leafy Vegetables, food sustainability, Agroecology, Ecosystem Services, Rural Sustainability*

INTRODUCTION
Indigenous leafy vegetables (ILVs) could contribute much toward sustainable food and support economic stability in rural areas of Kenya, especially in Elgeyo Marakwet County. ILVs require low agricultural inputs and are adapted to the local environment. Examples include amaranth, spider plant, and African nightshade. Moreover, ILVs contribute much to the rural economies due to the provision of income-generating activities to smallholder farmers and also do away with overreliance on imported or high-input crops.

Background of the Study
Indigenous leafy vegetables (ILVs) contribute much to food sustainability and help in supporting rural economies. Being adapted to the local climatic conditions, they can thrive with much fewer resources than crops that are non-native, thus being very sustainable as a source of food within the

rural communities. ILVs, on the other hand, require fewer amounts of pesticides and fertilizers, which not only contribute to reduced production costs but also help in maintaining environmental health, agricultural diversity, and making the rural agricultural systems resilient against pests, diseases, and climatic changes. The nutrition profiles of ILVs are very rich in essential vitamins, minerals, phytochemicals, and dietary fiber, which holistically bring health benefits to the rural populations by way of preventing nutritional deficiencies and boosting immune functions.

Economically, ILVs are very important in the development of stronger rural economies. Smallholder farmers may cultivate these crops with traditional, low-input methods and realize an income-generating opportunity through their sale in local markets. This cycling of income within the community enhances economic stability, decreases dependency on external sources of food, and supports cultural and dietary tradition, making sure that ILVs are well integrated into both the local diet and the economy. Thus, ILVs are a cornerstone for resilient communities and sustainable agricultural development because they weave food sustainability with rural economic empowerment.

Globally, 7,000 species of indigenous leafy vegetables exist (Mungofa et al., 2022). Many species of leafy vegetables exist in India which are commonly called as 'saag' in most parts of the country and this is appears to be derived from the nomenclature Sanskrit for all edible green leaves. Regionally, South Africa, has approximately 100 species of indigenous leafy vegetables, including nightshade spider plant, purslane, and blackjack, among others. Zulu et al. (2022) noted that some of indigenous leafy vegetables, including Amaranth grown in South Africa contain macronutrients including Vitamins A and C, magnesium, iron, and zinc. The author further alluded that South Africa's indigenous leafy vegetables are cultivated or grow in the wild.

Kenya is endowed with approximately 200 African indigenous vegetable species. An article by the Star Newspaper claimed that indigenous vegetables are salient in transforming rural economies (Praxides, 2023). Some of the African indigenous vegetables in Kenya include black nightshade (*osuga*), jute mallow (*mrenda*), amaranth (*mchicha*), and cowpeas(*kunde*), Finger millet- Wimbi (*Eleusine coracana*), Pearl millet- Mawele (*Pennisetum glaucum*), Sorghum bicolor (*great millet*), Tsimboka (*Amaranthus cruentus*), Banana (*Musa spp*), Bambara Groundnut, Tsimbande (*Vigna subterranean*), among others (Lidigu, 2023).

Lidigu (2023) recommended that indigenous leafy vegetables may be grown in Kenya, as they have a high nutritional value than exotic vegetables. Indigenous leafy vegetables are plants which are grown or cultivated in Elgeyo-Marakwet County through natural processes that cause them to evolve over a period. However, there is little literature on indigenous leafy vegetables in Elgeyo Marakwet County. A study by Wanjohi et al. (2020) revealed that there are 48 indigenous plant species in planted by Marakwet and the Sengwer communities, who are the main indigenous communities in Elgeyo Marakwet County.

Indigenous leafy vegetables are economically viable, and they contribute positively food security, which improves rural economies (Mungofa et al., 2022). Indigenous vegetables promote food security as they can withstand harsh weather and soil conditions compared to commercial

vegetables. The authors claimed that indigenous leafy vegetables could be used to improve the livelihoods of counties that face extreme food security challenges. The authors recommended that indigenous leafy vegetables could be used for poverty alleviation, as the growth of these vegetables helps tackle food shortage crisis, and earn income, which could be used in improving the socio-economic status of the farmers.

Indigenous leafy vegetables are critical in promoting food security and biodiversity conservation. Furthermore, the studies discussed by Lidigu (2023), Mungofa et al. (2022), and Wanjohi et al. (2020) show that indigenous vegetables should be considered for sustainable development, as they are adaptable to local climates. The studies also proved that indigenous leafy vegetables promote food sustainability, and they improve the socio-economic status of the local communities; therefore, they may be grown to improve the rural economies. Mungofa et al. (2022) mentioned that indigenous leafy vegetables have a high micronutrient content and high antioxidant properties compared to exotic vegetables, which makes them have desirable attributes; therefore, they are the most suitable for farming to achieve food security.

Imathiu (2021) implied that indigenous leafy vegetables contribute to biodiversity and sustainability. Indigenous leafy vegetables have various plant species, which withstand harsh climate conditions. The withstanding of local environmental conditions promotes the preservation of genetic diversity within the plant species, ensuring that the vegetables are resilient against climate changes and diseases. Indigenous vegetables offer dietary diversity because they promote a balanced diet (Gogo et al., 2018). They contain a variety of minerals and vitamins; therefore, they have a wide spectrum of nutrition benefits, mitigating deficiencies. Indigenous vegetables reduce monoculture, as it promotes polyculture (Zambrano et al., 2022). The growth of these vegetables allows farmers to diversify the growth of plants because it allows the growth of two or more compatible plants. Notably, Canning (2022) implied that indigenous vegetables adapt well to local climates and conditions, reducing the resources required for farming, such as water, fertilizers, and pesticides. The reduction of farming resources reduces the farming input, improving the rural economies.

Elgeyo-Marakwet County is located in the Rift Valley of Kenya and is celebrated for its agricultural heritage, especially in the growing of indigenous leafy vegetables (ILVs) such as spider plant (saga), amaranth (terere), and African nightshade (managu). These traditional crops are part and parcel of the local culture and form a very important part of the local cuisines in view of their high levels of vitamins, minerals, and antioxidants, contributing largely to securing food and nutrient safety. ILVs contribute much to sustainability in food because they require few agricultural inputs and hold the advantage of being well adapted to the local environment, making them reliable and environmentally friendly sources of food. Its commitment to the promotion of ILVs underscores sustainable agriculture and conservation of cultural heritage, ensuring these nutritious, resilient crops will remain at the heart of the rural economy and continue to support community livelihoods amidst evolving agricultural challenges.

Statement of the Problem

Unfortunately, most people, especially in African countries have negative perceptions towards indigenous leafy vegetables (Zulu et al., 2022). Shockingly, a report conducted by Elgeyo County Government (2022) claimed that approximately 100,000 residents in Elgeyo Marakwet County faced starvation due to food insecurity. The report noted that drought seasons caused food insecurity in the County. The Report further added that human-wildlife conflict, particularly from elephants also caused food insecurity, as wildlife significantly destroyed farmer's crops, resulting in crop cultivation destruction. Human-wildlife conflicts cause extensive damage on crops, which leads to crop damage, crop losses, reduced yields, economic losses, and food insecurity (Mekonen, 2020). Bokelmann et al. (2022) reiterated that most regions in Kenya are likely to face food insecurity due to erratic rainfall and regular long dry periods. The authors recommended that indigenous leafy vegetables should be grown to contribute to food security. They argued that indigenous leafy vegetables adapt to the local climate, and further contribute to sustainable production, ultimately, resulting to improved food society and improvement of the rural economies.

However, limited studies that have been conducted to examine how indigenous leafy vegetables could be used to improve rural economies. For instance, Bokelmann et al. (2022) studied how indigenous vegetables improve food and nutrition security. The study only focused on one project, HORTINLEA (Horticultural Innovation and Learning for Improved Nutrition and Livelihood in East Africa, conducted in 2014-2018. The study's results could be generalized to other parts in Kenya because it was a longitudinal study; therefore, the study's findings are limited in the number of years and the region. Similarly, another study was conducted by Imathiu (2021), who investigated the effect of underutilized indigenous African leafy vegetables on promoting food and nutrition security. The study concentrated on underutilized indigenous vegetables, limited the impact of promoting food security only to underutilized vegetables, and the study's findings cannot be generalized to all indigenous leafy vegetables. It is critical to study the role of indigenous vegetable in promoting rural economies, as indigenous vegetables can withstand unpredictable weather patterns (Lidigu, 2023). Elgeyo Marakwet County has been facing starvation due to food insecurity. Arguably, planting indigenous leafy vegetables would be ideal to combat food insecurity in the region (Mekonen, 2020). Therefore, there is an empirical gap that needs to be filled, and this study will fill the research gap by examining the role of indigenous leafy vegetables in improving rural economies in Elgeyo Marakwet County.

Specific Objectives

i. To evaluate the influence of food sustainability of indigenous leafy vegetables in the rural economies of Elgeyo- Marakwet County.

ii. To assess the economic impact of ILVs on rural households and communities.

Research Questions

i. What is the effect of food sustainability of indigenous leafy vegetables on sustainability of rural economies in Elgeyo-Marakwet County?

ii. What is the economic impact of indigenous leafy vegetables on the sustainability of rural households and communities in Elgeyo-Marakwet County?

LITERATURE REVIEW

Introduction

This section discusses the theoretical literature, empirical literature, and conceptual framework relevant to the study, focusing on food sustainability and its impact on rural economies.

Theoretical Literature Review

Agro ecology Theory

At its core, agro ecology emphasizes the importance of food sustainability through the use of local knowledge, ecological farming practices, and the preservation of natural resources. It advocates for diversified farming systems that rely on indigenous crops, such as indigenous leafy vegetables (ILVs), which are naturally adapted to local environments and can thrive without excessive dependence on chemical inputs. By using agro ecological practices, rural economies can become more self-sufficient, reducing vulnerability to external market forces and environmental shocks (Wezel et al., 2020).

The theory asserts that sustainable agriculture should balance ecological health, economic viability, and social equity. This balance is achieved by promoting practices such as mixed cropping, soil fertility management, and pest control through natural processes, which not only ensure the sustainability of food production but also enhance the resilience of rural communities. These practices help improve food security, reduce environmental impact, and increase the long-term viability of rural economies (Gómez-Echeverri et al., 2020).

For rural economies, agro ecology offers a pathway to economic resilience. By diversifying agricultural production and reducing reliance on external agricultural inputs, agro ecology helps smallholder farmers build more sustainable livelihoods. Indigenous leafy vegetables, for example, are low-cost crops that provide nutritional value, contribute to local food security, and can be sold in local markets, thereby supporting household incomes. This contributes to a stronger, more sustainable rural economy, where food security and economic stability are interdependent (López et al., 2021).

Agro ecology also advocates for the integration of social and economic systems with ecological practices to foster sustainable development. By promoting food systems that are ecologically diverse and economically viable, agro ecology helps strengthen rural economies by increasing local food production, reducing poverty, and enhancing access to nutritious food. The cultivation of indigenous leafy vegetables, which are well-suited to local climates and require minimal external inputs, aligns with these principles, offering a practical solution to food insecurity and economic instability in rural areas (Mungofa et al., 2022).

In conclusion, the Agro ecology Theory is highly relevant to this study as it emphasizes food sustainability and its role in promoting rural economic development. By integrating ecological

principles into agricultural practices and focusing on the resilience of indigenous crops, agro ecology offers a pathway to both food security and sustainable economic growth in rural communities, such as those in Elgeyo-Marakwet County.

Food Sustainability and Rural Economies

Mungofa et al. (2022) implied that indigenous leafy vegetables do not require much water, fertilizers, and pesticides, ultimately reducing production costs. Moreover, these agricultural practices promote food sustainability, improving farmers' income, ultimately promoting rural economies. Van Rensburg et al. (2004) investigated indigenous leafy vegetables role in mitigating hunger and malnutrition in South Africa. Van Rensburg et al. (2004) argued that indigenous vegetables contribute to biodiversity preservation. Indigenous vegetables preserve agrobiodiversity, contributing to food sustainability. There are various types of indigenous vegetables, and cultivating them promotes genetic diversity in the agriculture systems. This diversity mitigates crop failure and contributes to ecosystem resilience.

Arguably, the availability of indigenous leafy vegetables ensures the availability of diverse crops, which promotes long-term food security. Similarly, Ricciardi et al. (2021) examined the impact of small indigenous farms on sustainable food production. These farms promote biodiversity and are climate resilient. Indigenous leafy vegetables can adapt to local agroecological conditions, which include climate and marginal lands. Cultivating indigenous leafy vegetables diversifies agricultural production and mitigates climate change, including droughts, floods, and extreme temperatures. Indigenous leafy vegetables are climate-resilient, which ensures that food systems are robust and sustainable. Sustainable food systems foster farmers' confidence, motivating them to invest in indigenous leafy vegetables and contribute to the growth of rural economies.

Ngidi et al. (2023) conducted a study to investigate how indigenous leafy vegetables promote food security in South Africa. Indigenous leafy vegetables replaced exotic cash cops, as they can adapt to local climates. Additionally, indigenous leafy vegetables contain various nutritional ingredients, such as vitamins, minerals, and antioxidants. Furthermore, Ngidi et al. (2023) alluded that indigenous leafy vegetables are sustainable, as they are accessible, available, and highly nutritious. Their accessibility is due to the fact that they may be found easily in local ecosystems, thereby reducing the need for fertilizers and pesticides; therefore, they are economically sustainable for farming practices. Indigenous leafy vegetables are easily available, as they can adapt to local climates and any soil condition. As such, their availability makes them easily available for nutrients, fostering food security and resilience. Ngidi et al. (2023) noted that the cultivation of indigenous leafy vegetables has a minimal environmental impact, as they encourage environmentally sustainable farming practices, reducing the pressure to utilize natural resources.

The utilization of natural resources promotes environmental conservation, promoting food sustainability. Another study was conducted by Bokelmann et al. (2022) to investigate how indigenous leafy vegetables contribute to food security. According to the study, indigenous leafy vegetables reduce the reliance on monocultures, and contribute to promoting traditional crop varieties, fostering ecosystem balance and preserves critical genetic resources for future generations, which promotes food sustainability.

Woodhill et al. (2022) examined the effect of food systems on the rural wellbeing. Woodhill et al. (2022) argued that sustainable food production, such as the cultivation of indigenous leafy vegetables requires intensive labour, such as diversified agriculture or organic farming. Intensive labour translates for increased job opportunities and robust economic activities. Therefore, increased job opportunities increase revenue and improves the living standards for the rural households. Jónsdóttir and Gísladóttir (2023) assessed the relationship between sustainable food production and rural development. The study demonstrated that sustainable food production utilizes natural resources, such as water, soil, and biodiversity; therefore, farmers minimize input costs and maximize their yields, improving rural economies.

Empirical Literature Review: Inter-Variable Relationships

The empirical literature on food sustainability and its impact on rural economies reveals several inter-variable relationships, particularly around the cultivation of indigenous leafy vegetables (ILVs), their role in food security, and their broader economic implications for rural communities. These relationships provide a foundation for understanding the dynamics of rural economies and the sustainability of agricultural systems.

Food Sustainability and Economic Growth

Several studies have emphasized the crucial role of sustainable agriculture in boosting rural economies. For instance, Mungofa et al. (2022) and Ricciardi et al. (2021) argue that food sustainability is directly linked to economic growth in rural areas. By integrating agro-ecological practices that prioritize locally adapted crops such as ILVs, farmers experience reduced production costs, thereby improving their income and contributing to the overall economic resilience of rural communities. However, these studies do not fully address how external market forces and policy interventions can affect the economic benefits derived from sustainable agricultural practices.

While the empirical evidence supports the idea that indigenous crops are cost-effective, the relationship between their cultivation and rural economic stability is not always linear. The ability of ILVs to thrive without heavy reliance on external inputs (e.g., fertilizers and pesticides) certainly reduces costs for farmers, but local market dynamics and access to profitable markets remain significant variables. In many rural economies, especially those in marginalized regions, the challenge is not only production but also access to markets where these products can be sold at competitive prices. This gap in the literature suggests that further exploration of market access and the role of infrastructure development in supporting rural economies is necessary.

Food Security and Climate Resilience

The cultivation of ILVs is widely considered a key strategy for enhancing food security, particularly in the context of climate change. As noted by Ngidi et al. (2023) and Bokelmann et al. (2022), ILVs are climate-resilient, adaptable to marginal lands, and require fewer inputs, which makes them an effective tool in mitigating the effects of extreme weather events such as droughts and floods. These vegetables not only provide vital nutrients but also contribute to broader environmental sustainability goals by promoting agro-ecological practices that minimize degradation and resource depletion.

However, while there is a strong link between the climate resilience of ILVs and food security, the studies reviewed often overlook the social and economic dimensions that might hinder the full realization of these benefits. For example, Ngidi et al. (2023) emphasize that indigenous crops are accessible and nutritious, but the actual benefits to rural economies depend on the willingness of local communities to adopt these crops on a larger scale, which can be influenced by cultural preferences, knowledge gaps, or economic incentives. A potential contradiction in the literature arises from the tension between ecological benefits and the need for broader adoption of sustainable practices, which is not always guaranteed.

Summary of Study Gaps

The empirical literature on food sustainability, rural economies, and indigenous leafy vegetables reveals several important insights but also highlights some key gaps:

Market Access and Infrastructure: While studies highlight the cost-effectiveness and climate resilience of ILVs, they often overlook the role of market access and infrastructure in determining the economic viability of these crops for rural economies. Future studies should examine how improving market access and infrastructure can enhance the economic impact of sustainable agricultural practices.

Long-term Economic Benefits: There is a need for more research on the long-term economic benefits of cultivating ILVs, particularly in terms of job creation, income stability, and poverty alleviation. Further empirical work is needed to assess how labor-intensive agricultural practices can sustainably support rural wellbeing over time.

Social and Cultural Factors: Many studies focus on the ecological and economic aspects of food sustainability but fail to fully address the social and cultural factors that influence the adoption of indigenous crops. Further exploration of community attitudes, knowledge, and cultural preferences could provide deeper insights into the barriers and enablers of sustainable agricultural practices in rural areas.

By addressing these gaps, future research can provide a more comprehensive understanding of how food sustainability, particularly through the cultivation of indigenous leafy vegetables, can enhance rural economic development and food security.

CONCEPTUAL FRAMEWORK

Ravitch & Riggan (2016), defines a conceptual framework as a vehicle that brings into perspective the relevance of the research topic both theoretically and empirically and how the methods used will answer the research questions. In other words, the conceptual framework explains the research problem and the specific variables being estimated in the study. This study has adopted four independent variables with one dependent variables.

Below represents the conceptual framework for the study.

Figure 5: *Conceptual Framework*

Operationalization of the Study Variables

The dependent variable in the present study is rural economies. The determinants of performance are the independent variables: Biodiversity conservation and food sustainability.

Table 5: Operationalization of Variables

Objective	Variable	Indicators	Measurement Scale
Rural economies Food sustainability	Dependent variable	-Poverty rate -Agricultural productivity -Income distribution	Ordinal
	Independent variable	-Food security -Climate resilience	Ordinal

RESEARCH METHODOLOGY

The primary objective of this study is to explore the role of indigenous leafy vegetables (ILVs) in promoting food security and advancing rural economies in Elgeyo Marakwet County. Specifically, the study aims to assess the relationship between the cultivation of ILVs and the improvement of food security, as well as the contribution of ILVs to the economic resilience and sustainability of rural communities. The findings will provide valuable insights into how indigenous farming practices, particularly those involving ILVs, can be leveraged to foster both food sustainability and economic growth in rural areas.

In this study, descriptive research design was suitable because the study helped the researcher to explain how the variables of the study are related. A descriptive research design was necessary, as it helped in understanding how indigenous leafy vegetables promote food security and contribute to the advancement of rural economies. The study targeted the main indigenous groups farming indigenous leafy vegetables in Elgeyo Marakwet County, including the Marakwet and the Sengwer communities. The study initially referenced Wanjohi et al. (2020), which documented a target population of 157 people involved in indigenous leafy vegetable farming. However, according to the Elgeyo Marakwet Ministry of Agriculture, the total population involved in indigenous leafy vegetable farming is currently 320.The respondents consisted of farmers, traders, consumers, agricultural extension workers, community leaders, educators, health workers, cooperative members, parents/guardians, and youth involved in farming or vegetable trading.To determine an appropriate sample size, Slovin's formula was applied to ensure that the findings are statistically reliable and representative of the target population.

Using a 5% margin of error and a 95% confidence level, the sample size was calculated as follows:

$$n = \frac{N}{1 + N (e)^2}$$

$$n = \frac{320}{1 + 320\,(0.05)^2}$$

Therefore, the appropriate sample size was 177.7 ≈ 178 respondents.

The study aims to test two key hypotheses to examine the relationships between indigenous leafy vegetable (ILV) farming, food security, and rural economic development. The first hypothesis posits that there is a significant relationship between the cultivation of indigenous leafy vegetables and improved food security in Elgeyo Marakwet County. The second hypothesis suggests that the cultivation of ILVs contributes significantly to the economic resilience of rural households in the region. To test these hypotheses, inferential statistical tests, such as the chi-square test or correlation analysis, will be employed. These tests will help determine the strength and direction of the relationships between the variables, providing insights into how ILV farming impacts food security and economic stability in the rural communities of Elgeyo Marakwet County.

FINDINGS

This chapter presents the results and analysis of the data collected from respondents in the study, "Indigenous Leafy Vegetables and Sustainability of Rural Economies of Elgeyo-Marakwet County in Kenya". The findings are based on responses from participants, including farmers, traders, consumers, agricultural extension workers, community leaders, educators, health workers, cooperative members, parents/guardians, and youth involved in the farming or trade of indigenous leafy vegetables. This chapter provides a detailed analysis of the collected data in relation to the study's objectives.

Response Rate

Out of the 160 questionnaires distributed to the target respondents from the Marakwet and Sengwer communities, 150 were returned, resulting in a response rate of 93.75%, which is considered adequate for reliable data analysis and represents a strong level of participation in the study (Fosnacht et al., 2016).

Descriptive Statistics

Table 1: Food sustainability

Statements	**Mean**	**Std. Dev**
Implementing agroecological practices that promote biodiversity conservation positively contributes to food sustainability, ensuring long-term access to diverse and nutritious food sources.	4.27	.776
Enhancing agricultural biodiversity through crop diversification and traditional farming methods is essential for improving food security and resilience to environmental challenges.	2.33	1.201
Policies that promote sustainable farming practices, such as organic agriculture and agroforestry, are necessary for enhancing food sustainability and reducing the negative impacts of agriculture on biodiversity and climate.	4.33	.709

Statements	Mean	Std. Dev
Policies that prioritize sustainable land management practices, such as agroforestry and rotational grazing, are crucial for preserving genetic diversity and fostering economic resilience in rural communities.	4.18	.905
Education and awareness programs on the importance of biodiversity conservation play a vital role in empowering rural populations to engage in sustainable agricultural practices that benefit species richness, habitat quality, genetic diversity, and local economies.	4.36	.964

The descriptive statistics for food sustainability outlined in Table 4.4.2 reflect the perceptions of respondents regarding the significance of various practices and policies aimed at improving food security and sustainability. The mean values and standard deviations provide a clear picture of the levels of agreement on different factors:

Agro ecological practices promoting biodiversity scored a mean of 4.27 (SD = 0.776), showing strong agreement that these practices contribute positively to food sustainability and ensure long-term access to diverse and nutritious food sources. Crop diversification and traditional farming methods had a lower mean score of 2.33 (SD = 1.201), indicating some disagreement or uncertainty among respondents regarding their essential role in improving food security and resilience to environmental challenges. Policies promoting sustainable farming practices such as organic agriculture and agroforestry were rated highly, with a mean of 4.33 (SD = 0.709). This reflects a strong consensus on the necessity of such policies for enhancing food sustainability and reducing the adverse effects of agriculture on biodiversity and climate.

Sustainable land management practices, like agroforestry and rotational grazing, also received strong support, with a mean of 4.18 (SD = 0.905), indicating that respondents view these practices as vital for preserving genetic diversity and fostering economic resilience in rural communities. Education and awareness programs regarding biodiversity conservation received the highest mean score of 4.36 (SD = 0.964), showing a very strong agreement among respondents on the importance of such programs in empowering rural populations to adopt sustainable agricultural practices that positively impact food sustainability, biodiversity, and rural economies.
In summary, the statistics indicate a strong consensus on the importance of agro ecological practices, policies supporting sustainable farming, and education for enhancing food sustainability. However, there is some variability in the perceptions of traditional farming methods and crop diversification in their direct impact on food security.

Statement: Indigenous leafy vegetables enhance food sustainability, ensuring the long-term economic stability of rural communities in Elgeyo-Marakwet County.
Mean = 3.90, Std. Dev = 1.246

Table 3: Rural Economies

Statements	Mean	Std. Dev

The cultivation of indigenous leafy vegetables positively impacts biodiversity conservation, contributing to the sustainability of rural economies in Elgeyo-Marakwet County.	4.45	.630
Indigenous leafy vegetables enhance food sustainability, ensuring the long-term economic stability of rural communities in Elgeyo-Marakwet County.	3.90	1.246
The farming and consumption of indigenous leafy vegetables significantly improve the socio-economic status of households in rural economies within Elgeyo-Marakwet County.	4.05	.888
Indigenous leafy vegetables provide a reliable source of income, contributing to the financial resilience and growth of rural economies in Elgeyo-Marakwet County.	4.79	.411
The integration of indigenous leafy vegetables into local agricultural systems is essential for the overall economic development of rural economies in Elgeyo-Marakwet County.	4.59	.615

Overall Economic Development of Rural Economies

A mean of 4.59 shows that respondents strongly believe that the integration of ILVs into the agricultural systems of Elgeyo-Marakwet County is crucial for overall economic development. The relatively low standard deviation (0.615) indicates strong consensus. This view underscores the importance of incorporating ILVs not just as niche crops but as an integral part of the local agricultural economy. Their role extends beyond food and income—by supporting biodiversity, enhancing food security, and promoting sustainable agricultural practices, ILVs have a comprehensive influence on economic growth. Respondents likely recognize that for sustainable development, ILVs should be part of larger agricultural policies and initiatives that support rural development.

Statement: The integration of indigenous leafy vegetables into local agricultural systems is essential for the overall economic development of rural economies in Elgeyo-Marakwet County. Mean = 4.59, Std. Dev = 0.615

Inferential Statistics

Inferential statistics, such as correlation analysis was conducted to examine the relationships between indigenous leafy vegetables and their impact on food sustainability and rural economies in Elgeyo-Marakwet County. These analyses helped to determine:

1. Correlation Analysis**:** Explored the strength and direction of the relationships between the independent variables (food sustainability) and the dependent variable (rural economies). This provided insights into how closely related these variables are in the context of rural economic development.

This inferential statistical technique allowed for more robust conclusions and provided a deeper understanding of the role of indigenous leafy vegetables in driving rural economic outcomes.

Correlation Analysis
Food Sustainability and Rural Economies

Correlations

		Food sustainability	Rural economies
Food sustainability	Pearson Correlation	1	-.314**
	Sig. (2-tailed)		<.001
	N	150	150
Rural economies	Pearson Correlation	-.314**	1
	Sig. (2-tailed)	<.001	
	N	150	150

**. Correlation is significant at the 0.01 level (2-tailed).

Figure 6: Correlation analysis between food sustainability and rural economies

The correlation analysis between food sustainability and rural economies is presented in the table above. The Pearson correlation coefficient is -0.314, indicating a moderate negative relationship between these two variables. The p-value (Sig. 2-tailed) is less than 0.001, which is below the 0.05 threshold for statistical significance.

Interpretation

Since the p-value is less than 0.05, we reject the null hypothesis and conclude that there is a statistically significant relationship between food sustainability and rural economies. The negative Pearson correlation coefficient (-0.314) suggests that as food sustainability decreases, the sustainability of rural economies tends to increase, or vice versa.

This result is counterintuitive, as we might expect that better food sustainability would contribute positively to rural economies. The negative relationship implies that other underlying factors may be influencing the rural economy in a way that contrasts with expectations regarding food sustainability. It may also suggest that food sustainability alone, without considering other economic and environmental factors, does not directly improve economic conditions in rural areas.

Food Sustainability: B = -0.196, Std. Error = 0.021, Beta = -0.573, t = -9.426, $p < 0.001$. The negative B coefficient (-0.196) indicates that an increase in food sustainability is associated with a decrease in the sustainability of rural economies. This unexpected result suggests that food sustainability, as measured in this study, may have a complex or indirect effect on rural economies. The standardized coefficient (Beta = -0.573) reflects a strong negative influence on rural economies. The p-value < 0.001 confirms that this relationship is statistically significant. Socio-Economic Status: B = 0.247, Std. Error = 0.043, Beta = 0.267, t = 5.692, $p < 0.001$. The positive B coefficient (0.247) shows that an increase in socio-economic status leads to a positive impact on rural economies. The standardized coefficient (Beta = 0.267) indicates a moderate positive effect, and the p-value < 0.001 confirms that this relationship is statistically significant.

Discussion of Findings

The objective of this study was to explore the role of indigenous leafy vegetables (ILVs) in enhancing the sustainability of rural economies in Elgeyo-Marakwet County, Kenya. The study focused on four specific objectives: assessing the effects of ILVs on evaluating their influence on food sustainability.

Food Sustainability and Rural Economies

The second objective aimed to evaluate the influence of indigenous leafy vegetables (ILVs) on food sustainability in the rural economies of Elgeyo-Marakwet County. The findings revealed a negative relationship ($B = -0.196$, $Beta = -0.573$, $p < 0.001$) between food sustainability and rural economic outcomes, which suggests that greater emphasis on food sustainability as conceptualized in this study might be linked to diminished economic performance. This result may seem counterintuitive, but it highlights several challenges that rural economies face in balancing food sustainability with economic growth.

This finding aligns with the insights of Gkogkos et al. (2023), who note that promoting food sustainability often emphasizes traditional, low-input farming systems like those used to grow ILVs. While these practices are beneficial for environmental sustainability, they may not always be economically viable in the short term. Rural farmers may struggle to generate adequate income from ILVs because of limited access to larger markets, inconsistent demand, or insufficient infrastructure to support commercialization. Furthermore, Portugal-Nunes et al. (2022) discusses how sustainable food systems, though critical for long-term agricultural viability, sometimes sacrifice immediate economic returns, as they often require smaller-scale, diversified farming practices that do not yield the same financial benefits as industrial agriculture.

The results also highlight the broader systemic issues faced by smallholder farmers, particularly when trying to scale up production in a sustainable manner. Bilali et al. (2018) argue that while ILVs provide critical nutrients and are important for food security, the lack of market support, inadequate processing facilities, and low levels of consumer awareness about the nutritional benefits of ILVs create barriers to realizing their full economic potential. As a result, farmers may face economic challenges despite growing crops that are environmentally and nutritionally valuable.

This negative relationship suggests a need for a more nuanced approach to food sustainability that balances environmental goals with market viability. Strengthening value chains, increasing consumer awareness, and creating policies that link food sustainability with economic incentives could help overcome these challenges. For instance, supporting the commercialization of ILVs through certification for organic or sustainable agriculture could help unlock their economic potential, while still promoting food sustainability.

CONCLUSION AND RECOMMENDATIONS

This chapter presents the conclusions drawn from the findings of the study that had set out to explore the contribution of indigenous leafy vegetables in increasing the sustainability of rural economies in Elgeyo-Marakwet County, Kenya. The impacts were dwelled based on four main

aspects: (i) the impacts of ILVs on food sustainability, (ii) the influence of ILVs on food security, (iii) whether ILVs change the socio-economic status of rural households, and (iv) whether ILVs provide a source of income. The study tried to answer how the cultivation and consumption of ILVs might help to improve food systems and economic resilience in rural areas. Based on the findings, this chapter articulates detailed conclusions on the high importance of ILVs in improving food sustainability and securing livelihoods. It gives practical recommendations for policymakers and rural communities on how to tap the potentials of ILVs to achieve sustainable development. Finally, it points to areas of future research, especially in scaling up the cultivation of indigenous vegetables and further investigation on their role in enhancing food security and economic stability in similar regions.

Summary of Findings

This research on the role of indigenous leafy vegetables in sustaining rural economies within Elgeyo-Marakwet County has its importance stipulated along two broad areas, namely biodiversity conservation and food sustainability. On the aspect of biodiversity conservation, this research established that ILVs are important in the maintenance of health in ecosystems in rural setups. Thus, providing crucial ecosystem services such as soil fertility, pollination, and protection of water resources, ILVs support agro ecological practices that enhance the resilience of ecosystems by words, the ability of the rural environment to resist stressors such as climate variability or pest outbreaks. Such conservation of biodiversity underpins agricultural productivity and sustainability and further cements the role of ILVs in rural development strategies prioritizing ecological health. In this study, food sustainability the contributions of ILVs to food sustainability was inversely related to the outcomes of the rural economy. While the ILVs have great potential to improve levels of food insecurity and ecological objectives, limitations in market access, a lack of infrastructure, and low consumer awareness restrict scalability in rural settings. Then, these constraints limit the broader economic benefits that could be achieved by ILVs. This finding flags the need for stronger market linkages and effective commercialization strategies that could ensure full economic realization by ILVs and contribute to rural economies.

Recommendations

Based on the findings of this study, several recommendations are provided to enhance the role of indigenous leafy vegetables in promoting the sustainability of rural economies in Elgeyo-Marakwet County and beyond.

Promote Biodiversity-Friendly Farming Practices

To maximize the ecological and economic benefits of ILVs, biodiversity-friendly farming practices should be promoted at the community and policy levels. Agricultural extension programs should focus on training farmers in agro ecological practices that enhance biodiversity, such as crop rotation, intercropping, and organic farming. Policies that incentivize biodiversity conservation, such as subsidies for farmers who adopt sustainable practices or grants for reforestation and land restoration projects, should be implemented. These measures will help rural farmers preserve the ecosystems that sustain their agricultural productivity and ensure long-term economic stability.

Strengthen Market Linkages and Value Chains for ILVs

To address the challenges of commercializing ILVs, efforts should be made to strengthen market linkages and develop value chains. This can be achieved by improving access to processing facilities, storage infrastructure, and transportation networks that connect rural farmers with local and regional markets. Governments and development agencies should work with private sector actors to create value addition opportunities, such as processing ILVs into packaged products (e.g., dried or canned vegetables) that can be sold in urban and export markets.

In addition, promoting ILVs as niche products in organic or health-conscious markets could help farmers capture higher prices and increase their income. Certification schemes, such as organic or fair trade certifications, could be introduced to help farmers differentiate their products and gain a competitive edge in the market. These interventions would help align food sustainability with economic viability, ensuring that ILVs contribute to both environmental conservation and rural economic growth.

Promote ILVs as a Tool for Improving Household Nutrition and Economic Resilience

Indigenous leafy vegetables should be promoted as a tool for improving household nutrition and enhancing economic resilience. Agricultural policies and programs should emphasize the nutritional benefits of ILVs and encourage their cultivation in home gardens and smallholder farms. Educational campaigns targeting both rural and urban populations should be launched to raise awareness about the health benefits of ILVs, with a focus on their role in combating malnutrition and improving dietary diversity.

By promoting the cultivation and consumption of ILVs, policymakers can support household food security and help rural communities become more economically resilient. These efforts should be complemented by social protection programs, such as school feeding initiatives and community food banks that incorporate ILVs into their food baskets. This will ensure that vulnerable populations, such as children and the elderly, benefit from the nutritional value of ILVs while also supporting rural farmers.

Support the Commercialization and Marketing of ILVs

The commercialization of ILVs should be supported through targeted interventions that improve farmers' access to markets and promote the economic viability of indigenous crops. Governments and development agencies should invest in market infrastructure, such as rural markets and wholesale hubs, where farmers can sell their ILVs. Additionally, creating cooperatives or farmer groups can help smallholder farmer’s pool resources, negotiate better prices, and access larger markets.

Promoting the marketing of ILVs in urban and export markets could help increase demand for these crops. Governments and agricultural stakeholders should work together to develop branding and marketing strategies that highlight the unique qualities of ILVs, such as their nutritional value, organic nature, and cultural significance. By raising consumer awareness and creating demand for ILVs, farmers will be better able to capture higher prices and improve their income.

Conclusion

In conclusion, indigenous leafy vegetables (ILVs) hold immense potential for driving both environmental and economic sustainability in rural economies, particularly in regions like Elgeyo-Marakwet County. The findings of this study provide compelling evidence that ILVs contribute to key aspects of rural economic development, including **food sustainability**, socio-economic improvement, and income generation. However, the complex relationship between ILVs and food sustainability reveals critical challenges that must be addressed to fully leverage the potential of these crops for economic growth.

Despite the promising contributions of ILVs, the study reveals a negative relationship between food sustainability and rural economic outcomes, suggesting that while ILVs support ecological sustainability, they face challenges in contributing to immediate economic growth. This indicates a critical gap in the commercialization and scaling of ILVs, where smallholder farmers may struggle to balance sustainable practices with the need for economic returns. The findings suggest that while ILVs can improve food security and environmental health, their economic viability is limited by weak market access, low consumer awareness, and insufficient infrastructure for processing and distribution. Therefore, policies and interventions must aim to bridge this gap by developing stronger value chains and enhancing market linkages that can support the economic sustainability of ILVs.

Key Takeaways

Challenges with Food Sustainability: The negative relationship between food sustainability and rural economic outcomes highlights a critical area for intervention. Sustainable farming practices, while essential for long-term ecological health, may not yield immediate financial returns for smallholder farmers. This underscores the need for policies that support the commercialization of sustainable crops like ILVs, making them both environmentally and economically viable. Addressing market constraints and improving consumer awareness of the nutritional and cultural value of ILVs could help align sustainability goals with economic growth.

Strategic Importance of ILVs for Rural Development

The findings of this study underscore the strategic importance of promoting indigenous leafy vegetables as part of a broader rural development agenda. ILVs represent a valuable resource for both environmental sustainability and economic empowerment in rural areas, especially in regions facing food insecurity, environmental degradation, and economic marginalization. By leveraging the ecological benefits of ILVs and aligning them with economic incentives, policymakers, development practitioners, and farmers can achieve holistic sustainability one that balances environmental health with economic viability.

To ensure that ILVs reach their full potential in supporting rural economies, multifaceted interventions are needed. These should include investment in market infrastructure, capacity building for farmers, development of value-added products, and promotion of ILVs in new and emerging markets. Additionally, agricultural policies should integrate biodiversity conservation with economic objectives, ensuring that ILVs are positioned as both a sustainable and profitable crop for rural communities.

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