THE EFFICACY OF SUSTAINABLE AGRICULTURAL PRACTICES FOR ENVIRONMENTAL MANAGEMENT

BY

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THE REQUIREMENT FOR THE

NEW WELFARE SERVICES- SUSTAINABLE SERVICES AS THE DRIVER FOR REGIONAL DEVELOPMENT

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1.0 Chapter One: Introduction:

Understanding the sustainability concept: According to the UN World Commission on Environment,(Borowy, 2013) it is the balance between environment, economy, and equity. The development meets the needs of the present without compromising the ability of future generations to meet their own needs (Rauschmayer et al., 2012). Sustainability is integration of the environmental health, social equity, and economic vitality to create thriving, healthy, diverse, and resilient communities for this generation and the generation to come(Kiracı and Çalıyurt, 2022). This is all about our children, our grandchildren, and the world we will leave behind.

A standpoint in this essay is that sustainable service management in an ecosystem is the only way to protect, preserve, and manage the limited and nonrenewable resources. For instance, if we cut trees without planting more, in the long run, there will be no forests. These are the forests which help us to create clouds and they produce rainfall which enables our crops and all vegetation to grow, even us humans survive on that.

According to Campanhola and Pandey (2019), Agricultural industries are at a crossroads, facing the dual challenge of meeting the global food demand while minimizing environmental impacts. Food systems need to change fundamentally to become sustainable. Sustainable service management in agriculture refers to the strategic integration of sustainability principles into service operations, design, delivery, and innovation to enhance environmental, economic, and social outcomes Neven (2014).

The agricultural sector is a significant contributor to global environmental issues, including deforestation, water scarcity, and greenhouse gas emissions, (Rehman Khalid, 2015) However, it also suffers from these environmental changes, which threaten food security. Sustainable agricultural practices can play a pivotal role in transforming agricultural industry by adopting eco-friendly technologies, reducing waste, and improving resource efficiency. Despite its potential, the adoption

and impact of sustainable agricultural practices are not well understood. This academic essay aims to explore the efficacy of sustainable agricultural practices in the industry of agriculture for environmental sustainability.

1.1.Problem statement

Despite the recognized importance of sustainable agriculture practices, its implementation and efficacy remain underexplored and inconsistently documented. There exists a significant gap in understanding how those practices are applied within the agricultural sector, the barriers to their adoption, and the outcomes of such initiatives. This lack of comprehensive insight hampers the ability of stakeholders ranging from farmers, and agribusinesses to policymakers and consumers to make informed decisions that foster sustainability.

1.2.Specific Objectives

1. To identify sustainable agricultural practices which currently employed in the industry of agriculture for environmental sustainability.
2. To evaluate the impact of sustainable agricultural practices on environmental sustainability.
3. To assess the economic benefits and challenges associated with implementing sustainable agricultural practices.

1.3.Research questions

1. Are there any sustainable agricultural practices which currently employed in the industry of agriculture for environmental sustainability?
2. Has there been any impact of sustainable agricultural practices on environmental sustainability.
3. What are the economic benefits and challenges associated with implementing sustainable agricultural practices?

1.4.Methodology

The research adopted a mixed-methods approach, combining quantitative data analysis with qualitative case studies. A survey was conducted among agricultural businesses and service providers to gather data on the adoption and outcomes of sustainable agricultural practices. In-depth interviews and focus

groups with stakeholders, including farmers, agricultural service providers, and policy-makers, provided insights into the experiences, benefits, and challenges of implementing these practices.

1.5.Significance of the study:

This research holds the potential to significantly influence the agricultural sector's approach to sustainability. Demonstrating the efficacy of sustainable agricultural practices can encourage more widespread adoption of these practices, leading to improved environmental outcomes, enhanced food security, and better livelihoods for farming communities. Moreover, the strategic framework and policy recommendations can guide stakeholders in effectively integrating sustainability into agricultural service management, contributing to the sector's resilience and sustainability in the long term.

The research study was conducted in villages surrounding Kibale National Park, Isunga, Kasiisi, Rweteera, Rusenyi and Kiko in the Kabarole district. The site areas were selected based on the methods of the study.

The research fieldwork was done over three months starting from November 2023 to January 2024

1.6.**Theoretical Framework**

According to Neven (2014), Uganda's agricultural sector is a vital component of its economy, employing over 70% of the population and contributing significantly to the country's GDP. However, the sector faces numerous challenges, including climate change, soil degradation, and limited access to modern agricultural practices. Sustainable service management (SSM) offers a strategic approach to addressing these challenges by integrating sustainability principles into service operations, design, and delivery. This theoretical framework aims to explore the efficacy of sustainable agricultural practices in the industry in Uganda, drawing on relevant theoretical perspectives and empirical evidence.

Sustainable Development Theory is a theory that posits that development should meet the needs of the present without compromising the ability of future generations to meet their own needs. SSM aligns with this theory by promoting sustainable practices that preserve natural resources and support long-term economic and social development in Uganda's agricultural sector.

The Resource Based View, a firm's competitive advantage lies in its unique resources and capabilities. SSM can be viewed as a valuable resource for agricultural businesses in Uganda, providing them with a competitive edge by enhancing productivity, reducing costs, and improving environmental sustainability.

1.7. Empirical Evidence

Studies on sustainable agriculture initiatives in Uganda, such as the Sustainable Land Management Program and the National Agricultural Advisory Services provide empirical evidence of the benefits of sustainable practices in improving productivity, soil health, and farmer livelihoods. Surveys and interviews with farmers, agricultural service providers, and policymakers in Uganda provide insights into the current state of sustainable service management practices, their perceived benefits, and the challenges faced in their adoption and implementation. Environmental impact assessments and economic analyses of sustainable service management practices in Uganda's agricultural sector provide empirical evidence of their efficacy in improving environmental sustainability, economic viability, and social well-being.

2. 0 CHAPTER TWO: LITERATURE REVIEW

The transition to sustainable service management in agricultural industries is critical for addressing the environmental challenges and ensuring food security in the face of climate change. This research aims to provide a comprehensive understanding of the current state, benefits, challenges, and opportunities

associated with sustainable service management in agriculture, offering a roadmap for stakeholders to enhance sustainability and resilience in the sector.

2.2.1 To identify sustainable agricultural practices currently employed in the agricultural sector for environmental sustainability

Sustainable service management practices in the agricultural sector encompass a wide range of strategies and initiatives aimed at reducing environmental impact, improving economic viability, and promoting social equity (Siebrecht, 2020). Here are some key practices that have been identified and implemented.

Precision agriculture involves using technology, such as GPS, sensors, and drones, to optimize inputs like water, fertilizer, and pesticides. This reduces waste and environmental impact while improving crop yields and profitability. Integrated Pest Management, IPM is a holistic approach to pest control that emphasizes prevention, monitoring, and control methods that are least harmful to the environment and human health. This includes biological control, crop rotation, and the use of pheromones (Abrol and Shankar, 2012)

Many companies and organizations are implementing sustainable supply chain initiatives to reduce the environmental impact of their products. This includes sourcing materials from sustainable sources, reducing waste, and promoting fair labor practices.

Agroforestry involves integrating trees and shrubs into agricultural systems to improve soil health, conserve water, and provide habitat for wildlife. This can also provide additional income for farmers through the sale of timber, fruits, and nuts. Conservation agriculture involves practices like minimal tillage, cover cropping, and crop rotation to reduce soil erosion, improve soil health, and conserve water. Organic farming avoids the use of synthetic pesticides and fertilizers, relying instead on natural methods like composting, crop rotation, and biological pest control.

Regenerative agriculture goes beyond sustainable practices to actively improve the health of ecosystems. This includes practices like building soil organic matter, increasing biodiversity, and restoring degraded land.

Community Supported Agriculture (CSA) programs connect consumers directly with local farmers, providing them with fresh, seasonal produce while supporting local agriculture and reducing food miles. Agro ecology is a holistic approach to agriculture that integrates ecological principles into farming systems. This includes practices like polyculture, agroforestry, and the use of natural pest control methods.

These are just a few examples of the sustainable agricultural practices currently employed in the agricultural sector. There are many other innovative practices and technologies being developed and implemented around the world, and the field is constantly evolving as new research and technologies become available.

2.2.2 To evaluate the impact of sustainable agricultural practices for environmental sustainability.

Authors;Saliu and Luqman (2023), talk about the impact of sustainable service management on environmental sustainability in agriculture. It is stated that in recent years' sustainable agriculture has emerged as a promising alternative to conventional methods, it emphasizes practices that enhance environmental quality, preserve natural resources and promote economic viability for farmers. Here are some key findings from the literature:

Sustainable agricultural practices, such as integrated pest management, have been shown to reduce the environmental footprint of agriculture by minimizing the use of inputs like water, fertilizer, and

pesticides. This reduces pollution and conserves natural resources. Practices like conservation agriculture and agroforestry improve soil health by reducing erosion, increasing organic matter, and enhancing soil structure. This leads to better water retention, increased nutrient availability, and improved crop yields**,** (Koul and Cuperus, 2007)

Sustainable agricultural practices promote biodiversity by providing habitat for wildlife, supporting pollinators, and reducing the use of chemicals that harm beneficial insects and other organisms. Sustainable service management practices help reduce greenhouse gas emissions from agriculture by improving efficiency, reducing waste, and sequestering carbon in soils and vegetation.

Practices like conservation agriculture help conserve water by optimizing irrigation and reducing runoff and evaporation. Reduced Chemical Pollution: Sustainable service management practices can reduce chemical pollution by minimizing the use of synthetic pesticides and fertilizers and promoting natural pest control methods.

Sustainable service management practices improve the resilience of agricultural systems to climate change by enhancing soil health, conserving water, and promoting biodiversity. Sustainable service management practices can also have economic benefits for farmers, such as reduced input costs, increased yields, and improved market access for sustainably produced products.

Literature suggests that sustainable service management practices play a significant role in promoting environmental sustainability in agriculture. However, the adoption of these practices can be challenging due to factors such as lack of knowledge, technical skills, and financial resources. Therefore, there is a need to promote the widespread adoption of sustainable service management practices in agriculture, (Siebrecht, 2020).

2.2.3. To assess the economic benefits and challenges associated with implementing sustainable agricultural practices.

According to Zilberman (2014), the literature on the economic benefits and challenges associated with implementing sustainable service management in agricultural industries is extensive and multifaceted. Here are some key findings:

2.2.3. (i) Economic Benefits:

Sustainable service management practices lead to significant cost savings for farmers by reducing the need for inputs like water, fertilizer, and pesticides. For example, precision agriculture can help optimize the use of inputs, reducing waste and saving money. Some sustainable service management practices, such as conservation agriculture and agroforestry, have been shown to increase crop yields over time by improving soil health and fertility. Consumers are increasingly demanding sustainably produced food products, and many retailers and food companies are requiring suppliers to adhere to sustainability standards. This provides farmers with access to premium markets and higher prices for their products. Sustainable service management practices can help reduce the risk of crop failure and financial losses by improving soil health, conserving water, and promoting biodiversity. By promoting sustainable practices, farmers can improve the long-term viability of their operations, ensuring that they continue to produce food in the face of environmental challenges like climate change and resource depletion.

2.2.3.(ii) Economic Challenges:

Implementing sustainable service management practices often requires upfront investment in new equipment, technology, and infrastructure. This can be a barrier for farmers, especially smallholders with limited financial resources. Many sustainable service management practices require specialized knowledge and skills that farmers may not possess. Training and education programs can help address this challenge, but they can also be costly and time-consuming.

While sustainable practices provide access to premium markets, they can also require certification and compliance with sustainability standards, which can be costly and time-consuming. In some cases,

policies and regulations may hinder the adoption of sustainable service management practices. For example, subsidies for conventional agriculture may discourage farmers from transitioning to more sustainable practices. The agricultural industry is subject to market volatility, and sustainable service management practices may not always provide a buffer against price fluctuations and other market risks. Literature suggests that while there are significant economic benefits associated with implementing sustainable service management practices in agricultural industries, there are also challenges that need to be addressed. Policymakers, researchers, and industry stakeholders can play a role in overcoming these challenges and promoting the widespread adoption of sustainable practices.

3.0. CHAPTER THREE: ANALYSIS AND FINDINGS

Sustainable service management practices in the agricultural sector in Africa are a topic of significant discussion among farmers, policymakers, and agricultural experts. These practices are crucial for ensuring the long-term viability of agricultural production while minimizing negative environmental impacts. Here are some key points that farmers in Fort Portal, Kabarole district where a survey was carried out discussed regarding sustainable service management practices:

While in the field, a few survey questions were asked of farmers and the district agriculture extension service providers to support the notion of sustainable service management regarding environmental conservation in the agricultural industry.

3.1. What are the different practices or approaches farmers adopting in conserving the environment?

A male farmer in one of the villages visited discussed an approach called Conservation Agriculture, this involves minimal soil disturbance, permanent soil cover, and diversified crop rotations. It helps to improve soil health, reduce erosion, and conserve water. Farmers here in Fort Portal also use agroforestry practices Integrating trees and shrubs into agricultural landscapes, provides multiple benefits, including improved soil fertility, increased biodiversity, and enhanced resilience to climate change.

While in the field we extensively looked at Integrated Pest Management (IPM), which we said involves using a combination of techniques to manage pests, including biological control, crop rotation, and the use of pest-resistant crop varieties. This reduces the reliance on chemical pesticides and minimizes harm to beneficial insects and the environment. Further to that, a farmer explained the use of rabbit urine as an organic bio-control of pests and also acts as fertilizer for crops. An experiment of two months was run on collard greens to prove rabbit urine efficacy and the results came out positive from the analysis, there were variations in collard greens growth and yields observed by comparing the plots. The plots treated with rabbit-urine bio-pesticide showed significant changes that were different from plots with no treatment. (reference)

The table showing the effect of the urine ratio on pest activity

Treatment	Total plant leaves	Leaves infested	Plants infested	Pests on the plant
0 (control)	8.924±4.769[a]	1.104±1.663[a]	1.778±1.161[a]	1.167±3.324[a]
25 (T3)	8.819±4.174[a]	0.424±1.100[b]	0.750±0.881[c]	0.743±2.872[a]
33 (T2)	8.569±4.654[a]	1.340±2.238[a]	1.389±1.583[b]	1.014±3.290[a]
50 (T1)	8.438±4.718[a]	1.021±2.204[a]	1.361±1.489[b]	0.925±3.080[a]
P- Value	0.739	4.90e-05 ***	1.32e-15 ***	0.698522
F- Value	0.419	7.680	25.73	0.477

CV	47.65383	173.6836	76.12707	319.8073
LSD	0.9583278	0.3908822	0.2325154	0.7120281

Means not sharing a common single letter for each treatment were significantly different at $p < 0.05$. Mean ± Standard deviation.

For the p-value in all tables in this study, * indicates significance at 0.1, ** at 0.5, and *** at 0.05

Results from analysis to determine the efficacy of rabbit urine as a bio pesticide for control of cabbage lopper on collard greens production indicated significant differences in the number of plants infested ($p<0.05$). These differences indicated the leaves infestation appeared in Treatment 2 (33) which displayed the greatest infestation 1.340 ± 2.238^{a}. In Treatment 3 (25), 0.424 ± 1.100^{b}, the plot displayed the lowest leaf infestation as shown in the table above. In the process of rabbit urine controlling loppers, they are not killed but only deterred by the stringent smell from the urine. This means that the ecosystem will be maintained

Biomass weight

The biomass weight was tested to determine the element of rabbit urine acting as a bio fertilizer. Based on the analysis, the results showed that biomass weight was maximum in treatment (33) (2.600 ± 1.453^{a}) whereas the minimum was detected in treatment (25) (1.900 ± 0.242^{b}), P= 0.0144 *.

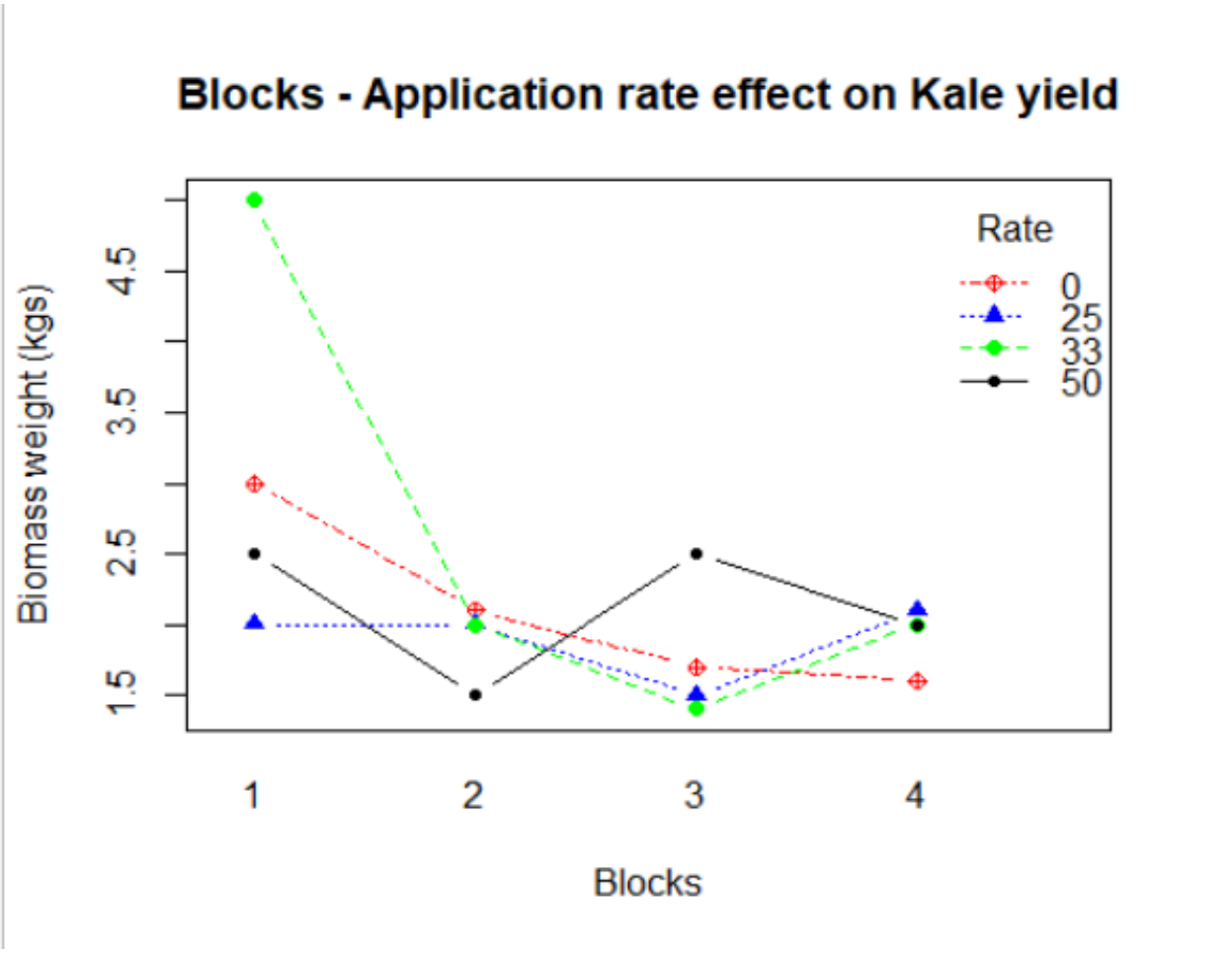
The collard greens' growth parameters and yield.

Treatment	LLP	LWP	Plant Height	p. Harvested	Harvestable L.P	Biomass weight
0	2.319 ± 0.638^{b}	1.975 ± 0.433^{a}	3.781 ± 1.248^{a}	2.323 ± 0.614^{b}	0.811 ± 0.130^{b}	2.100 ± 0.570^{b}
25	2.975 ± 0.556^{a}	2.231 ± 0.584^{a}	4.544 ± 1.151^{a}	2.583 ± 0.290^{a}	0.927 ± 0.195^{a}	1.900 ± 0.242^{b}
33	2.588 ± 0.745^{ab}	2.081 ± 0.439^{a}	4.225 ± 1.84^{a}	2.411 ± 0.444^{ab}	0.905 ± 0.230^{ab}	2.600 ± 1.453^{a}
50	2.436 ± 0.853^{b}	1.975 ± 0.492^{a}	4.593 ± 1.486^{a}	2.408 ± 0.465^{ab}	0.904 ± 0.174^{ab}	2.125 ± 0.428^{b}
P-Value	0.027 *	0.301	0.215	0.103	0.143	0.0144 *
F-Value	3.278	1.246	1.536	2.157	1.88	3.828
CV	24.455	21.030	28.16797	12.20359	16.96576	27.81543

LSD	0.447	0.308	0.8547153	0.2100603	0.1065145	0.4295475

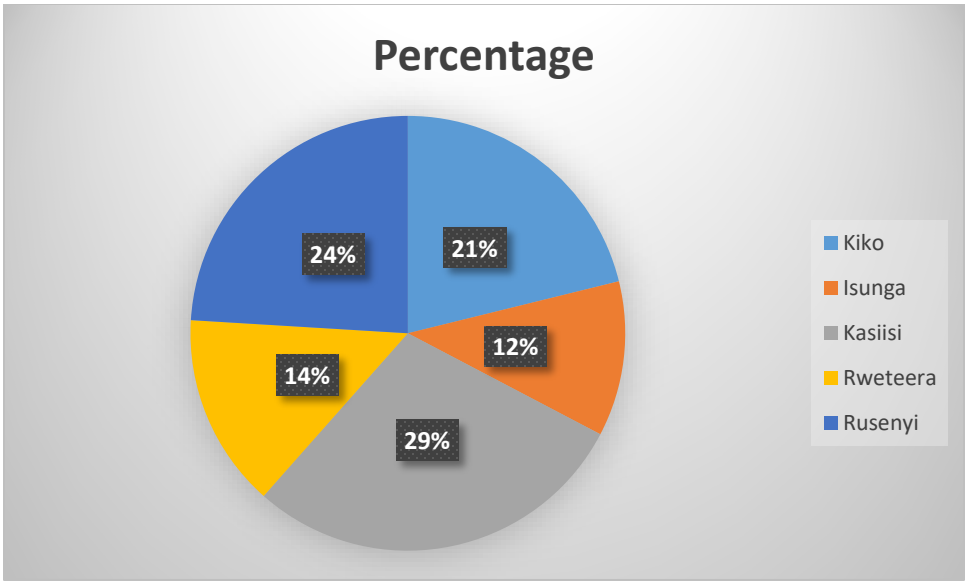
Means not sharing a common single letter for each treatment were significantly, different at p < 0.05. Mean ± Standard deviation.

The line graph below indicates that the maximum biomass weight was recorded from Block 1 (3.12kgs) whereas the minimum was obtained from Block 3 (1.78kgs),



Farmers discussed the importance of access to high-quality seeds, fertilizers, and other inputs, as well as extension services and training to help them adopt sustainable practices like Climate-Smart Agriculture which involves helping farmers adapt to and mitigate the impacts of climate change, examples include drought-resistant crop varieties and improved water management.

Many farmers in Fort Portal Western Uganda are adopting organic farming practices, which avoid the use of synthetic fertilizers and pesticides. Organic farming improves soil health, reduces pollution, and produces healthier food.



The pie –chart shows the farmers in percentages who were visited and found practicing organic farming practices in Western Uganda. the villages that were visited are, Kiko, Isunga, Kasiisi, Rweteera, and Rusenyi.

Field extension workers also discussed the need for supportive policies and institutions that promote sustainable agriculture, such as subsidies for sustainable inputs, land tenure security, access to credit, Capacity Building, and Knowledge building to help them adopt and adapt sustainable practices. This could include farmer field schools, demonstration plots, and peer-to-peer learning networks.

Overall, farmers in Uganda are increasingly recognizing the importance of sustainable service management practices for the long-term viability of agriculture. By adopting these practices, farmers can improve their livelihoods, protect the environment, and contribute to food security and economic development.

2.3. The reasons for adopting those practices?

Adopting sustainable agricultural approaches is essential for addressing pressing global challenges while ensuring the long-term viability of food production systems.

Sustainable agriculture practices help Environmental Conservation to preserve soil health, maintain biodiversity, conserve water resources, and reduce pollution. By minimizing the use of chemical fertilizers and pesticides, sustainable methods protect ecosystems and wildlife habitats. Also contribute to mitigating climate change by reducing greenhouse gas emissions, promoting carbon sequestration in soils and vegetation, and improving resilience to extreme weather events. Sustainable agricultural practices aim to optimize resource use, including land, water, energy, and inputs such as fertilizers and pesticides. By improving efficiency, farmers can reduce costs and enhance long-term productivity. Sustainable agriculture emphasizes diverse cropping systems, crop rotations, and integrated pest management, which can enhance resilience to pests, diseases, and other threats. This resilience improves food security by ensuring stable yields and diverse food sources. Sustainable agriculture can be economically beneficial for farmers in the long term. By improving soil health, reducing input costs, and diversifying income streams through practices such as agroforestry or value-added products, farmers enhance their resilience to market fluctuations and achieve better financial returns.

Sustainable agriculture practices promote fair labor practices, support rural livelihoods, and foster community engagement. By prioritizing social equity, sustainable agriculture contributes to vibrant rural communities and inclusive economic development. With increasing awareness of environmental and social issues, consumers are demanding more sustainably produced food. Adopting sustainable agriculture practices can help farmers meet market demand, enhance brand reputation, and access premium markets. Governments and international organizations are increasingly recognizing the importance of sustainable agriculture for achieving various policy goals, including environmental

protection, poverty alleviation, and food security. Policy support and incentives can encourage farmers to adopt sustainable practices.

Overall, farmers in Africa use a combination of qualitative and quantitative methods to evaluate the impact of sustainable service management on environmental sustainability in agriculture. These methods help farmers make informed decisions about which practices are most effective for their specific circumstances and contribute to the overall sustainability of agriculture in Africa.

RECOMMENDATIONS AND CONCLUSION

As we navigate the challenges and opportunities of modern agriculture in Uganda we must prioritize sustainable service management practices. These practices not only ensure the long-term viability of our agricultural systems but also contribute to environmental conservation, economic stability, and social well-being. To this end, I recommend the following strategies:

Promote Knowledge Sharing and Capacity Building, Support Policy Reforms and Institutional Strengthening, invest in Research and Innovation, Facilitate Access to Inputs and Services, and Ensure that farmers have access to high-quality seeds, fertilizers, and other inputs needed for sustainable agriculture. Facilitate access to financial services, such as credit and insurance, to support the adoption of sustainable practices, Promote Market Linkage and Certification Schemes, Raise Awareness, and Advocate for Sustainable Agriculture.

Conclusively, by prioritizing sustainable service management in agriculture, we can build a resilient and prosperous agricultural sector that meets the needs of current and future generations. Together, let us work towards a sustainable and thriving agricultural industry in Africa. We are on this planet together, both animals, plants, reptiles, and human beings. We humans greatly depend on this

ecosystem for survival, it's us the same people who deplete these resources without thinking about future generations, managing resources calls for a collective effort, we all have a role to play, and the decisions we make today matters, natural resources do not speak, lets speak for them, when we speak for them we speak for humanity, we preserve our future generation from the decisions we make today.

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