FACULTY OF NATURAL RESOURC AND ENVIRONMENTAL SCIENCES

DEPARTMENT OF SCIENCE IN FISHERIES AND WATER RESOURCE MANAGEMENT

ASSESSING THE POTENTIAL OF ENVIRONMENTAL AND SOCIAL ECONOMIC EFFECTS OF AQUA AGRO ECOLOGY,

CASE OF KAPTOYOY, SUB COUNTY, KWEEN DISTRICT.

BY

CHEPROT AMOS

BU/UP/2022/1215

RESEARCH REPORT SUMITTED TO THE FACULTY OF NATURAL RESOURCES AND ENVIRONMENTAL SCIENCES IN PARTIAL FULFILLMEN OF THE REQUIREMENTS FOR THE AWARD OF BACHELOR OF SCIENCE IN FISHERIES AND WATER RESOURCE MANAGEMENT.

MAY 2025

DECLARATION

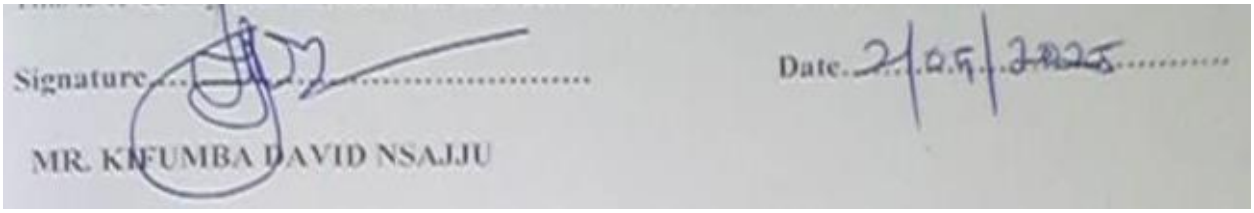
I Cheprot Amos, declare that this is my original work and has never been submitted to any other institution for award of any degree.

Signature…… **Date……**

CHEPROT AMOS

APPROVAL

This is to certify that this research has been submitted with my approval as supervisor.



DEDICATION

I dedicate this research report to my beloved father Mr. Seluk Isaac and my mother Mrs Kokop Babra, brothers for having been there for me in all situations during my academic struggle and make me accomplish this journey of my education.

ACKNOWLEDGEMENTS

I thank the almighty God who has brought me this far, most importantly the gift of life knowledge and courage to go through my studies amidst many challenges.

Secondly, I would like to appreciate the support my family has always been giving me, especially my parent Mr. Isaac Seluk in form of finance, guidance, courage and advice alongside their limited income and resources.

They never felt tired in correcting and replying to any of my questions and equip me with several skills regarding research studies. I really appreciate their efforts towards my success.

I also extend my sincere appreciation to my academic staff from Busitema University Namasagali Campus for their countless efforts and work done persistently to ensure that I am equipped with the required knowledge and skills required for the proper management of natural resources and environment and ensuring that this research is done. I convey my sincere gratitude to my research supervisor Mr. Kifumba David for guidance during this report writing regardless of their busy schedules.

Finally, I thank my fellow colleagues who helped me in one or the other, may the almighty God bless them all abundantly.

Thanks

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF ACRONYMS

PESCA	Promoting the Ecosystem of Coastal Aquaculture
FAO	Food and Agricultural Organization of the United Nations.
DFO	District Fisheries Officer.
IAA	Integrated Aquaculture Agriculture.
ICLA	International Council for Local Accreditation

ABSTRACT

Aqua Agro ecology is an innovation that combines aquatic farming with terrestrial agriculture, promoting sustainable and resource efficiency. Integrated Aquaculture Agriculture (IAA), have been promoted as a solution to reduce water pollution, enhance biodiversity, and optimize nutrient cycling . productivity Farmers in Kween district were unaware of the environmental and economic benefits of choosing to rear specific livestock together with fish farming and cultivation of food and cash crops in their land, and livestock together with fish farming in their land. This study can help the local communities of Kween district to adopt aqua Agro ecology to overcome challenges of poverty, malnutrition for both present and future generation.

The general Objective of study was to assess the environmental and socio-economic effects of aqua agroecology on farmers of Kween district. The specific objectives wereas to assess the environmental contribution of integrating crops and livestock with fish farming on the same piece of identify solutions to the challenges faced by farmers in adopting aqua Agro ecological practices, and to measure the income contribution of current aqua Agro ecological practices to the standards of living of local farmers in Kaptoyoy Sub County, Kween District. Data was analysed using the Histograms and pie charts to compare the environmental contribution of integrating crops and livestock with fish farming on the sam piece of land, to compare solutions to the challenges faced by farmers in adopting aqua agro ecological practices among adopters of aqua agro ecology and non adopters of aqua agro ecology and to compare the contribution of current aqua agro ecological practices to the standard of living of local farmers among the adopters of aqua agro ecology and non adopters of aqua agro ecology.

It was found that the farmers who adopted this integrated approach tended to diversify their crop choices, favouring crops like Irish potatoes They also integrated livestock effectively, particularly goats. Challenges among adopters of aqua Agro ecology and non adopters of aqua agro ecology were market access and limited capital. Costly fish feed, while non-adopters struggled more with water scarcity, to address these challenges, adopters prioritized constructing reservoirs. Adopters reportedimprovements in their living conditions, not only through income but also via food security and risk reduction.

.

CHAPTER ONE

1.0 INTRODUCTION

1.1. Background

1.1.1. Definition of terms.

Aqua Agro ecology is an innovation that combines aquatic farming with terrestrial agriculture, promoting sustainable and resource efficiency (Gliessman, 2015).

1.1.2. Environmental consideration of aqua Agro ecology.

It is generally acknowledged that an aquaculture site can only be managed with regard to the whole ecosystem (GAMBAS, 2002). Fish farming has been properly integrated with local natural resources.

Example of improvements in farm ecological integrity and environment according to, (world Bank, 1991, Gomiero, 1997, Ellis and Bahiigwa, 2003

Globally, aquaculture has surpassed capture fisheries in food production, indicating its growing importance in sustainable food systems. According to the FAO (2024), aquaculture accounted for more than half of global aquatic food production in 2022. This rise, however, has brought concerns about ecological degradation. Sustainable integrated systems, such as Integrated Aquaculture Agriculture (IAA), have been promoted as a solution to reduce water pollution, enhance biodiversity, and optimize nutrient cycling (Troell et al., 2024).

Emerging evidence shows that IAA can contribute to climate-smart agriculture by reducing reliance on synthetic inputs and boosting ecological integrity (Gomiero, 1997; Béné et al., 2021). Moreover, integrating aquaculture with terrestrial food systems enhances micronutrient production, offering a pathway to environmentally sound and nutritionally beneficial food systems (Ignowski & Belton, 2023).

In Sub-Saharan Africa, the expansion of aquaculture is seen as a critical driver of food security, economic resilience, and rural development. Despite its potential, the sector remains underdeveloped due to poor infrastructure, limited access to finance, and climate stressors (Muthoka et al., 2024). Uganda, however, stands out for its progressive aquaculture policies, including the implementation of the **PESCA Project**, which promotes environmentally friendly fish farming practices and farmer training (Ministry of Agriculture, 2024).

Ellis and Bahiigwa (2003) observed that integrated aquaculture systems in Uganda improved both environmental and socio-economic outcomes for rural households, especially in the eastern highlands. Smallholder fish farming has become a critical livelihood strategy for increasing food availability and buffering climate shocks. (personal comment).

Aqua-agroecology is environmentally relevant due to its potential to enhance ecological integrity at the farm level by aligning aquaculture practices with the broader ecosystem (personal comment). It is widely acknowledged that sustainable aquaculture cannot be effectively managed in isolation but must be integrated into the surrounding ecological system (Gambas, 2002). When fish farming is properly integrated with local natural resources—such as using nutrient-rich fish pond water to irrigate crops or recycling organic waste for fish feed—it contributes to the health of both aquatic and terrestrial ecosystems (personal comment).

This integrative approach has demonstrated several environmental benefits. For instance, it can improve nutrient cycling, reduce pollution, and decrease the reliance on synthetic fertilizers and pesticides (Gomiero, 1997). Moreover, fish farming within an agroecological framework can enhance biodiversity and soil health, contributing to the overall resilience of farming systems (World Bank, 1991). In Uganda, Ellis and Bahiigwa (2003) observed that integrated fish farming practices led to significant improvements in on-farm ecological conditions, highlighting the system's potential to foster environmental sustainability in rural agricultural landscapes.

1.1.3. Economic consideration of aqua Agro ecology.

Studies indicate such integrated system can enhance food security and improve livelihood of rural communities (FAO, 2020). Nubugoomu el al, (2021) observed that farmers who adopt Agro ecological practices experienced increased yields and income stability.

Integrated farming practices, including fishponds and crop-livestock systems, can enhance resource use and farm resilience (personal comment). According to Namatovu et al. (2017), the introduction of small-scale aquaculture in Uganda's highlands has improved income diversification and reduced pressure on land.

Incorporating digital technologies such as water quality sensors and precision aquaculture systems can further support environmental monitoring, optimize yields, and minimize risks to local ecosystems (Haque et al., 2023).

1.2. Problem Statement.

The continued reliance on small scale mono crop cultivation and large scale pastoral agricultural, methods in Kween district has led to soil impoverishment, soil erosion and increased occurrence diseases among livestock resulting in low crop and animal productivity Farmers in Kween district were unaware of the environmental and economic benefits of choosing to rear specific livestock together with fish farming and cultivation of food and cash crops on their land and livestock, together with fish farming in their land.

Some farmers claim aqua Agro ecology practices especially those of Soi fishermen group haD helped them to improve on their food security, reduced farmers alleged malnutrition, and increase income level. However, some also alleged that the social economic benefits are tempered by drought, inadequate market information, expensive fingerlings, expensive fish feeds, flooding, pests and diseases, and, inadequate technical support. some fish and non fish farmers are not aware of aqua Agro ecological practices in the district. Also, same farmers claimed had no clear guidance on how to select which complementary crop and livestock to be included in their farms.

This study, therefore, ought to provide the district administration with information on what existing combinations of crops and animals that it could advise farmers as appropriate to grow and rear respectively on their land, how these would be used to promote integrated fish farming under the current environmental conditions, and what social economic contribution this made to their' livelihoods. This would be useful in promotion of sustainable agricultural farming in the entire district. Understanding both the environmental and economic benefits of aqua Agro ecological practices in Kween district would guide the district administration formulate effective agricultural policies that would aid to transformed existing farming practices in the community from peasantry to sustainable commercial agriculture that would promote sustainable livelihoods.

1.3. Significance of the study.

The implementation of findings and recommendations of this study will help the local communities of Kween district to adopt aqua Agro ecology to overcome challenges of poverty, malnutrition for both present and future generation.

1.2. General and Specific Objectives

1.2. General objective.

To assess the potential environmental and social economic contribution of aqua Agro ecological practices for the livelihoods of farmers of Kween district.

1.2.1. Specific objectives.

i. To assess the environmental contribution of integrating crops and livestock with fish farming on the same piece of land.
ii. To identify solutions to the challenges faced by farmers in adopting aqua Agro ecological practices,
iii. To measure the income contribution of current aqua Agro ecological practices to the standards of living of local farmers.

1.3 Research questions.

i. What is environmental of integrating crops and livestock with fish farming on these same pieces of land. In Kween district
ii. What are the solutions to the challenges faced by local farmers in adopting aqua Agro ecological practices?
iii. What is the contribution of the income earned from current Agua Agro ecological practices to the standard of living local farmers.

1.4. Conceptual Frame Work.

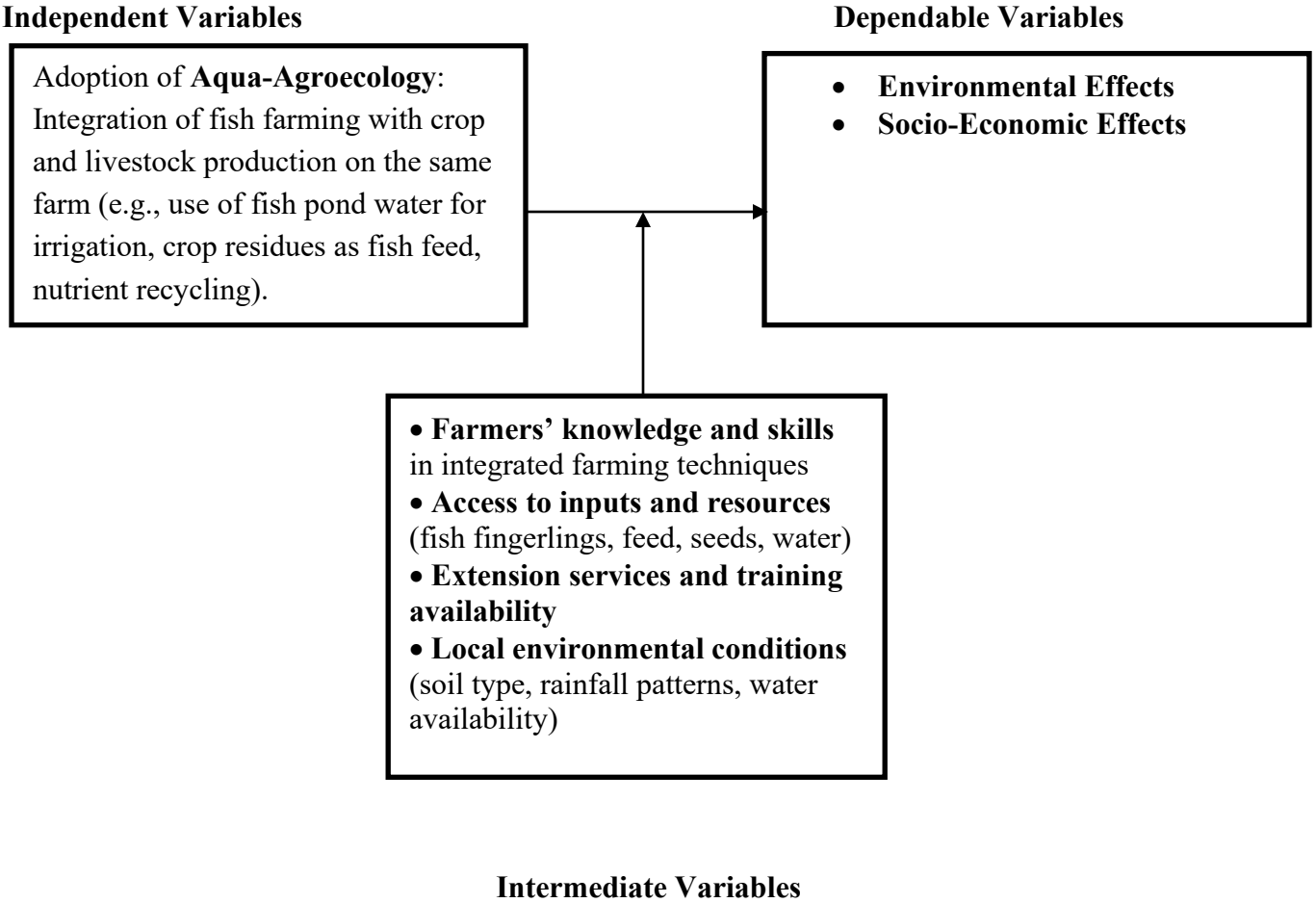


Figure 1.1. Conceptual Frame Work.

The adoption of aqua-agroecological practices is shaped by farmers' knowledge, resource availability, and environmental conditions, all of which influence how effectively these practices

are integrated. When successfully implemented, they lead to positive environmental outcomes such as improved soil and water quality and socio-economic benefits like higher income and better livelihoods. These gains can, in turn, create feedback loops, where improved socio-economic conditions empower farmers to further invest in and sustain environmentally friendly practices.

1.5. Limitations of the study.

Inadequate funds for financing travels to the community to data collection and acquiring all the material necessary for data collection for example printing questionnaires. This led to delayed data collection and also to move in late hours because sometimes moved on foot to field, this restricts the number of participants you can include in your study, leading to a smaller sample size. Smaller amount of data collected due to limited funds may not enable making a conclusion that is representative of the study area.

Time constraints to balance research activities with other commitments say work deadlines, house work, this made the research time frame to extend limiting thorough examination of the data, leading to less robust conclusions. Limited time available for the study led to smaller coverage of the study population hence smaller sample size of the population may not provide conclusions that reflect the actual socio economic and environmental contribution of aqua agroecological practices representative of the entire district.

Reluctance and biasness of some respondents to disclose some information, this made some information go unknown limiting the data quality since some data was hidden hence might reduce the validity of conclusions and recommendations. reluctance and biasness of some respondents to disclose information may not enable making conclusion which representative of the study area.

CHAPTER TWO:

2.0. LITERATURE REVIEW

2.1. Agro ecological Theory.

Agro ecology views agricultural systems as ecosystems, emphasizing the ecological interactions between organisms, farming practices, and the environment (Altieri, 1995). It promotes practices such as diversification, nutrient recycling, and the integration of aquaculture with crop and livestock systems to build ecological resilience and sustainability.

2.2. Environmental contribution of integrating crops and livestock with fish farming on the same piece of land.

One of the key environmental benefits of ICLA systems is the enhancement of soil structure and fertility. Gill et al. (2023) report that integrated systems in Northwest India significantly improved soil nutrient content through efficient organic matter recycling from livestock manure and pond sludge. Similarly, Swarnam et al. (2023) highlight that crop–livestock–aquaculture systems on humid tropical islands increased soil organic carbon and reduced the need for synthetic fertilizers, thereby promoting long-term soil productivity.

Rehman et al. (2024), note that integrating livestock and aquaculture into crop systems facilitates nutrient loop closure, with manure and fish pond effluents serving as valuable sources of nitrogen and phosphorus..

ICLA systems also contribute to improved water use efficiency. According to Gill et al. (2023), reusing nutrient-rich pond water for irrigating crops not only reduces freshwater extraction but also curtails the discharge of pollutants into nearby water bodies. Ignowski et al. (2023) further demonstrate that integrated systems in Bangladesh reduced fertilizer runoff, contributing to better surface water quality.

The practice of using livestock waste in fishponds promotes biological filtration, reducing eutrophication risks (Ndjadi, 2021). This integrated nutrient management significantly lessens the environmental footprint of farming while maintaining or increasing yields.

Swarnam et al. (2023) found that diversified farms sequester more carbon in both soil and biomass due to continuous ground cover and minimized tillage. Chatzichristou et al. (2024) echo this, noting that mixed systems reduce greenhouse gas emissions by lowering dependence on external inputs such as synthetic fertilizers and fossil fuel-based feeds. Moreover, research by the World Fish Center (2023) identifies ICLA systems as an effective nature-based solution for climate mitigation, emphasizing their potential to reduce methane emissions typically associated with rice paddies and livestock when integrated with aquaculture and plant systems.

Integrating crops, livestock, and fish farming promotes on-farm biodiversity by creating diverse ecological niches. The rice–fish system, for example, has been shown to support natural pest predators and reduce the need for chemical pesticides by up to 68% (Wikipedia, 2025). According to Gill et al. (2023), these systems also enhance pollinator presence and promote microbial biodiversity in soils, which is vital for nutrient cycling and disease suppression.
This ecological diversification leads to more stable agroecosystems, capable of withstanding environmental shocks such as droughts, pests, or market volatility).

2.3. Solutions to the challenges in adopting aqua Agro ecological practices.

A persistent barrier to adoption is the limited awareness and understanding of Agro ecological principles and integrated aquaculture systems among smallholder farmers (Personal comment). Many lack technical skills, especially in pond management, feed quality control, and disease management (Cheruiyot & Adhiaya, 2023) argues bridges this gap, targeted capacity-building programs such as training workshops, field demonstrations, and farmer field schools have proven essential (personal comments). These programs not only improve technical competence but also increase confidence in transitioning to complex practices (Frontiers in Sustainable Food Systems, 2024a).

Limited access to credit and land tenure insecurity reduce farmers' willingness to invest in long-term practices like integrated agriculture-aquaculture (Awuor et al., 2023). Enhancing access to affordable credit facilities, securing land rights, and providing micro-financing tailored to aquaculture inputs (e.g., fingerlings, feeds) are among the most effective solutions (personal comments).

In Kenya, adoption rates of integrated systems were significantly higher among farmers with access to formal credit and secure land (Awuor et al., 2023).
Participatory methods foster ownership and allow practices to be adjusted based on feedback, ultimately enhancing sustainability and farmer .

For example, fishponds have served as emergency food and cash sources during droughts in northern Zambia, offering adaptive functions beyond income (Anonymous, 2023).

The multifunctionality of integrated systems providing food, income, irrigation, and soil fertility offers a compelling incentive for adoption. Diversification reduces farmers' dependence on a single commodity and enhances resilience. Integrated agriculture–aquaculture (IAA) not only supports food and income diversification but also facilitates ecological benefits such as nutrient cycling and reduced agrochemical use (Awuor et al., 2023). These synergies align with broader agroecological goals, making IAA a cornerstone of sustainable rural development strategies.

2.4. Income contribution of aqua agro ecological practices to the standards of living .

Aqua-agro ecology integrates ecological principles into aquaculture and agriculture systems to maximize resource use, biodiversity, and sustainability, according to FAO (2009) defines small-scale aquaculture as a livelihood activity that contributes to household income, nutrition, and resilience, especially in rural and resource-constrained contexts. Measuring its contribution involves examining income generation, food security, asset accumulation, and expenditure on health and education. "The contribution of aquaculture to rural development cannot be measured only in terms of output; it must be assessed within the context of sustainable livelihoods and quality of life improvements" (FAO, 2009, p. 6). Awuor, Macharia, and Mulwa (2023) conducted an econometric analysis of smallholder fish farmers in Kenya and found that households practicing IAA earned significantly higher incomes compared to non-adopters, with net income from aquaculture forming a substantial proportion of total household earnings.
“Farm households that earned higher average profits from IAA were more likely to adopt and intensify its use” (Awuor et al., 2023,)

CHAPTER THREE

3.0. METHODS OF STUDY.

3.1. Pilot study.

A pretesting of the questionnaire was done before the main study to , this was to find out if the questions generated data related to the objectives , to remove irrelevant questions and fill the missing gaps in the questionnaire. It also helped to find out if the questions were answerable.

3.2. Description of study site.

3.2.1. Location.

Kween District is located in the Mount Elgon sub-region of Eastern Uganda (Figure 3.1). Kween District spans approximately 851 km², situated around 1°25′N, 34°31′E, at an average altitude of 1,900 m above sea level , Borders with Nakapiripirit (north), Amudat (northeast), Bukwo (east), Kapchorwa (west), Bulambuli (northwest), and shares its southern boundary with Kenya, Headquarters: The main administrative town is Binyiny, located roughly 69 km northeast of Mbale and kaptoyoy subcounty located west of binyiny town councile, 2km away from the district headquarters.

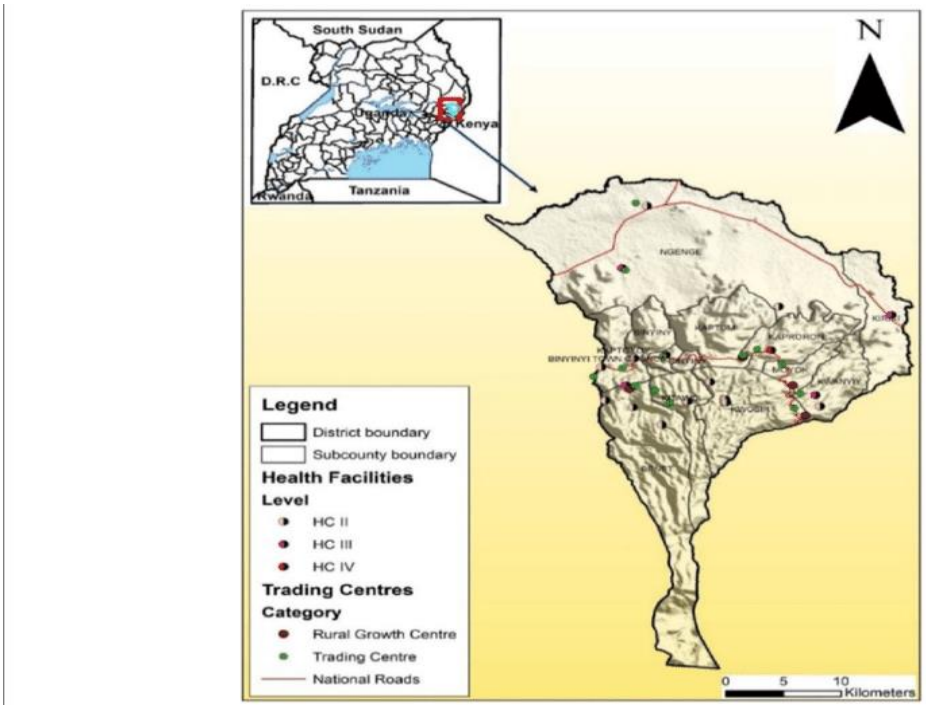


Figure 3.1 Location of Kween district on the map of Uganda..

3.3. Sampling size and procedure.

3.3.1. sample size.

A sample of 69 respondents were selected from the villages of Kaptoyoy sub county Kween district among adopters and non adopters of aqua Agro ecology .The sample size was determined using the Solvin's formula(Kate William ,2023).

N=N(1+Ne>2

Table 1 persons in the study.

Persons in the study	Frequency	Percentage
Adopters of aqua Agro ecology	29	42
Non adopters of aqua Agro ecology	40	58
Total	69	100

3.3.2. Sampling technique.

One member of a household had a chance of being selected and this eliminated bias in the data collected and results of analysis. As long as they were able to ask the required questions.

Project leaders and community leaders were selected because they had more information about aqua agro ecology among adopers of aqua agro ecology and non adopters of aqua agro ecology in the area and proper valued information.

3.4. Data types and collection methods

3.4.1. Data types.

Qualitative and quantitative data was collected. Primary data was collected by using questionnaires, interviews (face to face) and also observation method used. Secondary data was obtained from websites, journals, and publications.

3.4.2. Data collection methods.

Questionnaire.

The questionnaire contained both open ended and close ended questions. Structured questions were accompanied by a list of possible alternatives from which the respondents were able to select the answer that describes the situation. Were it was impossible to exaust all categories, the questionnaire included a category others, specify" to cater for those responses. In semi-structured questions, the respondents were given freedom of responses. Questionnaires were filled in printed sheets. As shown in **appendix 1.**

Interviewing .

Respondents were asked questions verbally and the responses was recorded and used to supplement the information gathered using other methods. The interviews were face to face and this enabled to gained in -depth insight from participants' experiences , and perspective ,allows exploration of complex issues within their context and also provide flexilibility to adopt questions based on participant responses.

Observation .

This provide real-time data on how community being affected both positively and negatively on the introduction of aqua agro ecology. It allowed direct observation of physical changes in the environment, infrastructure which were not apparent through other data collection method.

3.4.3. Data analysis.

Microsoft excel was used for analysis to understand the socio economic benefits and challenges among adopters of aqua agro ecology and non-adopters of aqua agro ecology.The histograms were used to compare the environmental contribution of integrating crops and livestock with fish farming on the same piece of land, to compare solutions to the challenges faced by farmers in adopting aqua agro ecological practices among adopters of aqua agro ecology and non adopters of aqua agro ecology and to compare the contribution of current aqua agro ecological practices to the standard of living of local farmers among the adopters of aqua agro ecology and non-adopters of aqua agro ecology.

CHAPTER FOUR

4.0. PRESENTATION OF THE RESULTS.

4.1. Demographic characteristics.

4.1.1. Composition of respondents by Gender.

60.9% of the respondents were males in contrast to 39.1% that were females (Figure 4.1).

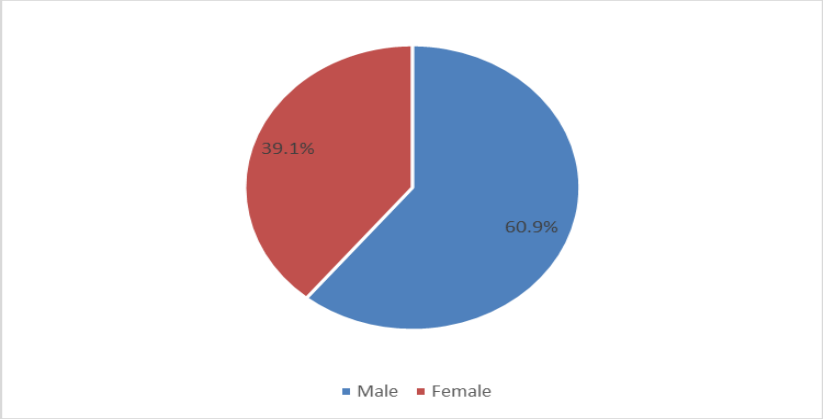


Figure 4.1. Percentage composition of respondents according to Gender.

4.1.2. Age bracket of the respondents.

52.1% of the respondents were aged between 26-50 in contrast to 25.9% and 22% who were aged between 20-25 and above 50 years respectively (Figure 4.2).

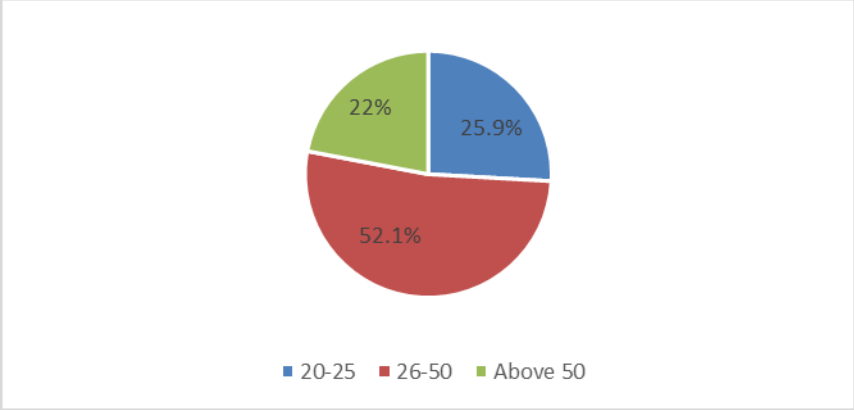


Figure 4.2. Percentage Composition of respondents according to the age bracket.

4.1.3 . Education levels of respondents

45% and 25% of the respondents were in secondary and primary school respectively in contrast to 17% and 13% were in tertiary and others respectively (Figure 4.3).

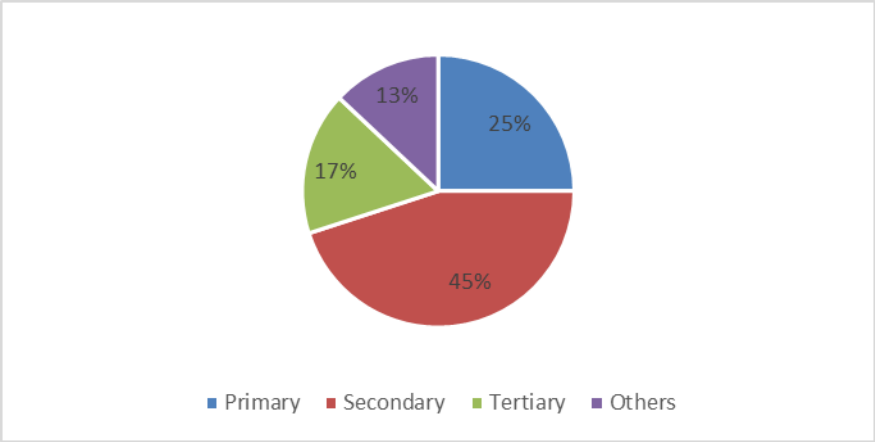


Figure 4.3. Distribution of education level in percentage.

4.1.4. Composition of respondents according to marital status.

55% and 32% of the respondents were married and single respectively in contrast to 7% ,4% and 2% who were divorced, widow and others respectively (figure 4.4).

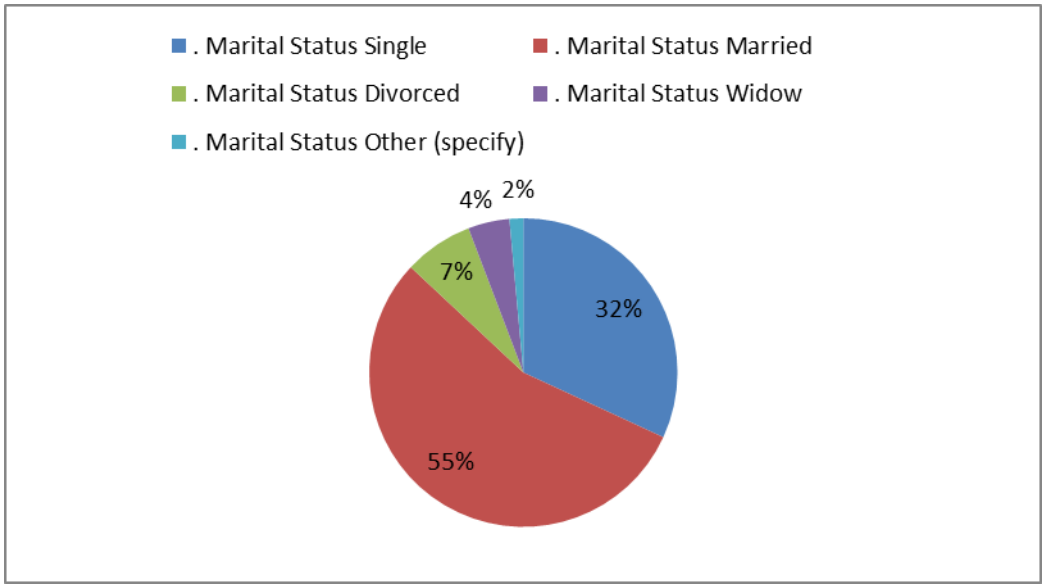


Figure 4.4. Percentage distribution of respondents according to marital status.

4.1.5. Composition of respondents according to their Occupation.

65% of the respondents were farmers in contrast to 17%,12%,and 6% who were farmers ,businessmen and others respectively (figure 4.5).

Figure 4.5. Percentage composition of respondents by occupation.

4.1.6. Religious composition of respondents.

64% of the respondents were catholic in contrast to 26%,6% and 4% who were others, Moslems and without a religion respectively (Figure 4.6).

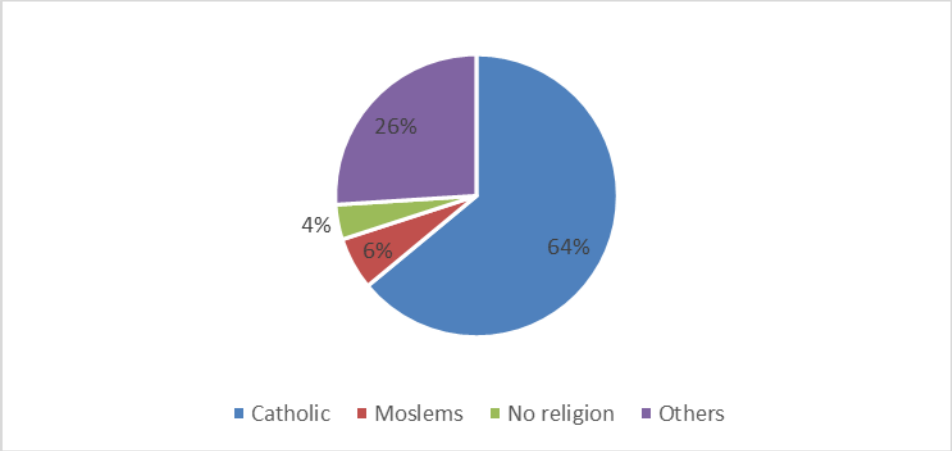


Figure 4.6. Percentage composition of respondents according to religion.

4.2. Environmental contribution of integrating crops and livestock with fish farming on the same piece of land.

4.2.1. Size of land owned by respondents in the community.

51% and 43% of the respondents were having size of the land owned above one hectare and 1 hectare respectively in contrast to 6% who are having below one hectare (Figure 4.7).

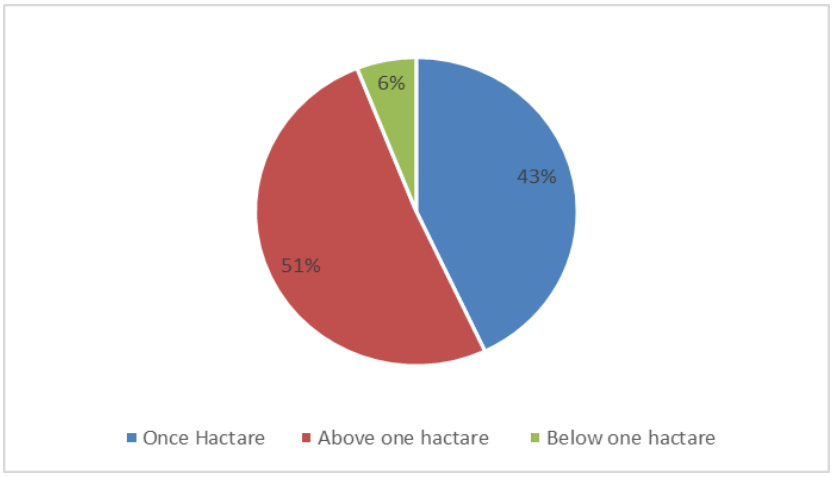


Figure 4.7 Percentage comparison respondents according to size of land owned by respondents.

4.2.2. Composition of respondents according to distance of farm from homes in the community.

58% and 36% of the respondents were having farms near their homes , and far from home respectively in contrast to 6% who were having others (figure 4.8).

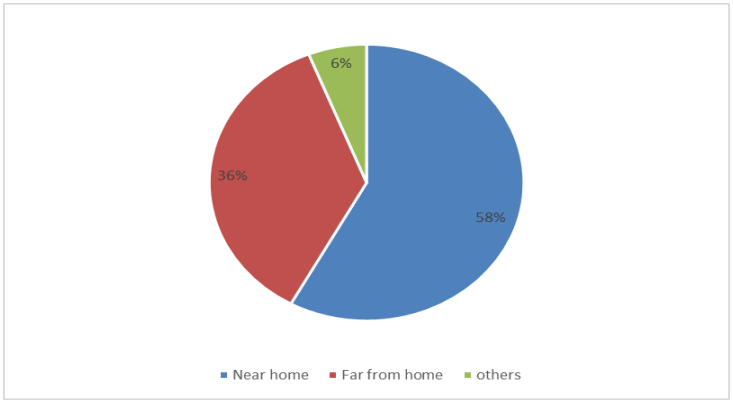


Figure 4.8. Percentage comparison of respondents according distance of farm from homes.4.2.3. Composition of respondents according to crops grown.

44%, 26.2% and 20.35 of the respondents grow maize, Irish potatoes, and beans respectively in contrast to 9.5% who grow other crops (Figure 4.9).

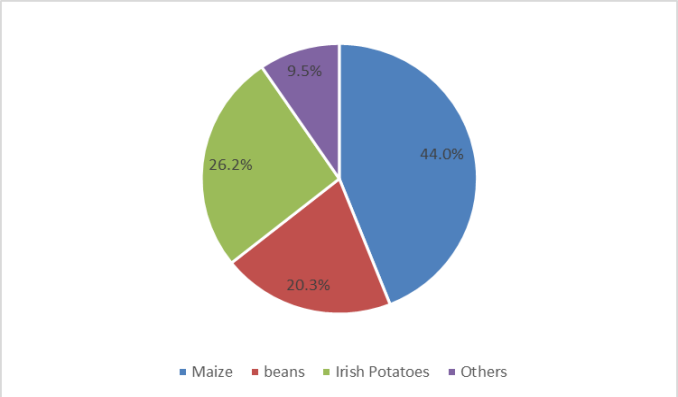


Figure 4.9 . Percentage comparison of respondents according to crops grown.

4.2.4 . Composition of respondents according to Animals reared.

58% and 36.2% of the respondents were rearing goats and cattle respectively in contrast to 21.7%,14.5% and 7.2,who were rearing sheep, pigs and others respectively.

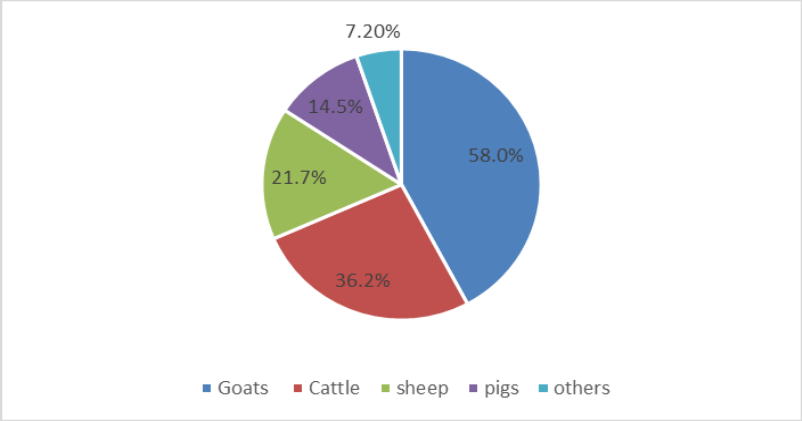


Figure 4.10 Percentage comparison of respondents according to Animals reared

4.2.5. `Duration of agricultural practices among farmers.

49.3% of the respondents have been carrying out agricultural practices for more than two years in contrast to 29% and 21.7% who have been conducting agricultural practices for two years and one year respectively.

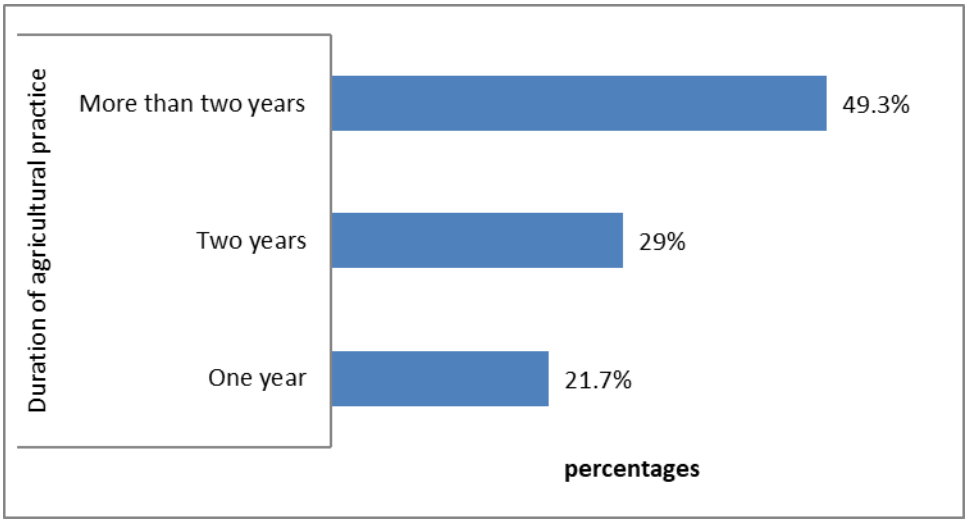


Figure 4.11. Percentage comparison of duration of agricultural practices by on environmental benefit in percentages.

4.2.6. Comparison of types of crops grown among non-adopters and adopters of aqua agroecology.

48.1% and 20.2% of the respondents among adopters of aqua agroecology and non adopters of aqua agroecology respectively grow irish potatoes contrasted to 12.9% and 26% of the adopters of aquaagrecology and non adopters of aqua agroecology respectively who grow maize (Figure 4.12) ,

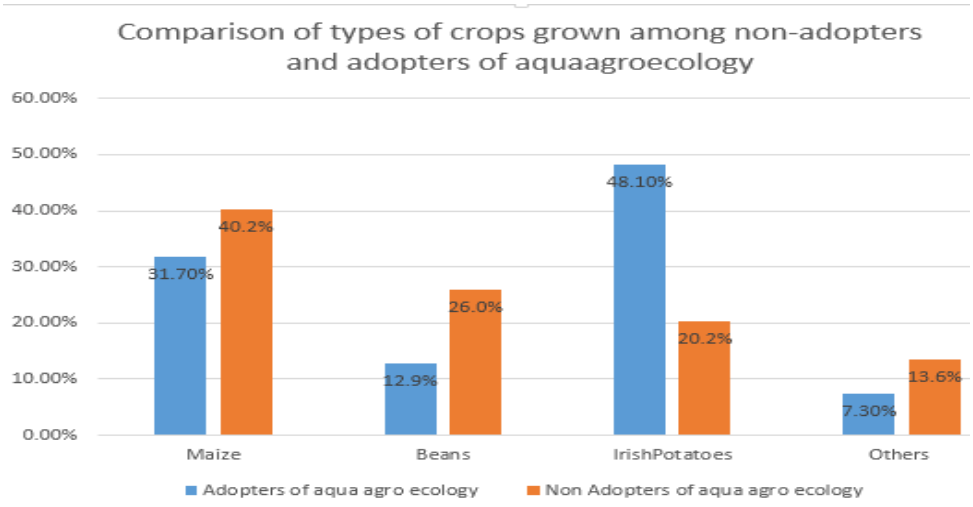


Figure 4.12 Percentage Comparison of types of crops grown among adopters and non-adopters of aqua agro ecology.

31.7% and 40.2% of the adopters of aqua agroecology and non-adopters of aqua agroecology respectively cultivate maize .

4.2.7. Comparison of types of animals reared among non-adopters and adopters of aqua agroecology.

58% and 42% of respondents among adopters of aqua agro ecology and non adopters of aqua agro ecology respectively rear goats contrasted to 36.2% and 26% of the adopters of aqua agro ecology and non adopters of aqua agro ecology respectively who rear cattle. (Figure 4.13) .

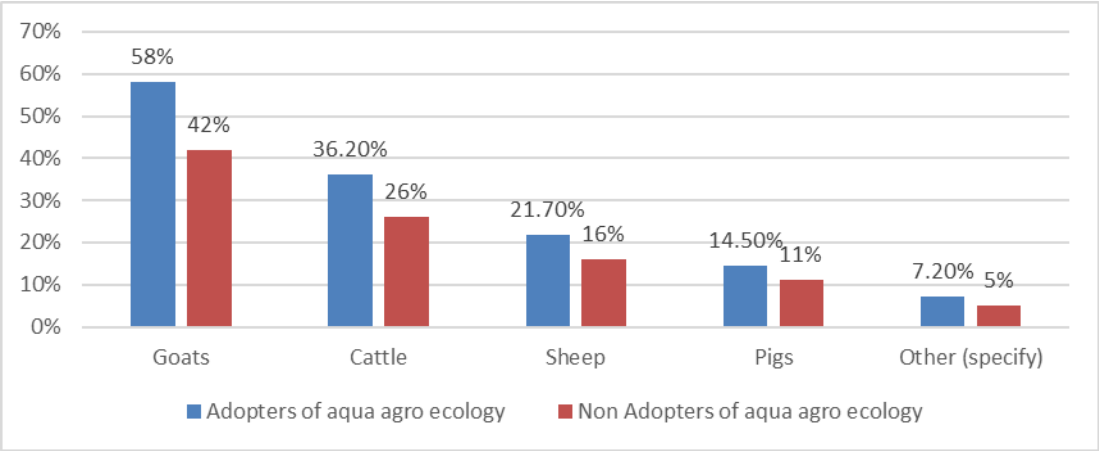


Figure 4.13 Percentage comparison of animals reared between non adopters and adopters of aqua agro ecology.

21.7% and 16% of the adopters and non adopters of aqua agro ecology respectively rear sheep contrasted to 14.5% and 11% of the adopters of aqua agro ecology and non adopters of aqua agro ecology respectively who rear pigs.

4.2.8. Comparison of duration of adoption of type of agricultural activity among non-adopters and adopters of aqua agroecology.

49.3% and 47.9% of respondents among adopters of aqua agro ecology and non adopters of aqua agro ecology respectively have been in agricultural activity for more than two years contrasted to 29% and 24.4% of the adopters of aqua agro ecology and non adopter of aqua agro ecology respectively who have been in agricultural activity for two years (figure 4.14).. .

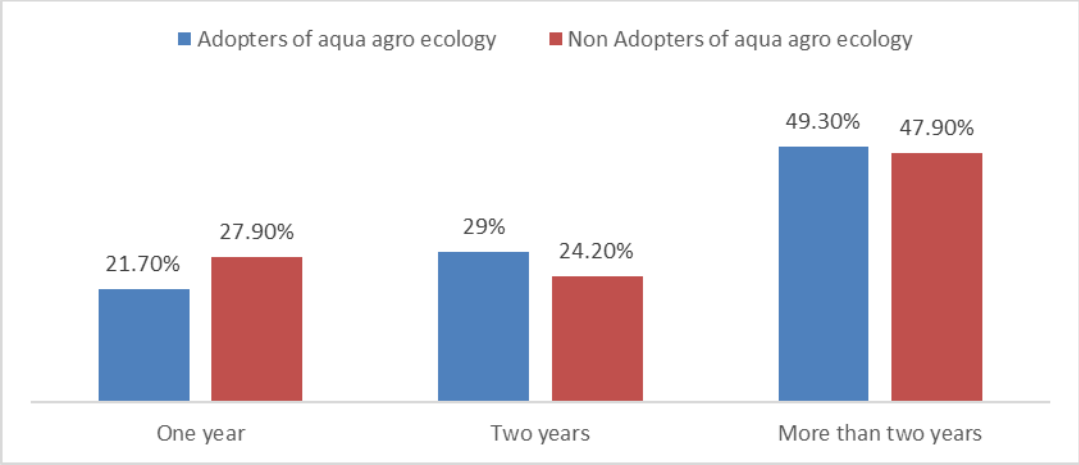


Figure 4.14 Percentage comparison of duration of agricultural activity of adopters and non-adopters of aqua agro ecology.

21.7% and 27.9% of adopters of aqua agro ecology and non adopters of aqua agro ecology have been in agricultural activity for one year.

4.2.9. Comparison of availability of linkages in agricultural components among non-adopters and adopters of aqua agroecology.

71% of respondents among non- adopters of aquaagroecology indicated there are linkages among agricultural components on the farm while 29 % indicated there were absent as contrasted to 20% among adopters of aquaagroecology who indicated linkages existed while 80% indicated they were not there (figure 4.15).

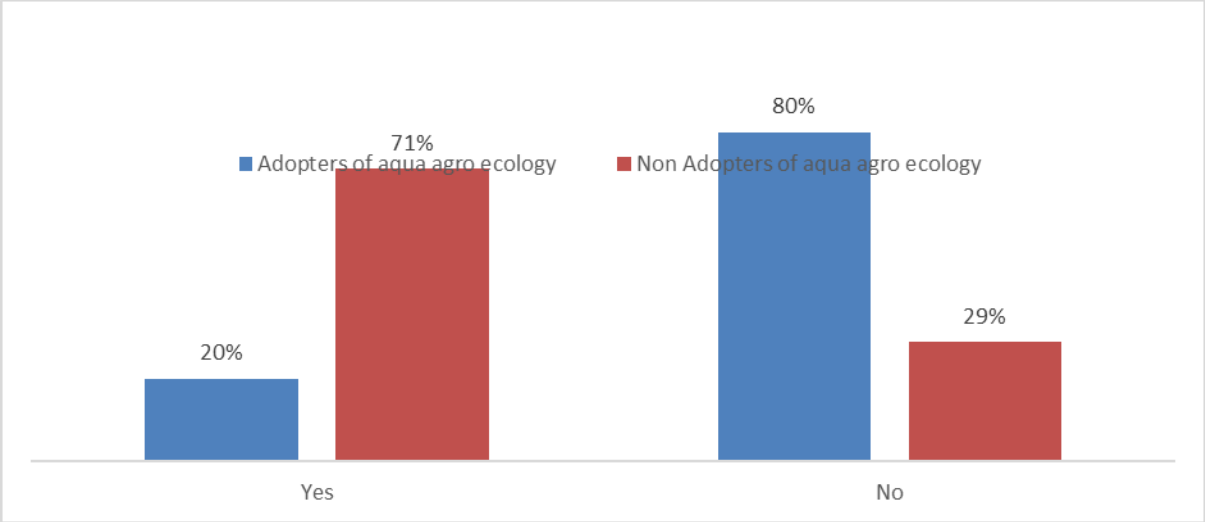


Figure 4.15 percentage comparisons linked between fish farming and other components among non-adopters and adopters of aqua agro ecology.

4.2.10. Comparison of availability of environmental benefits of integrating agricultural components among non-adopters and adopters of aqua agroecology.

87% of the respondents among non adopters of aqua agro ecology said there are environmental benefits of integrating agricultural components on the farm while 13% said there are absent contrasted to 94% of the non adopters of aqua agro ecology who said environmental benefit do not exist while 6% said the environmental benefits exist (Figure 4.16).

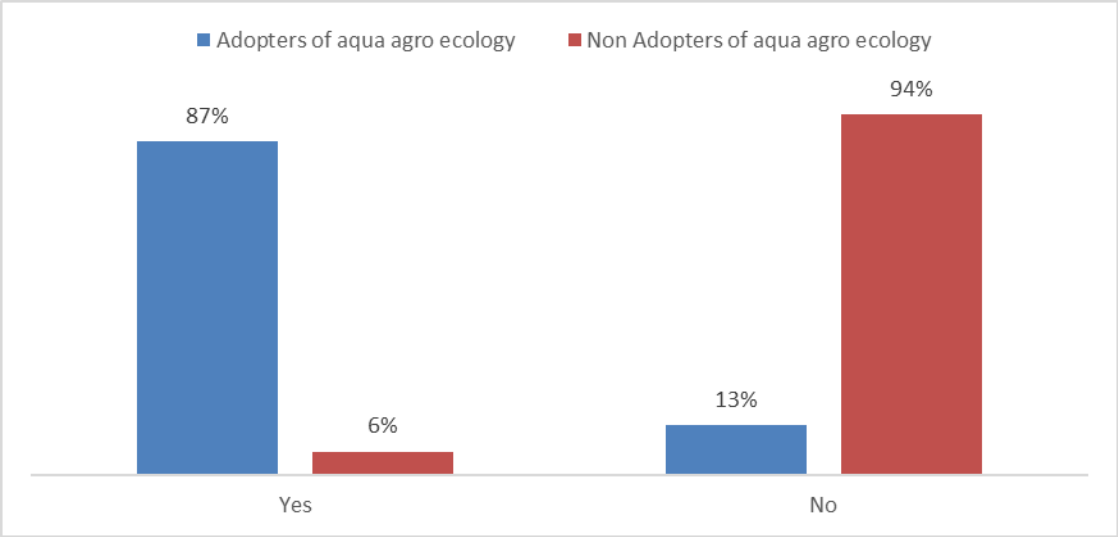
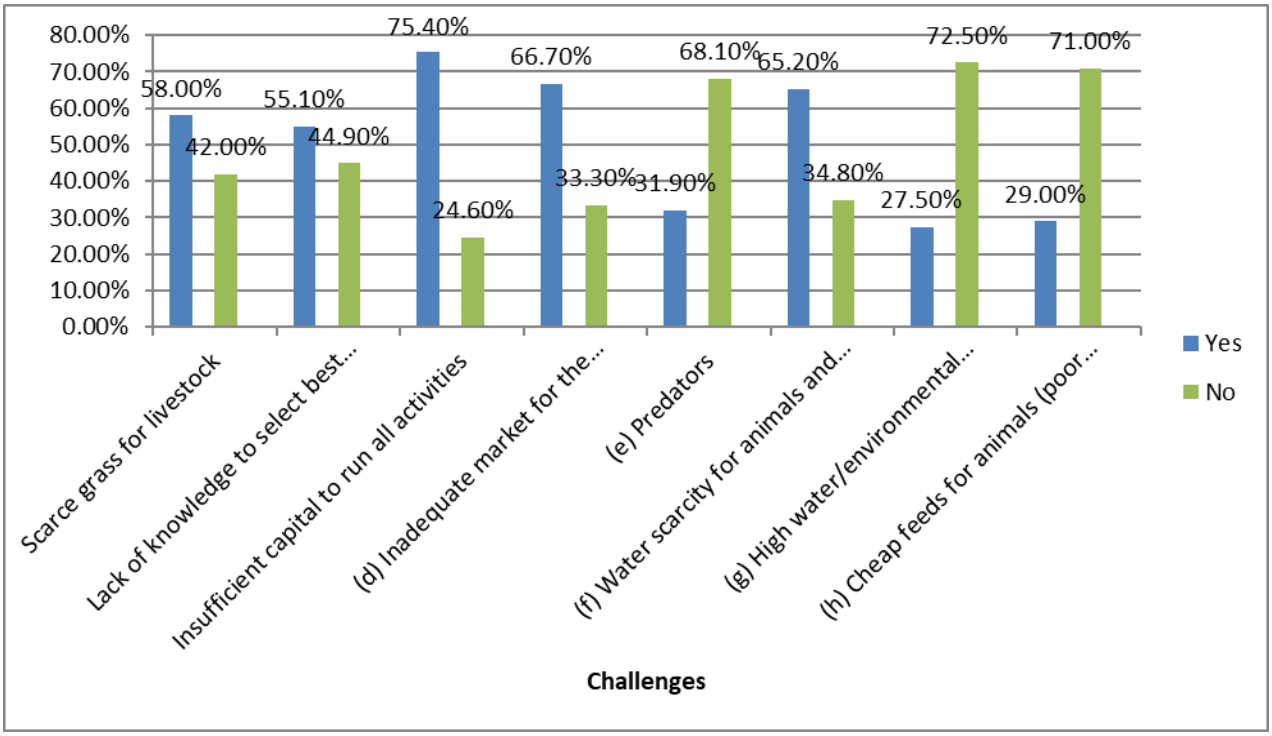


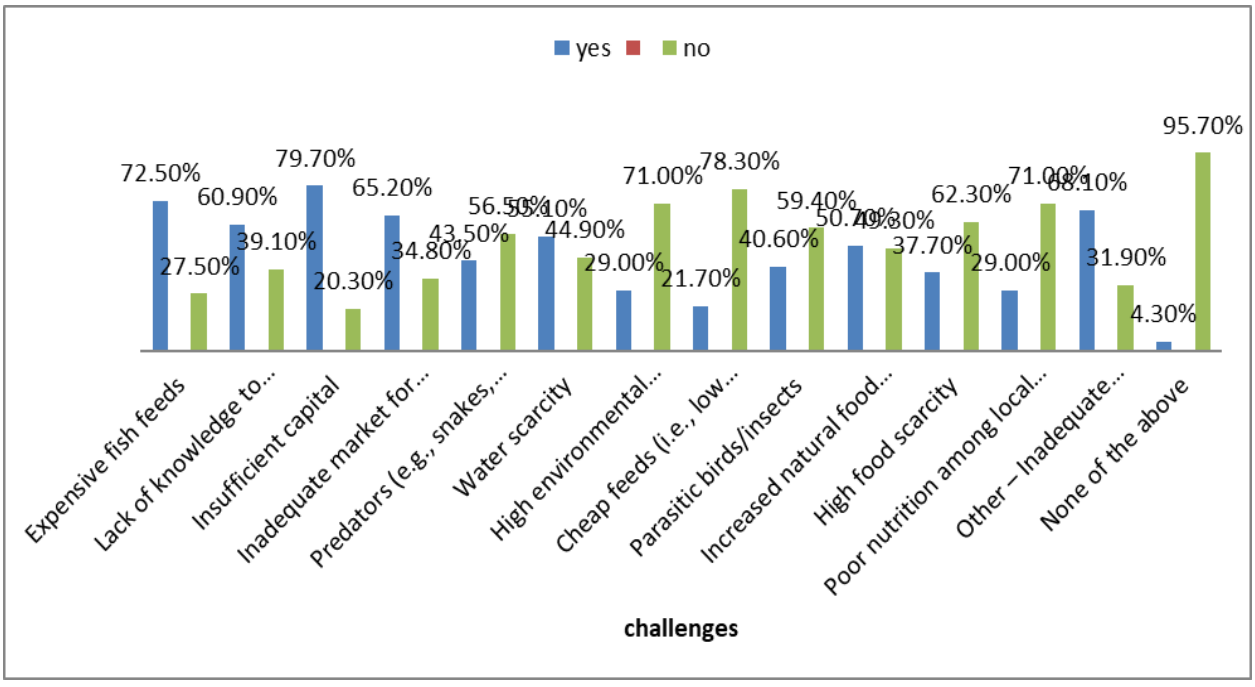
Figure 4.16. Percentage comparison of environmental benefit of integrating crops, livestock, and fish among adopters and non-adopters of aqua agro ecology.

4.3.1. Comparison of challenges faced by adopters of aquaagroecology and non-adopters and adopters of aquaagroecology.

75%, 66.7%, 65.2% 58% and 55.1% of the respondents among non adopters of agroecology indicated inadequate market access, insufficient capital, water scarcity, scarce grass for livestock, and lack of knowledge to select best practices respectively as their challenges in contrast to 79.7%, 65.2%, 72.5%, and 60.9% among adopters of agroecology who reported inadequate market access, insufficient capital, expensive fish feeds and lack of knowledge to implement practices effectively and critical gaps in financial, technical, and input support respectively as their challenges (figure 4.17).



(a) Non adopters of aqua agroecology.

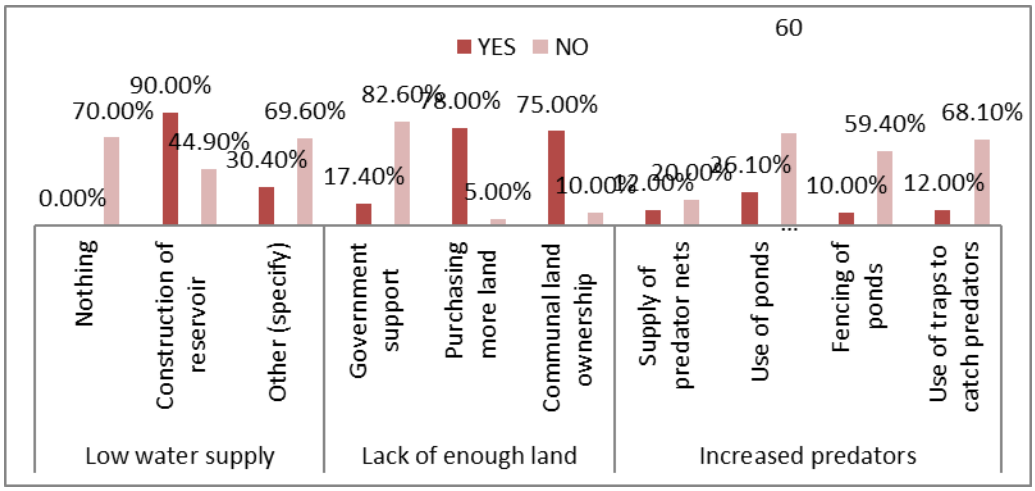


(b) Adopters of aqua agro ecology

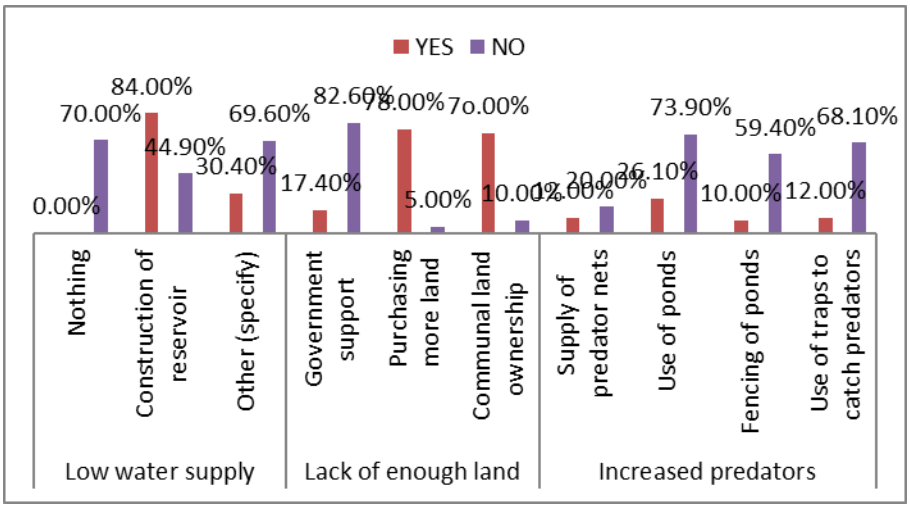
Figure 4.17. Comparison of Challenges faced by the adopters of aqua agro ecology and non-adopters of aqua agroecology.

4.3.2. Comparison of solutions to challenges faced after adoption aqua agroecological practices among non-adopters and adopters of aqua agroecology.

90%,78% and75% of the respondents among adopters of aqua agro ecology agreed that solution to low water supply was construction of reservoirs and lack of enough land was purchasing more land,community land ownership in contrast to 84%,78%,70% and 26.1% among non adopters of aqua agro ecology who reported that solution to low water supply were construction of reservoirs, purchasing more land,and lack of enough land were communual land ownership and increased predators use of fish ponds respectively(figure 4.18).



(a). Adopters of aqua agro ecology.



(b). Non **adopters of aqua agro ecology.**

Figure 4.18 Solutions to challenges faced after integration among the adopters and non adopters of aqua agro ecology.

4.4. Income among adopters and non-adopters of aquaagroecological practices

4.4. 1 Comparison of acknowledgement of changes in incomes among non-adopters and adopters of aqua agroecology.

37.7% and 33.3% of respondents among adopter of aqua agro ecology and non adopters of aqua agro ecology respectively indicated there is income contribution ranging between 500000 to 700000 contrasted to 3 4.8% and 31.9% of adopters of aqua agro ecology and non adopters of aqua agro ecology respectively who indicated income contribution ranged between 300000 to 400000 (figure 4.19).

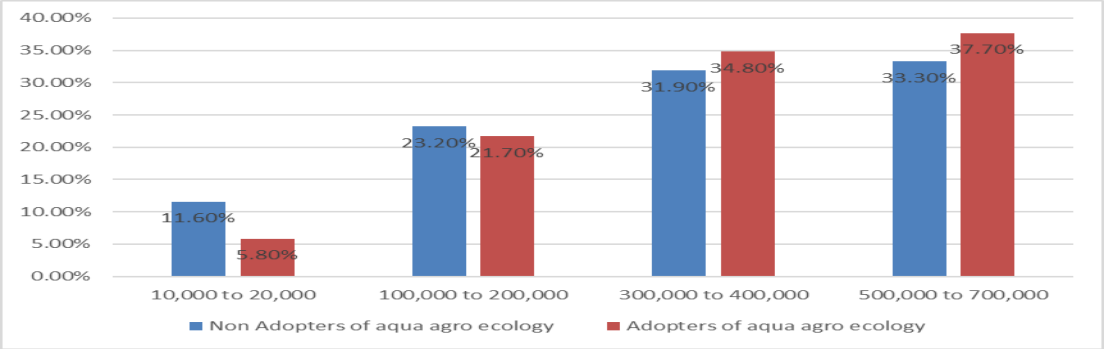


Figure 4.19 Comparison of acknowledgement of changes in incomes among non-adopters and adopters of aqua agroecology.

21.1% and 23.2% of adopters of aqua agro ecologyand non adopters of aqua agro ecology indicated there are income contribution ranged from 100000 to 200000 respectively contrasted to 5.8% and 11.6% of adopters of aqua agro ecology and non adopters of aqua agro ecology indicated there are income contribution ranged from 10000 to 20000) respectively.

4.4.2. Comparison of main Sources of Income before Integration among adopters and non adopter of aqua agro ecology.

61% and 60.9% of the respondents among non adopters of aqua agro ecology and adopters of aqua agro ecology respectively reported there main sources of income was sales of animal products contrasted to 22% and 21.7% of non adopters of aqua agro ecology and adopters of aqua agro ecology respectively said source of income was bank loans (figure 4.20).

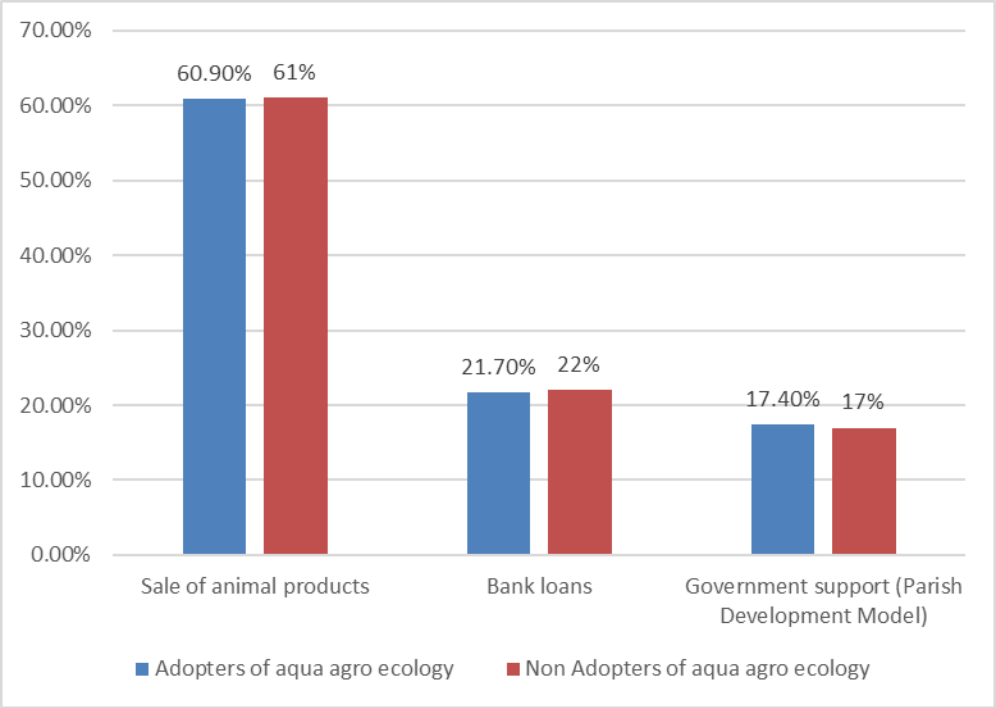


Figure 4.20 Percentage comparison of main sources of income before integration among adopters and non adopters of aqua agro ecology.

17% and 17.4% of non adopters of aqua agro ecology and adopters of aqua agro ecology reported source of income was government support(parish development model) respectively.

4.4.3. Comparison of improvement in living conditions since adoption of aqua agroecology among adopters and non-adopters of aqua agroecology.

78% of the respondents among adopters of aqua agro ecology agreed improvement in their standards of living condition since adoption of aqua agro ecology while 22% disagreed contrasted to 15% of respondents among non adopters of aqua agro ecology who agreed contributed to their improvement in standards of living condition while 85% disagreed improvement in living condition since adoption of aqua agro ecology (figure 4.23).

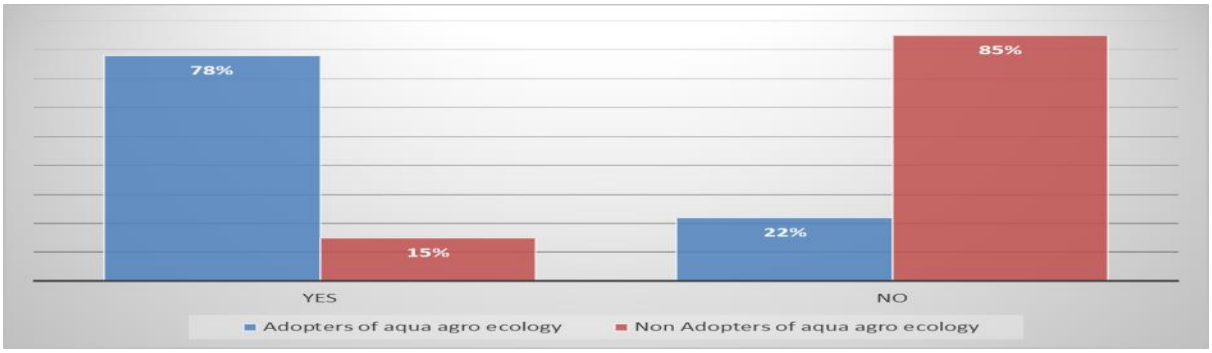


Figure 4.21 Percentage comparison of improvement in living condition among adopters and non-adopters of aqua agro ecology.

4.5. Respondents' Recommendations

4.5.1. Comparison of recommendations for enhancing aqua agro ecological practices in the community among adopters and non-adopters of aquaagroecology.

35.8% and 29.5% of respondents among adopters of aqua agro ecology and non adopters of aqua agro ecology respectively recommended market access by farmers contrasted to 28.8% and 30.8% of the adopters of aqua agro ecology and non adopters of aqua agro ecology respectively who recommended land access, (figure 4.22).

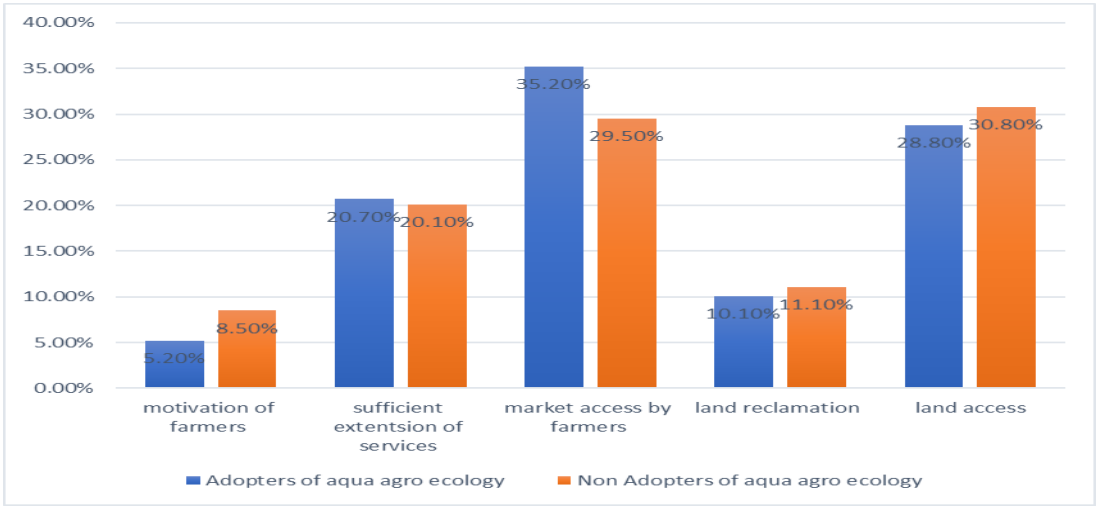


Figure 4.22 Percentage comparison of recommendations for enhancing aqua agro ecology among the adopters and non-adopters of aqua agro ecology.

20.7% and 20.1% of adopters of aqua agro ecology and non adopters of aqu agro ecology respectively who sufficient extension services.

CHAPTER FIVE

5.0 DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.1. Socioeconomic Contribution of Integrating Fish Farming with Crop and Animal Husbandry.

socio economic contribution of integrating fish farming with crops and animal husbandry showed increased cultivation of irish potatoes, , According to Prein (2002), argues that integrated systems favor crops that can utilize fish pond sediments as fertilizer and provide processing waste as fish feed, explaining the preference for potatoes among adopters

socio economic contribution of integrating fish farming with crops and animal husbandry increased goat rearing . According to Nhan et al. (2007) demonstrated that goats are preferred in aqua agroecological systems because their manure enhances pond productivity while requiring minimal water resources compared to cattle.

Among adopters of aqua agro ecology and non adopters of aqua agro ecology respondents had agricultural experience of more that two years. According to Kassam et al. (2019) argues that successful adoption of integrated systems depends more on access to appropriate knowledge and resources than on farming experience.

Among non adopters of aqua Agro ecology respondents preferred linkages among agricultural components on the farm. According to Dumont et al. (2013) explain that experienced practitioners recognize that physical proximity does not guarantee functional integration, requiring deliberate nutrient cycling and synchronized production cycles.

Among adopters of aqua Agro ecology were interested expensive fish feeds compared to non-adopters of aqua Agro ecology who had water scarcity, According to Edwards (2015) argues that feed costs remain a major constraint in aquaculture integration, often requiring optimization of on-farm feed production to achieve economic viability .

Fish farming together with crop cultivation and livestock rearing were interested with solution of low water supply with construction of reservoirs and lack of enough land with purchasing of more land. according to little and Edwards (2003) emphasize that successful aqua agroecological systems require reliable water management infrastructure to optimize benefits across all components.

5.2. Environmental Contribution of Integrating Fish Farming with Crops and Animal Husbandry.

Fish farming together with crop cultivation and livestock rearing increased environmental benefits. According to Garbach et al. (2017) found that farmers' environmental perceptions are shaped by practical experience, with experienced practitioners.

Fish farming together with cultivation of crops and rearing of livestock increased water availability. According to Mohanty et al. (2018) demonstrate that well-managed aqua agroecological systems can enhance water use efficiency through recycling and multiple-use strategies.

5.3. Income Benefits of Integrating Fish Farming with Crops and Animal Husbandry.

Among adopters of aqua Agro ecology and non adopters of aqua Agro ecology had increased income . According to Pretty et al. (2018) agues that integrated farming systems typically provide income stability and risk reduction rather than dramatic income increases in the short term.

Fish farming together with crop cultivation and livestock rearing preferred animal product sale as major source of income .According to Tittonell (2014) notes that while integrated systems may not immediately change primary income sources, they provide additional income streams that enhance overall livelihood security.

Among the adopters of aqua agro ecology respondents had improvement in living condition since adoption of aqua agro ecology. According to Altieri and Nicholls (2017) explain that integrated systems provide multiple pathways to improved livelihoods including enhanced food security, dietary diversity, and reduced production risks.

Among adopters of aqua agro ecology and non adopters of aqua agro ecology respondents were interested in market access. According to Van den Berg and Jiggins (2007) emphasize that both groups require targeted support, though adopters need specialized extension services addressing integration complexities.

5.2. Conclusions.

Farmers who adopted this integrated approach tended to diversify their crop choices, favouring crops like Irish potatoes that align well with fish farming . They also integrated livestock more effectively, particularly goats.

Challenges among adopters of aqua agro ecology and non adopters of aquaagro ecology were market access and limited capital. Costly fish feed, while non-adopters struggled more with water scarcity. To address these challenges, adopters prioritized constructing reservoirs.

Adopters reported improvements in their living conditions, not only through income but also via food security and risk reduction.

Both adopters of aqua agro ecology and non adopters of aqua agro ecology highlighted the need for improved market access, land availability, and extension services.

5.3. Recommendations

The study identified the need for improved market access.

There is need to establish farmer field schools and peer learning groups focused on aqua agroecology to build technical capacity and share best practices, especially on predator management and efficient input use.There is need to Promote communal land ownership models and cooperative water reservoir projects to address land and water scarcity challenges more effectively.

There is need to facilitate formation of farmer cooperatives to improve bargaining power, collective marketing, and access to profitable markets for integrated produce.

The government should Invest in rural water infrastructure such as reservoirs and irrigation schemes to support water-dependent integrated farming.

The government should Strengthen agricultural extension systems with specialized training on aqua agroecology, promoting sustainable farming practices and technology dissemination.

REFERENCES

Anonymous. (2023). Smallholder aquaculture diversifies livelihoods and diets thus improving food security status: Evidence from northern Zambia. *Agriculture & Food Security*.

Awuor, F. J., Macharia, I. N., & Mulwa, R. M. (2023). Adoption and intensity of integrated agriculture aquaculture among smallholder fish farmers in Kenya. *Frontiers in Sustainable Food Systems*, 7, 1181502.

Altieri, M. A. (2018). *Agroecology: The Science of Sustainable Agriculture*. CRC Press.

Barrett, C. B., Benton, T. G., Fanzo, J., Herrero, M. T., Nelson, R., Bageant, E., et al. (2020). Socio-technical innovation bundles for Agri-food systems transformation. *Cham: Palgrave Macmillan*.

Boulestreau, Y., Casagrande, M., & Navarrete, M. (2021). Analyzing barriers and levers for practice change: a new framework applied to vegetables' soil pest management. *Agron. Sustain. Dev.*, 41, 44.

Brummett, R. E., & Noble, R. (1995). Aquaculture for African smallholders. *WorldFish*.

Cheruiyot, J. K., & Adhiaya, M. (2023). Adoption of aquaculture technologies and management practices, challenges and productivity of fish-ponds in Kakamega County, Kenya. *Asian Journal of Fisheries and Aquatic Research*, 22(1), 25-36.

Dey, M. M., Paraguas, F. J., Kambewa, P., & Pemsl, D. E. (2010). The impact of integrated aquaculture–agriculture on small-scale farms in southern Malawi. *Agric. Econ.*, 41, 67-79.

Dumont, B., Fortun-Lamothe, L., Jouven, M., Thomas, M., & Tichit, M. (2013). Prospects from agroecology and industrial ecology for animal production in the 21st century. *Animal*, 7(6), 1028-1043.

Edwards, P. (2015). Aquaculture environment interactions: past, present and likely future trends. *Aquaculture*, 447, 2-14.

FAO. (2020). The State of Food Security and Nutrition in the World 2020. Food and Agriculture Organization of the United Nations.

Garbach, K., Milder, J. C., Montenegro, M., Karp, D. S., & DeClerck, F. A. (2017). Biodiversity and ecosystem services in agroecological landscapes. In *Agroecology* (pp. 405-429). Academic Press..

Gill, M., et al. (2023). Integrated systems improve soil health in agriculture. *Agricultural Systems*.

Ignowski, J., & Belton, B. (2023). Integrating aquaculture with terrestrial food systems: A pathway to sustainable food systems. *Sustainable Agriculture Reviews*.

Kassam, A., Friedrich, T., & Derpsch, R. (2019). Global spread of conservation agriculture. *International Journal of Environmental Studies*, 76(1), 29-51.

Karanja, D., Onyango, J., & Mugo, F. (2021). Environmental benefits of integrated fish and crop farming in smallholder systems. *Aquaculture Reports*, 20, 100639.

Liu, Y., Chen, X., & Zhao, M. (2021). Crop selection and management in integrated farming systems. *Agroecology and Sustainable Food Systems*, 45(1), 25-41.

Little, D. C., & Edwards, P. (2003). Integrated livestock-fish farming systems. Food & Agriculture Organization

Mugisha, J. (2019). Barriers to the adoption of sustainable agricultural practices in Uganda: A case study of Kween District. *Journal of Agricultural Science*.

Mungai, N., Wanjiku, S., & Kibet, L. (2022). Landholding size and adoption of agroecological practices in Kenya. *Land Use Policy*, 115, 105959.

Mohanty, R. K., Ambast, S. K., Panigrahi, P., & Mandal, K. G. (2018). Water quality suitability and water use indices: useful management tools in coastal aquaculture of Litopenaeus vannamei. Aquaculture, 485, 210-219.

Nhan, D. K., Phong, L. T., Verdegem, M. J., Duong, L. T., Bosma, R. H., & Little, D. C. (2007). Integrated freshwater aquaculture, crop and livestock production in the Mekong delta, Vietnam: determinants and the role of the pond. Agricultural Systems, 94(2), 445-458.

Njeru, A., Otieno, H., & Simiyu, M. (2023). Impact of farm proximity on productivity in smallholder agriculture. *African Journal of Agricultural Research*, 18(7), 460-472.

Ochieng, E., Oduor, F., & Kinyua, A. (2023). Barriers to adoption of integrated farming systems in rural communities. *Journal of Rural Development*, 40(1), 89-104.

Prein, M. (2002). Integration of aquaculture into crop-animal systems in Asia. *Agricultural Systems*, 71(1-2), 127-146.

Pretty, J., Benton, T. G., Bharucha, Z. P., Dicks, L. V., Flora, C. B., Godfray, H. C. J., ... & Wratten, S. (2018). Global assessment of agricultural system redesign for sustainable intensification. *Nature Sustainability*, 1(8), 441-446.

Tittonell, P. (2014). Livelihood strategies, resilience and transformability in African agroecosystems. *Agricultural Systems*, 126, 3-14.

APPENDIX 1:

RESEARCH QUESTIONNAIRES.

QUESTIONNAIRE FOR RESPONDENTS

Dear respondent, I am **Cheprot Amos**, a student of Busitema University, Faculty of Natural Resources and Environmental science, Namasagali Campus. I'm pursuing Bachelor of Science in Fisheries and Water Resources Management. As a course requirement, a research study is supposed to be carried out. You are invited to participate in the study titled; **"Assessing the potential environmental and social economic effects of aqua agro ecology practices for farmers of Kween district' taking Kaptoyoy sub county as a case study**. The purpose of the study is to obtain information about ways aqua agro ecological practices contribute to livelihoods and the income of the local farmers practicing it.

This is therefore to seek your assistance to participate in this study. Your response will greatly contribute a lot towards the better management and utilization of natural resources in the district. The information provided shall be strictly for academic purposes and your identity shall be kept confidential.

INSTRUCTIONS:

I. Place a tick [√] in the brackets in front of the most were necessary

II. Provide detailed answers in the space provided.

Section A: Demographic characteristics of the respondent

1. Gender:
2. Male ☐ Female ☐
3. Age bracket: (I) 20-25 ☐ (ii) 25-35 ☐ (iii) Above 40 ☐
4. Highest Education level attained (please specify the level you attained).
   (i) Primary ☐ (ii)secondary ☐
   (ii) O level ☐ (iv) A level ☐ (v) Diploma ☐ (vi)None ☐
   (vii)Graduate
5. Marital status (please specify your status)
   (i) single ☐ (iv) Widow ☐

(ii) married (v) Other (specify)

(iii) Divorced

6. Occupation (i) Farmer. (ii) Not a farmer. ....

(iii) Business men (iv) Any other m(Specify)……

7. The size and number of dwellings………………………..
8. Religion
9. (i) Christian (ii) Moslem
10. (ii) No religion .…………………………

Section B. Environmental contribution of integrating crops and livestock with fish farming on the same piece of land.

9(a) what is the size of your land?

(i) One hectare (ii) above one hectare (iii) Other………..

(b) How far is your farm land from home?

(i) Near home (ii) Far from home (iii) Other specification

(c) Which crops do you have in your farm land?.

(i) Maize (ii) Beans (iii) Irish potatoes. Other (Specify)

(d) What type of animals to you rear in your farm land?

(i) Goats (ii) Cattle (iii) Sheep. (iv) Pigs. (v) Other (Specify)

(e) How long have you been conducting this agricultural practice?

(i) One years (ii) Two years (iii) More than two years (Specify)

(f) Why do you grow this/these crop(s) ?..

…………………………………………………………………………………

,,,

…………………………………………………………………………………

(g) Why do you keep this /these animal(s)?...

……………………………………………………………………………..

……………………………………………………………………………

…………………………………………………………………………………………

……………………………………☐…………………………………☐

(10) Do you rear fish? (a) YES ☐ (b) NO ☐

(i) If No proceed to number 13, (ii) If yes proceed to number 11

11. (a) When did you adopt fish farming?,,

………………………………………………………………………………..

(b)Which species do you rare?

(i) Catfish ☐ (ii) mirror carp ☐ (iii) Nile tilapia ☐

(c) Why do you rare this species you named in 11(b) above?...

…………………………………………………………………………………………

………………………………………………………………………………………

………………………………………………………………………………………..

…………………………………………………………………………………………

(d) Is there any link between fish farming in your land and other components.

(i) Yes. ☐ (ii) No ☐

(e) If yes, name the components to which fish farming in your farm is linked with.

(i)maize.☐ (ii) Irish potatoes ☐ (iii) Banana ☐ (iii) Other (specify)

……………………………………………………………………………………………..

(f) Why do you link the components you mentioned in (11) (e) above?..................................

………………………………………………………………………………………..

…………………………………………………………………………………………

…………………………………………………………………………………………

(g) What are the environmental challenges you faced before integrating fish farming with the components you mentioned in (10) (b) above?...................

…………………………………………………………………………………………

…………………………………………………………………………………………..

………………………………………………………………………………………

12(a) Does integrating crops and livestock with fish farming on the same piece of land benefit the environment?

(i) Yes ☐ (ii) No ☐

(b) If yes, in what ways does the integration of crops and livestock with fish farming on the same piece of land benefit to the environment.

Rate as below

Environmental Aspect	Rate by ticking			Reason(s)
	Increased/ improved	No change	Reduced/ decreased /destroyed	
(i) Soil fertility				
(ii) Crop yields				
(iii) Water conservation				
(iv) Biodiversity				
(v) Animal Pests and diseases				
(vi) Crop pests and diseases				
(vii) Animal health growth				
(viii) Soil erosion				
(ix) Livestock stocking				
(x) Over grazing				
(xi) Water supply in rivers/ponds				
(xii) Others (specify				

(c) If **no** why?.....

……..

…….

13.If NO to 10 above, how has growing different types of named crops together with named livestock affected your environment?

Rate as below

Environmental Aspect	Rate by ticking			Reason(s)
	Increased/ improved	No change	Reduced/ Decreased/ Destroyed	
(i) Soil fertility				
(ii)Crop yields				
(iii)Water conservation				
(iv)Biodiversity				
(v)Animal Pests and diseases				
(vi)Crop pests and diseases				
(vii)Animal health growth				
(viii)Soil erosion				
(ix)Livestock stocking				
(x)Over grazing				
(xi)Water supply in rivers/ponds				
(xii)Others (specify				

Section c: Solutions to challenges

Adopters of aqua agro ecological practices

14. What challenges have you faced during this integration of fish farming with other named agricultural practices on your land/plot/farm?

Challenge	Tick as appropriate	
	YES	NO
(a)Expensive fish feeds		
(b) Lack of knowledge to select best link components in the farm		
(c) Insufficient capital to run all the activities in the farm		
(d) Inadequate market for the produce		
(e)Predators		
(f) Water scarcity		

(g) High water/environmental temperatures		
(h) Cheap feeds		
(i) Parasitic birds/insects		
(j) Increased natural food supply from insects/worms (add as appropriate)		
(k) High food scarcity		
(m) Poor nutrition among local people….		
(n) Other (Specify) (n)Inadequate extension services .		
None of the above		

Non adopters of aqua agro ecological practices.

15. What are the challenges you faced at the time you first integrated crops with other livestock?

Challenge	**Tick as appropriate**	
	YES	**NO**
(a) Scarce grass		
(b) Lack of knowledge to select best link components in the farm		
(c) Insufficient capital to run all the activities in the farm		
(d) Inadequate market for the produce		
(e) Predators		
(f) Water scarcity for animals and irrigation of crops……		
(g) high water/environmental temperatures that affected		
(h) Cheap feeds for animals……		
(i) Increased natural food supply from insects/worms (add as appropriate)		
(j) Lower water/environmental temperatures		
(k) None of the above		
(l) High food scarcity		
(m)Poor nutrition among		
Other (Specify) Expensive feeds for livestock		

16. What challenges have you faced during this integration?

Challenge	Tick as appropriate	
	YES	NO
(a) Scarce grass		
(b) Lack of knowledge to select best link components in the farm		
(c) Insufficient capital to run all the activities in the farm		
(d) Inadequate market for the produce		
(e) Predators		
(f) Water scarcity		
(g) high water/environmental temperatures		
(h) Cheap feeds for animals		
(i) Parasitic birds/insects		
(j) Increased natural food supply from insects/worms (add as appropriate)		
(k) Lower water/environmental temperatures		
(l) None of the above		
(m) High food scarcity		
Other (Specify)		

17. How have you solved these challenges?

Challenge	Solution	Tick as appropriate	
Low water supply	(a) Nothing	Yes	No
	(b) Construction of reservoir (c) Etc.		
	You would close if possible.		
Lack of enough land	(a) Government support		
	(b) Purchasing of more land		
	(c) Communal land ownership.		
Increased predators	(a) Supply of predator nets to guard fish		
	(b) Ponds.		
	(c) Fencing of the ponds.		

	(d) Use of traps to catch predators.		

……

18(a).Have you received any training or support for aqua agro ecology?

(i) Yes. ☐ (ii) No ☐

(b).If yes, what type of support?

……

(c) If no, why?.....

Section D. Income contribution from aqua agroecological and non aquaagroecological practices

19. .Income earned before integration

Component	Income It is better you give ranges because farmers do not want to disclose their "secrets" on finances!	Tick as appropriate	
		Yes	No
(a)	E.g. 10000/= to 20000/= per year		
(b)	30000/=to40000/=per year		
(c)	50000/=to 60000/= peryear		
(d)	70000/=to 80000/= per year		

20(a) .Income earned after integration

Component	Income It is better you give ranges because farmers do not want to disclose their "secrets" on finances!	Tick as appropriate.	
		Yes	No
(a)	E.g. 10000/= to 20000/= per year		
(b)	100000/= to 200000/=per year		
(c)	300000/= to 400000/= per year		
(d)	500000/= to 700000/= per year		

21(b) .Is there improvement in your income

(i). If yes why?.....

……

(ii).If no why?.....

……..

(a) Main sources of income before integrating (List them) ……

Sources of income	Rank(Highest to lowest)	Tick as appropriate	
		Yes	No
(i).Sale of animal products	Highest		
(ii).Bank loans	Medium		
(iii). Government support through parish development model.	Lowest		

(b) .How much did you earn from your agricultural activities you have before integrating them?

Component	Income It is better you give ranges because farmers do not want to disclose their "secrets" on finances!	Tick as appropriate	
		Yes	No
Irish potatoes	2000000/= per year		
Beans	500000/= per year		

22.Does integration of …fish contribute to your household income?

(i) Yes

(ii) No

If yes, why?.....

……..

23.(a).Income earned through integration of fish with crops…(1000000/= to 4000000/=) per year……

(b).Size of land utilized after integration of …fish with livestock is two hectares……

(c).Agricultural activities practiced after integration of…fish with crops…are, maize, banana plantation……..

Component	Income It is better you give ranges because farmers do not want to disclose their "secrets" on finances!	Tick as appropriate	
		Yes	No
Maize	(1000000/= to 2000000/=)per year		
Banana plantation	(2000000/= to 3000000/=) per year		

24. How does this income contribute to your standard of living?

……

25. What improvements have you seen in your living conditions due to this income?.

(a) Improved standard of living.

(b) Increased daily income through sale of farm produce

(c) Improved personal welfare

(d)

If no to above why?.....

……

Section E.: Community and policy support

26. Have you been involved in any community initiatives related to aqua agro ecology?

(i) Yes

(ii) No

27. If yes, please describe your involvement:

……..

If no why?.....

……...

28. What role do local leaders play in supporting aqua agro ecological practices?

……..

……..

29. What policies or programs do you think could help promote these practices?

……..

…….

Section f.: Final thoughts

30. What recommendations do you have for enhancing aqua agro ecological practices in your community?

……

31. Any additional comments or suggestions?

……

Thank You!

THE BUDGETFOR THE RESEARCH PROJECT

ITEMS	QUANTITY	COST
Ream Of Rotratrim	01	22,000=
Pen	01 Box	25,000=
Note Book	01	5,000=
Feeding	2 Month	300,000=
Accommodation(Rent)	2 Month	70,000=
Transport(Mobility)	2 Month	150,000=
Typing And Printing Of Questionnaire	69 Copies	50,000=
Camera	01	150,000=
Scoop Net	01	50,000=
TOTAL		***1,057,000=***