

# ECONOMIC AND ENVIRONMENTAL BENEFITS OF FISH AND POULTRY MIXED FARMING: EMERGING TECHNOLOGICAL INNOVATION FOR SUSTAINABLE DEVELOPMENT

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## Abstract

It was observed that the environmental degradation from rearing fish and poultry farming is on the increase due to poor handling of waste from farm animals. This practice is common among the farmers with free care attitude and little or low level of technology despite that animal farmers are among jobs providers, economy builders for national growth and sustainable development. This paper investigated the “Economic and Environmental Benefits of Fish and Poultry Mixed Farming: Emerging Technological Innovation for Sustainable Development”. The purpose of this study was to examine the economic and environmental benefits of rearing fish and poultry farm. This study was carried out at selected poultry farms in Afijio Local Government Area of Oyo State. Forty (40) fish and poultry farmers were randomly selected for this study. Opinions of respondents were harvested on economic and environmental consequences of rearing fish and poultry from fish and poultry farmers in the study area. The study sought for answers to the research questions and tested hypotheses, while the instruments were validated by four experts in the School of Vocational and Technical Education Programmes, Emmanuel Alayande College of Education, Oyo. The reliability coefficient was determined using Cronbach Alpha method and the results yielded a reliability coefficient of 0.91. The researcher used frequency counts, mean and standard deviation to analyze the research questions. The t-test was used in testing the hypotheses at 0.05 level of significance. The problems identified among others are air, water and land pollution caused by organic waste from poultry animals in the study area. It was observed from the findings of this study that rearing of fish and poultry are contributing immensely to the economic growth and with minimal adverse environmental effects (air, land and water pollution) in the communities of the study area. It was recommended that fish and poultry farmers should be encouraged to embrace rearing of fish and poultry since this practice largely contributes to economic growth and safety environment.

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## Introduction

Farming enterprise is a form of business whose main objective is to make a profit. It is therefore extremely important that the farmers should pay attention to all components of production and handle them with high level of technology for appreciable economic benefit and environmental safety. Purposively, the aim and objective of tilling the land is to produce sufficient food for human consumption and other uses. Awuku, Baiden, Brese and Ofose (2001) defined agriculture as the cultivation of land

for crop production and raising of livestock, poultry and fish for human uses. Similarly, Akinmade (2001) stated that agriculture provides food and other products for human need. The use of modern techniques for chicken and fish rearing is necessary and crucial in order to meet their increase demand. Makinjola, (2001) observed that transformation agriculture from nomadic life was possible by embracing modern agricultural practices and this can be done when all hands are on deck towards modern agricultural technological advancement.

Fish and poultry mixed farming system is a branch of farming enterprise which involves commercial breeding of fishes usually in fish tank or artificial enclosures such as fish ponds reared with poultry or livestock in which the poultry animal shed their manure directly into the fish pond as fertilizer which supports the growth of photosynthetic organisms. This integrated fish farming system produces high yields with low input, while the fish receiving limited supplementary feed because the system serves as natural source of feed for fish. According to Asala (1994) the essence of integrated farming system is to increase the productivity of fish and chickens as to meet the challenges of food shortage and reducing the unemployment rate and checks the excesses of pollution from poultry or livestock droppings. The system also achieves no waste, low cost and low energy production system since the by-products of one enterprise is recycled into another as input which creates safe environment.

Apart from market forces, demands for agricultural products should be put into consideration before establishing any integrated farming enterprise in any area (Ayinla, 2003). Integrated farming is also notable for maximizing land use, reduces cost of input, enables effective utilization of available farming space for maximizing production, diversifies protein production, encourages enterprise combination to improve profitability and therefore dictates farmer socio-economic status. Asala, (1994) also reported that efficiency in resources use is also shared by integrating fish farming with irrigation system as well as by utilizing inland surface waters and flood plains for cage culture. According to FAO (2018) fish industry plays a vital role in domestic trade as well as in import and export market. For instance, consumption of fish has health, nutritional, environmental and social advantages over other terrestrial animal meat. Therefore, fisheries are regarded as an important sector in an effort to increase

animal protein consumption and achieve food security for the growing population (FAO, 2018).

According to Pulis (2013), pollution is defined as the introduction by man into the environment by such substances or energy liable to cause interference with legitimate uses of environment But Adewumi, Ayinde, Adenuga and Zachaeus (2012), defined pollution as disequilibrium condition from equilibrium condition in any system. But pollution prevention practices are implemented throughout the industrial process, a business will be well on its way to achieving environmental sustainability.

Integrated farming reduces both financial cost through waste management and clean-up and environmental costs on health problems and environmental damage. But for better economy, new ideas for doing things are required in order to acquire larger profitability and this could be termed as innovation. According to Horby,(2001) innovation is defined as the something of the new things, ideas or ways of doing something that has been introduced or discovered. Innovation could also be seen as new ideas, more effective device or process and application of better solutions that meet new requirements in articulated need or existing market needs. It is also defined as accomplishment through more effective products, processes, services, technologies or ideas that are readily available to markets, governments and societies. Whereas, Ajeleti (2015) stated that innovation are new ideas, methods or inspiration of doing things:

Among the challenges undermining the growth and development of Nigeria are poor technology, bad agricultural system, poor economy status, poor industrial set up unhealthy environment and all these challenges required timely innovative ideas. Summarily, agricultural innovation is the process whereby individual or organization bring new or existing products, processes

or ways of organization into use for the first time in a specific content in order to increase effectiveness, competitiveness, reliance shock or environmental sustainability and thereby contribute to food security and nutrition, economic development and sustainable natural resources management (Food and Agricultural Organization, 2018).

### **Literature Review**

Fishery means the enterprise of raising or harvesting fish as food and for trade activities. However threats by human overfishing and environmental issues, have required increased regulation of fisheries to prevent conflict and increase profitable economic activity on the fishery. Fisheries provide a vital source of food, employment, trade and economic well-being for people throughout the world. In West Africa, several million households along the coast and also inland are critically dependent on fishing for their livelihoods.

### **Socio and Economic Importance of Fish Production in Nigeria**

Sustainable fisheries management is crucial to food security, poverty alleviation and economic growth. Fisheries industries are promoting greater economic development in Nigeria thereby play important role in poverty reductions (Assefa, 2014). Similarly, fishery industries play a vital role in domestic trade, import and export markets growth and development and while sport fishing serves as a recreational activity. It is also a vital source of protein and micronutrients for human consumption and also provides fishmeal as an excellent source of protein and vitamins for farm animals.

Similarly, employment opportunities in the fisheries sectors have grown more rapidly thereby providing a considerable workforce both directly and indirectly. Therefore, fishery business is a good means of job creation

opportunities for rural, pre-urban and urban unemployed and under employed people (Assefa, 2014).

### **Challenges of Fish Production in Nigeria**

In Nigeria, economic stagnation, environmentally unsustainable, poverty and poor markets pose serious constraints to fisheries development. Dual problems of food security and poverty are major and immediate challenges for Nigeria where about 45 percent of the people live below the poverty line, with the level of impoverishment being worse in rural areas where 85 percent of the population live (FAO, 2018).

Nigeria's fishery sector also suffers from limited human resource availability, with an acute shortage of trained personnel. This constraints on fishery management, technical and extension support services are some of major threats. Public and private investment in fishery and aquaculture is also low and the infrastructures are inadequate (FAO, 2018). Moreover, lack of government support, remote locations and poor services, low literacy and innumeracy and weak organization capacity are other factors that expose fishing communities to poverty (FAO, 2018).

### **Poultry Development**

Poultry is a term used for any kind of domesticated bird, captive-raised for its utility. Poultry can be defined as domestic fowls, including chickens, turkeys, geese, quail and ducks the are raised for the production of meat or eggs (Bamidele *et al.*, 2020). Many socio-cultural factors affect poultry production. For instance, some communities ban ducks, as they are presumed dirty and destructive to drinking water supplies. Some communities regard pigeons as a sign of peace and concord in other communities, pigeons are regarded as an evil omen, since they are used by native doctors in sinister rituals. Another socio-cultural constraint to poultry development is the value placed upon poultry for use at ceremonies and festivals or even as a

source of income in times of need but not as a source of daily food or as a regular source of income. Another major constraint to poultry production is the high value placed upon crop production rather than livestock production. This affects the willingness to put much time, expense and effort into livestock production. Theft is also a great constraint coupled with social norm that determines ownership of livestock (Bamidele *et al.*, 2020).

### **Economic Importance of Poultry Farming**

Across regions, poultry production is quickly becoming more intensive, geographically concentrated, vertically integrated and linked with global supply chains. Poultry farming provides employment and income opportunities for smaller poultry producers. Poultry production is generally considered as supplementary to other livelihood activities, actually a form of saving and insurance, and contributes to income diversification. In developing countries, poultry animals are kept for eggs, meat and feathers, generate income and secure food security (Fadimu, *et al.*, 2020).

### **Environmental Pollution**

Environmental pollution is the unfavorable alteration of our surroundings, wholly or largely as a by product of man's actions, through direct or indirect effects of the changes in the energy pattern, radiation levels, and chemical and physical constitution and abundance of organisms. The decline in environmental quality as a consequence of pollution is evidenced by loss of vegetation, biological diversity, excessive amounts of harmful chemicals in the ambient atmosphere and in food grains, and growing risks of environmental accidents and threats to life support systems.

The pollution may be categorized as air pollution, water pollution, soil/land pollution, noise pollution, radioactive pollution and thermal pollution. The benefits of pollution

prevention and environmental sustainability not only include cost savings and regulatory compliance, but also improved working conditions for employees, competitive advantages with environmental safety of clients and consumers, and improved community health and promote regulator relations.

### **Statement of the Problem**

The continuous rise in number of fish and poultry farming industries at different locations in Nigeria for food and sustainability struggle resulted in rise in quantity of waste produced from these agro-industries that consequently posing danger for human health is a concern to the author. The presumed solution is the adoption of integrated farming system in which the waste produced will either be consumed or recycled into another substance of human benefit in order to cut down the cost for the disposal of by product and pave way for clean and safe environment for man and other beings.

### **Objectives of the Study**

The objectives of the study are to find out economic benefits:

- i. of fish farming only
- ii. of poultry farming only
- iii. and environmental safety of fish and poultry farming  
(Integrated fish and poultry farming)

### **Significance of the Study**

The findings of this study would improve the economy of poultry and fish farmers when the cost of waste disposal is cut off from the cost of production. Similarly, the level of environmental degradation will also reduce when environmental pollution from farm animal is at minima due to clean and safe environment for humanity. Again, the health status of the farm workers and farmers families will be improved and the problem of diseases and epidemic will be gradually decreased due to clean and healthy

environment. Similarly, the farmers, farmers families and farm marketers will save more money instead of spending their money in treating unknown ailments contacted from the dirty farm environment.

### **Research Questions**

**The following research questions are used for the study:**

1. Does rearing of only fish farming generates satisfactory income to farmer?
2. Does rearing of only poultry farming generates enough income to farmer?
3. Does rearing of fish and poultry farming (integrated fish and poultry farming) generates appreciable income and ensure environmental safety?

### **Research Hypotheses**

H0<sub>1</sub>: There is no significant difference in income generated between farmers rearing fish and poultry farm (integrated) and farmers rearing poultry farm only

H0<sub>2</sub>: There is no significant difference in income generated between farmers rearing fish and poultry farm (integrated and rearing fish farm only.

H0<sub>3</sub>: There is no significant difference in environmental safety between rearing fish and poultry farm (integrated) and rearing poultry farm only.

### **Scope of the Study**

The scope of this study was restricted to four integrated farms in Afijio Local Government Area of Oyo State, Nigeria.

### **Methodology**

Descriptive survey design was adopted which involves collection of data from a sample of entire population of poultry and fish farmers in Afijio Local Government Area of Oyo State using 10 respondents in each study centre which make the total number of sample respondents to be 40.

**Population of the Study:** The population of this study includes all technical staffers in all integrated farms in Afijio Local Government Area of Oyo State.

**Sample and Sampling Technique:** Random sampling technique was adopted for this study so as to guarantee that every sector of the population has an equal chance of being included in the sample. Hence, five (10) technical staffers from each integrated farms were selected from four (4) farms making a total of forty (40) respondents in the study area.

**Research Instrument:** The instrument employed was self-designed questionnaire tagged “Economic and Environmental Benefit of Fish and Poultry Mixed Farming: Emerging Technological Innovation for Sustainable Development.”

### **Validation of the Instrument**

The information for the study was subjected to face and content validity by four (4) specialists in the School of Secondary Educations, Vocational and Technical Programmes, Emmanuel Alayande College of Education, Oyo. The items were reviewed, thus, items were reworded in line with the suggestions of the specialists.

### **Reliability of the Instrument**

The instrument was trial tested on 16 respondents from farms other than from the selected samples for the research. Data collected were analyzed and internal consistency of the instrument was determined using Cronbach Alpha Reliability Co-efficient which yielded a reliability index of 0.91, hence the instrument was found reliable.

### **Method of Data Collection**

The instrument was administered on forty (40) respondents from four randomly selected integrated farms at Afijio Local Government Areas of Oyo State. Two research assistants supported the researcher on field to make research work successful. The instrument has Sections A and B. Section A sought for the demographic

data of the respondents and Section B had items that sought information from the respondents on the compounded questions. The four point rating scales used are: Strongly Agree (4), Agree (3) Strongly Disagree (2) and Disagree (1).

### Method of Data Analysis

The data collected was analysed using descriptive statistics (Mean (x) and Standard Deviation (SD)), while inferential statistics (t-test) was used to test hypotheses. Any mean rating which is equal to or greater than ( $x \geq 2.50$ ) was considered agreed, while mean (x) below or less than 2.50 ( $x < 2.50$ ) considered disagreed. Hypothesis was accepted when t-calculated value was lesser than t-critical value or otherwise rejected.

### Results

The data collected from the field are used for the analysis of the results and discussions of findings. The data and discussions of findings are presented below.

**Research Question 1:** Does rearing of only fish generate satisfactory income to farmers?

**Table 1:** Mean rating and standard deviation on income generated by only fish farming.

S/N	Items	Mean(x)	Standard Deviation (SD)	Decision
1	Fish farming alone can yield satisfactory profit to farmer annually	1.6	0.49	Disagree
2	Fish farming alone generates enough income to farmer and government	1.8	0.40	Disagree
3	Fish farming need to be supported by other farming systems as integrated farming system	3.5	0.50	Agree
4	Fish feeding requires supplementary feeding system through integrated farming in order to make more profit	2.8	0.49	Agree
5	Integrated farming system yields more income to farmers	3.6	0.49	Agree

Source: Field Survey, 2023.

The data presented in Table1 above shows the 5-items being considered on the income generated from fish farm. The mean responses for items 1 and 2 (1.6 and 1.8) are below 2.5, respectively. The table shows that items 3, 4 and 5 (3.5, 2.8 and 3.6) have the mean responses above 2.5,

respectively. It was revealed that item 5, has the highest mean response (3.6), which suggested that integrate farming system yield more profit to farmers. The standard deviation ranged from 0.4 to 0.5 reflecting the consensus of opinion by the respondents.

**Research Question 2:** Does rearing of poultry farming generate enough income to farmers and government?

**Table 2:** Mean rating and standard deviation on income generated by only poultry farming.

S/N	Items	Mean (x)	Standard Deviation (SD)	Decision
1	Rearing only poultry yield enough income to fish farmers annually	1.75	0.43	Disagree
2	Rearing poultry alone yield enough income to poultry farmers and generate enough revenue to government	1.71	0.49	Disagree
3	Poultry farming needs to be part of integrated farming system to increase the income generated	2.83	0.65	Agree
4	More fund is wasted when disposing waste at poultry farm	3.72	0.85	Agree
5	Waste from poultry farm can be turned to wealth at integrated farm	2.82	0.98	Agree

### Source: Field Survey, 2023

The results presented in table 2 above shows the 5-items being considered on the income generated by poultry farming. The mean responses for items 1 and 2 (1.75 and 1.71) are below 2.5, respectively. Similarly, the table also shows that items 3, 4 and 5 (2.83, 3.72 and 2.82) have their means responses above 2.5, respectively. Items 3 stated that poultry farming needs to be part of integrated farming system in order to increase income being generated. Similarly, item 4 supported that waste disposal at poultry farm wasted more money and item 5 suggested that the waste at poultry farm can be turned into wealth when operating integrated farming system. The standard deviation ranged from 0.43-0.98 shows the consensus of opinion by the respondents.

**Question 3:** Does rearing of fish and poultry together generate more income and ensure environmental safety?

**Table 3:** Mean rating and standard deviation on generation of more income and assurance of environmental safety when rearing fish and poultry (Integrated fish and poultry farming)

S/N	Items	Mean(x)	Standard Deviation (SD)	Decision
1	People living within the integrated farm were being relieved from the risk of air and water pollution from poultry waste	3.45	0.80	Agree
2	More money is conserved through waste management system adopted in integrated system of farming	3.42	0.66	Agree
3	More money is realized from rearing fish and poultry together (integrated farming)	3.62	0.49	Agree
4	Farm workers and near by communities feel more comfortable with the method of waste management at integrated farm within and outside the farm	3.76	0.45	Agree
5	More land is conserved by the integrated farming system	3.81	0.42	Agree

Source: Field Survey, 2023

The data presented in table 3 shows 5-items being considered for generation of more income and environmental safety when rearing fish and poultry together. The mean responses for items 1 to 5, (3.45, 3.42, 3.62, 3.76 and 3.81) are above 2.5, respectively. It was observed that item 5 has highest mean response (3.76), which stated that more land was conserved by the integrated farming system. The standard deviation ranged from 0.42-0.80 shows the consensus opinion by the respondents.

### Test of Hypotheses

**Hypothesis 1:** There is no significant difference between income generated by farmers rearing fish and poultry and farmers rearing poultry alone.

**Table 4:** The t-test of mean response between the income generated by farmers rearing fish and poultry farm (integrated) and farmer rearing poultry farm alone.

Variables	N	X	SD	DF	t-cal.	t-crit.	Remark
Response from poultry farmers	24	4	1.35	38	1.45	1.65	Accepted
Response from fish and poultry farmers	16	3.13	1.25				

Source: Field Survey, 2023.

Table 4 represents t-test data analysis when comparing the income generated between fish and poultry farm and that of poultry farm only. The results at the Table 4 shows that the calculated t-value of 1.45 was less than the critical t-value of 1.65 at 38 degree of freedom when Alpha level was 0.05, the null hypothesis was accepted at 'P' greater than the Alpha level. So the hypothesis which stated that there was no significant difference in income generated between farmers rearing fish and poultry and farmer rearing poultry only was therefore accepted.

**Table 5:** The t-test of mean response between the income generated by farmers rearing fish and poultry farm (integrated) and farmer rearing fish farm alone.

Variables	N	X	SD	DF	t-cal.	t-crit.	Remark
Response from poultry farmers	26	4.2	1.36	38	1.46	1.65	Accepted
Response from fish and poultry farmers	11	3.21	1.26				

Source: Field Survey, 2023.

Table 5 represents t- test data analysis when comparing the income generated between fish and poultry farm and fish farm only. The results at the Table 5 shows that the calculated t-value of 1.46 was less than the critical t-value of 1.65 at 38 degree of freedom when Alpha level was 0.05, the null hypothesis was accepted at 'P' greater than the Alpha level. So the hypothesis which stated that there was no significant difference in income generated between farmers rearing fish and poultry and farmer rearing fish only was therefore accepted.

**Hypothesis 3:** There is no significant difference in environmental safety between rearing fish and poultry and rearing poultry only.

**Table 5:**

The t-test of mean response on environmental safety between rearing fish and poultry farm and rearing only poultry farm.

Variables	N	X	SD	DF	t cal.	t crit.	Remark
Poultry farm been run alone	12	3.33	0.97	38	1.51	1.65	Rejected
Poultry and fish farm run together	28	7.07	1.10				

Source: Field Survey, 2023.

Table 5 above represents t-test analysis of the data generated when comparing the mean responses of environmental safety between rearing fish and poultry together and rearing poultry alone. The results at table 5 above shows that the calculated t-value of 1.51 is less than the critical t-value of 1.65 at 38 degree of freedom when Alpha level was 0.05, the null hypothesis is accepted at 'P' greater than the Alpha level. So the hypothesis which stated that there was no significant difference in environmental safety between rearing fish and poultry simultaneously and rearing poultry alone was therefore accepted.

### Discussion of Findings

The results generated from the respondents on 'Economic and Environmental Consequences of Fish and Poultry Mixed Farming revealed that either rearing of only fish or only poultry cannot yield enough income to farmers and the Government. It was also revealed that rearing of fish or poultry separately will require a lot of money to feed the fish and to dispose the organic waste from poultry animals. But the rearing of fish and poultry simultaneously will give the advantage of natural food to fish inside the ponds by feeding on photosynthetic organisms that lived on organic poultry waste.

Similarly, it was also revealed that rearing of fish alongside the poultry will facilitate comfortable environment to farm

workers and to the nearby communities and consequently increase their health status. And at the same time facilitate timely and appropriate control of water, land and air pollution in the farm and the near by communities as well. It was also revealed that simultaneous rearing of fish and poultry will provide more jobs opportunities, provides food, eggs, chicken and fish meat and generally improves the lives cities and rural dwellers (FAO, 2015). Again, the simultaneous rearing of fish and poultry will boost the income of the farmers and internally generated revenue of the Governments at all levels and plays a vital role in overall domestic trade as well as in import and export markets FAO (2018).

Generally, the simultaneous rearing of fish and poultry will conserve more land and this is evident in the cities, towns and places where land is very expensive and scarce. This type of integrated system of farming brings physical development such as electricity, roads, potable water, health service, easy communication system, facilitate education and other social services to the rural dwellers areas (Asala, 1994).

### Conclusion

Based on the results of the findings, it could be concluded that rearing of fish and poultry animals is contributing largely to the economic growth and environmental safety of individual, provides food and job opportunity and increases government income from time to time.

### Recommendations

By judging from the outcome of this study, the researcher therefore recommended that farmers should be encouraged to embrace the mixed farming of fish and poultry animals because this practice will largely contributing to economic growth and development of farmers and the nation at large.



Secondly, Government at all levels should provide soft loans to farmers to make their ventures booming and be commercialized.

Finally, Government should strictly enforce the law which is regulating the handling and management of the agro-industrial waste in the state and at national level in order to reduce the risk of health hazard emanated from agro-industrial waste.

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