ECONOMICS OF INTEGRATED AGRICULTURAL SYSTEMS ON FARM PRODUCTIVITY IN OVIA NORTH-EAST LOCAL GOVERNMENT AREA, EDO STATE, NIGERIA

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UNIVERSITY OF BENIN

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A PROJECT SUBMITTED TO THE DEPARTMENT OF AGRICULTURAL ECONOMICS AND EXTENSION, FACULTY OF AGRICULTURE, UNIVERSITY OF BENIN, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF THE BACHELOR'S DEGREE IN AGRICULTURE.

NOVEMBER, 2025

CERTIFICATION

This is to certify that the research work on the Economics of Integrated Agricultural Systems on Farm Productivity in Ovia North-East Local Government Area of Edo State was carried out by Oyarekhua Sandra Tomisin with the Mat. No AGR2000046 under the supervision of the department of Agricultural Economics and Extension Services, Faculty of Agriculture, University of Benin, Edo State, Nigeria.

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Dr. K.I. Eweka

Project Supervisor

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Dr. J. Egbodion

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DEDICATION

I wholeheartedly dedicate this research work to God Almighty, the source of wisdom, strength, and inspiration. His grace has guided me through every step of this journey. To Him be all the glory.

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With a heart full of gratitude, I give all thanks and glory to God Almighty, my source of wisdom, strength, and guidance. His grace has sustained me, His love has uplifted me, and His divine favor has made this journey possible. Through every challenge, He has been my refuge, and without His mercy, this research would not have been accomplished.

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ABSTRACT

This study examined the economic impact of Integrated Agricultural Systems (IAS) on farm productivity in Ovia North-East Local Government Area of Edo State, Nigeria. The study aimed to describe the socio-economic characteristics of farmers, assess the profitability and cost of integrated and conventional farming systems, and identify the major constraints affecting IAS adoption. Primary data were collected from fifty farmers through structured questionnaires and analyzed using descriptive statistics and profitability indicators such as Gross Margin, Net Farm Income, and Return on Investment (ROI). The results revealed that farming in the area is male-dominated (60%) with a mean age of 50 years and an average of 14 years of farming experience. The majority (80%) of respondents had tertiary education, reflecting a relatively literate farming population.

The profitability analysis showed that IAS had a total production cost of ₦2,234,380.20, profit of ₦1,673,056.29, and ROI of 0.75, while conventional farming recorded a higher ROI of 2.55 due to lower setup costs. However, integrated systems demonstrated greater long-term sustainability through resource recycling, soil fertility improvement, and diversified income streams. Major constraints identified were climate variability, water scarcity, inadequate knowledge or training, and labor shortage.

The study concludes that IAS are economically viable and environmentally sustainable but require significant initial capital and technical knowledge. It recommends enhanced farmer training, access to affordable credit, and supportive agricultural policies to encourage wider adoption and improve productivity.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background of the Study

Agriculture is the economic mainstay of the majority of households in Nigeria (Udoh et al. (2000) and a significant contributor to Nigeria's economy (Amaza, 2000). The important benefits of the agricultural sector to Nigeria's economy include: the provision of food, contribution to the gross domestic product (GDP), employment generation, provision of raw materials for agro-allied industries, and generation of foreign earnings—until the early 1970s, agricultural exports were the main source of foreign exchange earnings (Oni et al., 2009).

Globally, agricultural systems have become increasingly simplified over the past 150 years to meet the food production demands of growing populations, while maximizing short-term economic returns and minimizing financial risk (Barrett, 2020; Pretty, 2008; Ramankutty et al., 2018). This simplification has led to the dominance of high-yielding monocultures, heavy use of chemical fertilizers and pesticides, and dependence on irrigation and fossil fuels (Hendrickson, 2015).

Such systems tend to favor large-scale, specialized producers that dominate transnational agribusiness and food supply chains, thereby marginalizing smallholder and diversified farmers (Harris, 2019; Stringer et al., 2020). However, these large-scale monoculture farms are now facing vulnerabilities due to their lack of resilience to climate change (Nelson and

Phillips, 2018; Ray et al., 2015) and global supply chain shocks, such as the COVID-19 pandemic (Altieri and Nicholls, 2020; Clapp and Moseley, 2020; FIAN International, 2020).

Scientists have warned that high-input, simplified production systems not only fall short of meeting human nutritional needs (Snapp, 2020) but also degrade soil health (Kopittke et al., 2019), contribute to biodiversity loss (Allen and Hof, 2019; Benton et al., 2021; Brühl and Zaller, 2019; Carmona et al., 2020), and undermine long-term farm productivity and economic sustainability (Pérez-Méndez et al., 2020; IPES-Food, 2020). These limitations present significant barriers to achieving Sustainable Development Goals (SDGs), especially SDG 2.3 (doubling small-scale producers' income) and SDG 2.4 (ensuring sustainable food systems) (Barrett, 2020; Wezel et al., 2020).

Integrated Agricultural systems may be part of the solution. IAS incorporate different species and/or varieties of plants, fish, and/or livestock at multiple temporal and spatial scales (Kremen and Miles (2012)). Multiple reviews show that, compared to simplified farming systems, IAS improve biodiversity and ecosystem services such as pollination, nutrient cycling, and water regulation (Beillouin et al., 2021; Rosa-Schleich et al., 2019; Sánchez et al., 2022; Tamburini et al., 2020), thus improving outcomes for both people and nature (Sánchez et al., 2022).

1.2 Statement of the Problem

In theory, IAS may provide better financial outcomes than simplified systems by reducing risks related to yield, prices, inputs, and markets (Bowman and Zilberman, 2013). For instance, risks can be lowered by selecting crop combinations with uncorrelated price patterns, different input needs, or varying tolerance to weather extremes—thereby stabilizing yields, labor demand, and profitability (Bowman and Zilberman, 2013).

However, modern agricultural systems are increasingly specialized and intensified, often relying on high levels of external inputs to maintain stable production. While these methods can be productive, they frequently result in environmental degradation, nutrient depletion, soil biota disruption, and higher production costs. Intensive livestock operations (e.g., dairy, poultry, and piggery) also depend heavily on external feed, which contributes to pollution and waste mismanagement both during input production and on-site disposal. Moreover, these systems reduce biodiversity and increase vulnerability to climate and market changes—especially for resource-poor farmers.

In India, for example, it has been shown that specialized systems cannot ensure stable income or food, energy, and environmental security. Farmers depending solely on monoculture cannot earn a decent livelihood. To address the limitations of specialized, input-driven farming, there is growing recognition of the need to integrate crop, livestock, and fishery components to enhance income diversity and nutritional security (Kashyap et al., 2022). Integrated Agricultural Systems (IAS) are thus gaining attention among smallholder farmers (those cultivating less than one hectare) for their potential to reduce anthropogenic inputs and enhance ecological functions such as nutrient recycling, soil fertility, and environmental performance. When well-managed, IASs offer business synergy, ecological stability, and improved economic resilience (Kashyap et al., 2022).

1.3 Justification of the Study

IAS are promoted as a pathway to more sustainable agricultural production (Sánchez et al., 2022). Several studies suggest that diversified systems can lead to higher gross incomes (Himmelstein et al., 2017) and lower production costs (Rosa-Schleich et al., 2019; Sanderson et al., 2013) compared to simplified systems. However, not all findings are consistent, and there remain significant knowledge gaps regarding the economic viability and profitability of diversified systems in varying contexts.

This lack of clarity creates uncertainty for farmers and investors. Agricultural donors also hesitate to invest in diversified systems due to concerns about profitability and scalability (Anderson et al., 2020). These knowledge gaps likely slow down the adoption of integrated practices, even in places where they are profitable, as lack of information about costs and benefits deters farmers from transitioning to new systems (Arslan et al., 2020).

There is a clear need for stronger empirical evidence on the economic viability of integrated systems, particularly in different agro-ecological and socio-economic contexts. No comprehensive global review has yet examined the agronomic and economic conditions under which diversification is truly viable, although this remains a top concern for farmers and policymakers alike.

To help close this evidence gap, this study explores the economic impact of integrated agricultural systems on farm productivity by comparing key financial metrics such as benefit-cost ratio, gross income, total cost, gross margin, and net income between integrated and simplified systems.

1.4 Objectives of the Study

- **Describe the socio-economic characteristics of the IAS farmers in the study area.**
- **To evaluate the income and cost of integrated agricultural systems.**
- **To identify constraints limiting the adoption and profitability of integrated agricultural systems.**

CHAPTER 2

2.0 LITERATURE REVIEW

2.1 Conceptual Framework

Integrated Agricultural Systems (IAS) refers to a farming approach that combines multiple agricultural enterprises—such as crops, livestock, fishery, and agroforestry—on a single farm in a synergistic and sustainable manner. IAS aims to optimize resource use, minimize waste, and enhance overall farm productivity and profitability. Unlike conventional or simplified farming systems that focus on single enterprises, IAS encourages ecological balance, economic resilience, and food security (Kashyap et al., 2022).

The theoretical foundation for IAS lies in systems theory and agroecological principles, which emphasize the interdependence between farm components and the surrounding environment. These systems promote nutrient recycling, biodiversity, and efficient energy flow, making them more sustainable and adaptive to environmental shocks compared to monoculture-based approaches (Pretty, 2008).

2.1.1 Feasible Integrated Agricultural System (IAS) Combinations (Expanded)

Integrated Agricultural Systems (IAS) intentionally combine two or more enterprises on the same farm so that by-products from one become inputs for the other, cutting costs and boosting resilience and profitability (Pretty et al., 2018). Below are three context-appropriate combinations for Ovia North-East LGA, Edo State.

A. Crop–Livestock: Plantain (Musa spp.) + Goats

Local and regional importance of plantain.

Plantain is a major staple and income crop in southern Nigeria (including Ovia North-East), widely grown and traded across Edo State's plantain belts and markets (Ovia North-East and Ovia South-West) (Iheanacho & Agbarha, 2015).

Across West and Central Africa, an estimated ~70 million people derive >25% of their food energy from plantain. It is among the most important sources of food energy in the lowland humid forest zone (IITA, 2000). West Africa produced nearly 39 million tonnes of plantain in 2017, with a mean annual growth rate of ~1.7% driven by area expansion and yield gains (FAOSTAT, 2019). Studies in Edo/neighboring states highlight plantain's central role in household diets, local markets, and livelihoods (Oni et al., 2009; Honfo et al., 2020).

Varietal diversity

West African value chains handle numerous hybrids (e.g., Aloga, Aloga 2M, Gnivlan, Kpahissi, Orishele, Pelipita), marketed at different ripening stages to meet consumer preferences (Chabi et al., 2018; Kpenavoun Chogou et al., 2019; Honfo et al., 2020).

Goat production and plantain residues as feed

Small ruminants (goats) are well-adapted to the humid–subhumid tropics and can utilize plantain residues efficiently. Multiple studies recommend plantain/banana peels as supplemental feed for goats and sheep due to their favorable crude protein and digestible

energy profile—especially useful in dry seasons or for smallholders (Baiyeri, 2004; Izonfuo & Omuaru, 1988)

Controlled feeding trials show dry ripe plantain peels can partially replace maize in goat diets without negative effects on growth (Egbebi et al., 2016). Reviews similarly conclude that banana/plantain by-products are widely used as livestock supplements in producing regions, creating low-cost rations and reducing waste (Kumar et al., 2022).

Manure–soil fertility link for plantain

Field work in Nigeria shows goat manure improves soil pH and nitrogen and can raise plantain yields by ~33% at recommended rates (Samuel et al., 2003, cited in studies from Southwest/Southeast Nigeria)..

Shade and animal welfare/ecology

Trees/large perennials (e.g., plantain mats) provide shade, mitigating heat stress in small ruminants and improving grazing behavior/performance; evidence from agroforestry–livestock studies documents lower coat/skin temperatures and better welfare under tree shade (De et al., 2020; Peer Community Journal, 2025; Springer Agroforestry Systems, 2023).

Advantages of Plantain production and goat rearing (Plantain ↔ Goats).

- **Feed recycling: Goats consume dead/dried plantain leaves and peels from household/market processing, lowering purchased feed costs. (Egbebi et al., 2016)**

- **Soil fertility: Goat droppings applied as mulch/manure at plantain bases improve nutrient cycling and yields (Samuel et al., 2003).**
- **Microclimate services: Plantain stands provide shade/windbreak, reducing goat heat stress; goats assist weed control under plantain (De et al., 2020; Bécard-Berthet et al., 2025).**
- **Cost and risk: Dual outputs (plantain + goats) diversify income and buffer price/weather shocks (FAO/IITA syntheses). (IITA, 2000; FAOSTAT, 2019).**

Because plantain is a major food and cash crop in Ovia North-East value chains (Iheanacho & Agbarha, 2015) and goat keeping is common among smallholders, the Plantain–Goat IAS fits local diets, markets, and resource bases while lowering fertilizer and feed bills. (Iheanacho & Agbarha, 2015).

B. Crop–Fish: Vegetables (Pumpkin/Waterleaf) + Catfish (Clarias gariepinus)

This would be the main combination observed for the study. Nigeria is Africa's #2 aquaculture producer and a leading producer of African catfish, with strong suitability for pond/tank production with growth to market size in ~4–5 months, hardy, omnivorous (Ologbon et al., 2013; Adeogun et al., 2023).

Common vegetables and household use

Two widely consumed vegetables in southern Nigeria (including Edo) are fluted pumpkin (Telfairia occidentalis, "ugu") and waterleaf (Talinum triangulare). Ugu is one of Nigeria's most consumed leafy vegetables and a daily diet staple (Akanbi et al., 2007; Akoroda, 1990);

waterleaf is commonly grown/used in soups and home meals (Danilola et al. (2023); UF/IFAS EDIS, 2022)

Both vegetables are nutrient-dense; they contain protein, minerals, vitamins and even bioactives, contributing to household nutrition and are extensively sold in Benin City markets (Emokaro & Enokeran, 2015)

Advantages of Vegetable production and catfish rearing

- **Nutrient flows: Pond water/effluent rich in dissolved nutrients fertilizes vegetables, reducing synthetic fertilizer needs (Nwankwo & Worlu, 2019)**
- **By-product feeds: Vegetable trimmings and agro-by-products can supplement catfish diets to lower feed costs (NAERLS, 2016)**
- **Labor/land efficiency: Vegetable beds on pond dikes or adjacent plots exploit irrigation proximity and organic sediments.**
- **Produces fish protein + vegetables for home meals (soups/stews) while creating saleable surpluses.**
- **Short crop cycles (waterleaf/ugu) synchronize well with the ~4–5-month catfish cycle, generating staggered cash flow (Ologbon et al., 2013)**
- **Lower input bills via organic irrigation and feed substitution**

C. Livestock–Fish Integration: Poultry (Layers/Broilers) + Catfish

Poultry is a fast-growing livestock sub-sector. It is a common smallholder enterprise providing eggs and meat and significant supplementary income even in Edo state(Ekunwe et al., 2006)

What Poultry and Catfish Integration Involves

- **Manure fertilization: Poultry droppings fertilize ponds, stimulating plankton that forms natural fish food, reducing commercial feed cost (Olaoye & Omitoyin, 2015)**
- **Documented productivity gains: Trials report higher net fish production under poultry-cum-fish systems versus non-integrated ponds (e.g., 82.14 kg/200 m^3 vs. 62.32 kg/200 m^3) (Mandal et al., 2018).**
- **Crop linkage: Pond effluent + poultry manure combinations can enhance adjacent crop growth, closing nutrient loops on mixed farms (SSRN/Port Harcourt studies, Duruigbo et al., 2019)**

Risk and good practice note

While integrated poultry–fish lowers feed costs, inadequate manure management may elevate microbial loads or select for AMR bacteria in pond environments; best practice requires proper loading rates, composting, and water exchange (Aquaculture Reports, 2021)

Advantages for Ovia North-East households.

- **Complementary cash flows: Eggs/meat provide frequent income; catfish provide periodic lump-sum revenue.**
- **Lower feed/fertilizer costs and higher net fish yield from natural pond productivity.**
- **Diversified diet (animal protein + potential vegetable plots on dikes), strengthening household food security.**

2.2 Empirical Review of Integrated Agricultural Systems

2.2.1 IAS and Farm Productivity

Several studies have documented the positive impact of integrated systems on agricultural productivity. For instance, a study in Western India reported increased yields in cassava and yam when intercropped with legumes and combined with poultry or fish farming (Kashyap et al., 2022). Similarly, diversified farms often experience better soil fertility, reduced pest pressure, and more stable yields due to ecological intensification (Beillouin et al., 2021).

In Nigeria, empirical evidence from smallholder farms shows that integrated systems using crop-livestock combinations lead to higher productivity per hectare compared to monoculture systems (Oni et al., 2009). This is attributed to efficient land utilization, organic manure use, and reduced chemical dependency.

2.2.2 IAS and Profitability

The financial profitability of IAS has been a recurring theme in the literature. Sánchez et al. (2022) conducted a global meta-analysis and found that diversified farming systems generally result in higher gross margins and lower production costs than simplified systems. Integrated farms benefit from multiple income streams, reduce input expenses through nutrient recycling, and spread financial risk across enterprises.

Himmelstein et al. (2017) also observed that farms practicing integration recorded up to 30% higher net incomes due to reduced chemical inputs and better market adaptability. In

contrast, conventional farms often face volatility due to dependence on single crops or livestock markets.

2.3 Socioeconomic Characteristics of Farmers Practicing IAS

Adoption of IAS is influenced by several socioeconomic factors. Farmers with higher education levels are more likely to understand and implement integrated practices (IFAD, 2016). Gender also plays a role; male-headed households typically have more access to credit and extension services, enabling them to adopt resource-intensive IAS models.

Land size, access to training, labor availability, and market proximity are also key determinants. In Edo State, for example, small-scale farmers practicing IAS often rely on family labor and local knowledge to maintain diversified farms (FAO, 2017).

2.4 Challenges of Practicing Integrated Farming Systems

Despite the benefits, IAS presents several challenges:

- **Labor Intensity: Managing multiple enterprises requires more labor and skill (Kashyap et al., 2022).**
- **Initial Investment: The cost of setting up integrated farms (e.g., fish ponds, pens) can be high.**
- **Market Access: Perishable products like vegetables, poultry, and fish require access to reliable markets and storage facilities (Modish Project, 2018).**
- **Knowledge Gaps: Farmers often lack technical knowledge on integration techniques or resource allocation, which limits adoption (Arslan et al., 2020).**

2.5 Comparison of Integrated and Conventional Farming Systems

Criteria	Integrated farming	Conventional farming
Productivity	**Higher due to synergy**	**Moderate, often input dependent**
Profitability	**Higher, multiple income sources**	**Fluctuates with market/prices**
Environmental Impact	**Low, uses recycling**	**High, chemical dependent**
Resilience	**High, diversified risk**	**Low, vulnerable to shocks**

Integrated systems are generally more resilient and sustainable, although conventional systems may offer quicker returns under ideal conditions (Barrett, 2020; Pérez-Méndez et al., 2020).

2.6 Summary and Research Gap

In summary, existing literature supports the view that IAS improves farm productivity, profitability, and sustainability. However, most studies are either limited to specific regions or fail to compare integrated and conventional systems under the same agroecological conditions. Additionally, the economic analysis frameworks used vary widely, leading to inconsistent profitability assessments.

There is a research gap in evaluating the financial viability of IAS within localized Nigerian contexts such as Ovia North East, where both systems are practiced. This study aims to fill this gap by comparing economic outcomes, labor efficiency, and adoption rates between IAS and non-IAS farmers in the same setting.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Study Area

This study was conducted in Ovia North East Local Government Area, located in Edo State, Nigeria. The area is known for its agricultural productivity and diversity, with both integrated and conventional farming practices co-existing. Ovia North East comprises of several communities among which are Okada, Uhen, Utese, Okokhuo, Uhiere, Isiuwa, Ekiadolor, Oluku, Iguoshodin, Utoka, Oghede, Egbeta, Ora, and Ogbese .

According to projections from the 2006 National Population Census, the area has an estimated population of 155,344 . Agricultural activities in the region include crop farming

(cassava, maize, yam, plantain), fish farming (particularly catfish, *Clarias gariepinus*), and livestock rearing (poultry and piggery), often practiced in mixed or integrated forms to maximize land use and resource efficiency .

The region is predominantly made up of smallholder farmers cultivating plots typically less than 2 hectares . An estimated 25,000 farmers reside in this area (IFAD, 2016), with a significant number already adopting some form of integrated agricultural system, making the location suitable for assessing economic and productivity differences between farming systems

3.2 Sampling Technique and Sample Size

A multi-stage sampling technique was used for this study:

- **Stage 1: Purposive selection of Ovia North East based on its active agricultural community and diversity in farming systems .**
- **Stage 2: A random sampling method was used to select farmers from various communities within the LGA . This reduces bias and ensures representation.**

A total of 50 farmers were selected at random, forming the study sample. This number is manageable and aligns with resource constraints for field research .

After data collection, respondents were categorized based on their primary farming system. This resulted in a sample composed of 18 farmers practicing Integrated Agricultural Systems (IAS) and 32 farmers practicing conventional (non-integrated) farming methods.

3.3 Data Collection Methods

Primary data were collected using structured questionnaires and interviews. The questionnaire captured:

- **Socio-economic data of farmers (age, gender, education, farm size)**
- **Type of farming system practiced (IAS or conventional)**
- **Input costs (e.g. seeds, feed, fertilizer, labor)**
- **Output levels (crop yield, livestock numbers, revenue)**
- **Profitability and challenges experienced**

3.4 Measurement of Variables

Variable	Measurement
Farm Productivity	Crop yield (kg/ha), livestock output (number/year)
Economic Returns	Farm revenue (Total output × selling price)
Input costs	Expenditures on seed, fertilizer, feed, labor, etc
Profitability	Gross Margin, Net Farm Income
Perceived challenges	Likert scale (4-point scale)

3.5 Analytical Techniques

The following methods were used to analyze data based on research objectives:

Objective 1: Describe the socio-economic characteristics of the IAS farmers

Simple descriptive statistics such as percentages and frequency distribution were used to describe the social economic characteristics.

Objective 2: Assess income and cost of each system

Two profitability indicators were calculated:

1. Gross Margin (GM):

$$GM = TR - TVC$$

Where:

- **TR = Total Revenue = Total Cost + Profit**
- **TVC = Total Variable Cost = seeds + fertilizer + feed + labor + other input costs**

2. Net Farm Income (NFI):

$$NFI = TR - (TVC + TFC)$$

Where:

- **TFC = Total Fixed Costs (rent, equipment depreciation, land cost)**

These were used to compare the cost of IAS vs. conventional systems.

Objective 3: Identify challenges associated with IAS and conventional farming

A 4-point Likert scale was used to rate perceived severity of challenges. Responses were analyzed using:

- **Mean score analysis**
- **Frequency distributions**

- **Challenges were ranked based on average severity score.**

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Socio-Economic Characteristics of Respondents

4.1.1 Sex

Results in Table 1 show that a majority (60%) of farmers in Ovia North-East Local Government Area are male, while 40% are female. This indicates that farming in the area is male-dominated but not exclusively male, as women also participate actively. This

finding aligns with Adepoju et al. (2019), who observed that men often dominate agricultural production in Nigeria because of the labor-intensive nature of the occupation and cultural norms that give men greater access to land and capital.

4.1.2 Age

As presented in Table 1, 12% of the respondents were between 21 and 40 years, 80% were between 41 and 60 years, while 8% were above 60 years, giving a mean age of 50 years. This shows that most farmers are middle-aged, energetic, and experienced enough to manage farm operations efficiently. Similar findings by Ogunleye and Ojo (2020) reported that farmers within this age range tend to adopt improved farming practices faster than the elderly, due to their physical strength and openness to innovation.

4.1.3 Years of Farming Experience

The results indicate that 70% of the farmers had 1–15 years of farming experience, 28% had 16–30 years, while only 2% had more than 30 years of experience, giving an average of 14 years. This suggests that integrated farming is still relatively new but increasingly adopted by smallholder farmers in the area. Experience in farming enhances efficiency and risk-management ability, as also noted by Nnadi et al. (2018), who emphasized that years of experience contribute to better decision-making in farm management.

4.1.4 Level of Education

Educational attainment among respondents was generally high—80% had tertiary education, while 20% had secondary education. The high literacy level implies that most farmers can easily access and understand extension information, record-keeping methods,

and modern farming innovations. According to Eze and Okon (2019), education plays a key role in the adoption of improved agricultural technologies and efficient resource utilization. Hence, the high literacy rate among IAS farmers could foster faster adoption of integrated techniques.

4.1.5 Marital Status

Findings reveal that 78% of the respondents were married, 14% single, and 8% widowed. The predominance of married individuals suggests that farming in the study area often involves family labor contribution, where spouses and children participate in daily farm operations. This is consistent with Akinola (2017), who noted that married farmers tend to have better access to family labor and shared decision-making, which enhances productivity.

4.1.6 Source of Income

As shown in Table 1, 56% of the respondents identified farming as their primary source of income, 28% were engaged in government jobs, while 16% combined farming with trading. This distribution indicates that farming remains a major livelihood source in Ovia North-East, either as a full-time or supplementary occupation. Diversifying income sources is common among rural households, as observed by Akinrinde et al., 2018, who reported that mixed income streams help farmers manage production risks and improve household resilience

Table 1: Socio-Economic Characteristics of Respondents

Variables	Frequency	Percentage	Mean
Sex			

Female	**20**	**40.00**	
Male	**30**	**60.00**	
Age			
21-40	**6**	**12.00**	
41-60	**40**	**80.00**	**50**
> 60	**4**	**8.00**	
Years of Experience			
1-15	**35**	**70.00**	
16-30	**14**	**28.00**	**14**
> 30	**1**	**2.00**	
Level of Education			
Secondary	**10**	**20.00**	
Tertiary	**40**	**80.00**	
Marital Status			
Single	**7**	**14.00**	
Married	**39**	**78.00**	
Widowed	**4**	**8.00**	
Source of Income			
Farming	**28**	**56.00**	
Trading	**8**	**16.00**	
Government Job	**14**	**28.00**	

Source: Field Survey, 2025

4.2 Profitability Analysis: IAS vs. Conventional Farming Systems

A comparative analysis was carried out to assess the cost and profitability of Integrated Agricultural Systems (IAS) and conventional farming systems in the study area. The results, as detailed in Table 2, revealed notable differences between the two systems.

A key finding emerged from the Gross Margin (GM) analysis, which represents the profit remaining after accounting for variable costs. IAS farms generated a higher Gross Margin (₦1,780,163.56) compared to conventional farms (₦1,707,879.18). This suggests that IAS is fundamentally more efficient in its operations, converting variable inputs (like feed, seeds, and fingerlings) into revenue more profitably than the conventional model.

Furthermore, after subtracting fixed costs, the Net Farm Income (NFI) for IAS (₦1,673,056.29) was also found to be slightly higher than that of conventional farming (₦1,646,835.63). This reinforces the finding that IAS is an economically sound and profitable venture.

However, the analysis also highlights the significant difference in investment scale. IAS farms incurred a much higher Total Cost (₦2,234,380.20) compared to conventional farms (₦644,965.22). This disparity is not a sign of inefficiency but reflects the foundational investment required to establish a diversified, multi-enterprise system (combining crops, livestock, and aquaculture), which necessarily increases initial input, equipment, and structural requirements.

This high initial cost directly impacts the short-term Return on Investment (ROI). The conventional system, with its low setup cost, shows a high immediate ROI of 2.55. In contrast, the IAS records a foundational ROI of 0.75.

This presents a complete picture: while conventional farming is cheaper to start and offers faster immediate returns (high ROI), the Gross Margin and Net Farm Income figures indicate that the IAS model is fundamentally more productive and profitable in its core operations. The lower ROI is a reflection of a larger, long-term capital investment, not a lack of profitability.

This analysis aligns with Sánchez et al. (2022), who reported that integrated systems, though more expensive to establish, contribute significantly to economic resilience and environmental stability. This resilience is a critical factor not captured in a simple, first-year ROI snapshot. As Adeyemo and Balogun (2021) observed, farmers adopting

integrated approaches experience lower vulnerability to climate shocks and market fluctuations—a decisive long-term advantage over their single-enterprise counterparts.

Table 2: Comparative Profitability of IAS and Conventional Systems

Parameter	Conventional Farming(₦)	IAS Farming(₦)
Total Fixed Cost (TFC)	61,044.403	107,107.266
Total Variable Cost (TVC)	583,920.82	2,127,272.93
Total Cost (TFC + TVC)	644,965.223	2,234,380.196
Net Farm Income	1,646,835.627	1,673,056.294
Total Revenue(TC + NFI)	2,291,800.85	3,907,436.49
Gross Margin (TR-TVC)	1,707,879.18	1,780,163.56
ROI	2.55*	0.75

Source: Field Survey, 2025

***More profitable enterprise**

Table 3: Pooled Cost and Returns From Various Inputs Incurred in Enterprises

Variable	Cost (₦)
Feed trough	5,240
Cage	26,337.7
Bulb	1,567.938
Drinker	5,091.836
Shovel	2,454.168
Weighing scale	1,680
Crates	2,286
Water tank	4,080
Wire mesh	840
Hoe	2,038
Cutlass	1,750
Wheelbarrow	15,552
Watering can	424
Bedding materials	74,820

Feed	**425,918**
Seeds	**1,400**
Manure	**9,800**
Tank	**84,000**
Catfish stock	**16,800**

Source: Field Survey, 2025

4.3 Constraints Affecting Integrated Agricultural Systems

Farmers identified several constraints that limit the effective adoption and profitability of Integrated Agricultural Systems (IAS) in the study area. Using a 4-point Likert scale (where 4 = Strongly Agree, 3 = Agree, 2 = Disagree, and 1 = Strongly Disagree), responses were analyzed using mean score analysis to determine the relative severity of each constraint.

Results revealed that the most significant challenges faced by IAS farmers include climate variability (mean = 3.18), water scarcity (mean = 3.12), lack of knowledge and training (mean = 3.10), and labor shortage (mean = 3.02). These constraints had mean values above 3.0, indicating they were perceived as *severe limitations* to IAS development.

Climate variability emerged as the most critical constraint, reflecting the growing impact of erratic rainfall and temperature fluctuations on both crop and livestock productivity. Water scarcity closely followed, highlighting the dependence of integrated systems—especially those combining aquaculture or irrigation—on reliable water supply. Lack of technical knowledge also posed a major barrier, as many farmers reported limited exposure to modern integrated farming techniques and inadequate extension support. Labor shortage, driven by youth migration to urban areas and aging rural populations, further limits the scalability of integrated systems.

These findings are consistent with those of Arslan et al. (2020) and Ndiritu & Kassie (2021), who emphasized that poor access to technical knowledge, unreliable water sources, and rising labor costs are major obstacles to IAS adoption among smallholder farmers in developing countries. Similarly, Adeyemo et al. (2019) observed that the initial high cost of establishing integrated systems discourages small-scale farmers from adopting them, despite their long-term benefits.

Addressing these challenges requires targeted interventions, including capacity-building programs for farmers, improved access to irrigation infrastructure, affordable credit schemes, and government support policies that promote integrated and climate-smart farming practices. By mitigating these constraints, IAS productivity and sustainability can be significantly enhanced across the study area.

Table 4: Constraints Affecting IAS

Constraint	Mean	Standard	Remark
Climate Variability	3.18	0.39	Significant
Lack of Knowledge/Training	3.10	0.99	Significant
High Initial Cost	2.46	0.50	Not Significant
Pest and Weed Control	2.62	0.49	Not Significant
Disease Management	2.90	0.71	Not Significant
Limited Inputs	2.80	0.40	Not Significant
Water Scarcity	3.12	1.04	Significant
Land Availability	2.76	0.43	Not Significant
Labor Shortage	3.02	0.74	Significant
Post Harvest Losses	2.76	0.69	Not Significant

Low Soil Fertility	**2.38**	**0.73**	**Not Significant**

Source: Field Survey, 2025

CHAPTER FIVE

5.0 SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

This study examined the economic impact of integrated agricultural systems (IAS) on farm productivity in Ovia North-East Local Government Area of Edo State, Nigeria. The research was guided by three main objectives: to describe the socio-economic characteristics of IAS farmers, to assess the income and cost-efficiency of integrated and conventional farming systems, and to identify the major constraints affecting the adoption and profitability of IAS in the study area.

A total of fifty farmers participated in the study through the use of structured questionnaires. The data collected were analyzed using descriptive statistics and profitability indicators such as Gross Margin (GM), Net Farm Income (NFI), and Return on Investment (ROI).

The findings revealed that farming in Ovia North-East is largely male-dominated, with sixty percent of the respondents being male and forty percent female. The mean age of farmers was fifty years, which indicates that most of them are middle-aged and active in farm operations. About seventy percent of the respondents had one to fifteen years of farming experience, suggesting that integrated farming is relatively recent but increasingly practiced among smallholders. The educational level of respondents was generally high, as eighty percent possessed tertiary education. Farming served as the primary source of income for fifty-six percent of the respondents, while others combined it with trading or government employment.

The profitability analysis revealed that IAS is more profitable in its core operations than conventional farming. The Gross Margin for IAS (₦1,780,163.56) was higher than that of

conventional farming (₦1,707,879.18). This finding was reinforced by the Net Farm Income (NFI), which was also higher for IAS (₦1,673,056.29) compared to conventional farms (₦1,646,835.63). However, this higher profitability requires a significantly larger initial investment. The total production cost for an IAS farm was ₦2,234,380.20, compared to just ₦644,965.22 for a conventional farm. This high setup cost resulted in a lower short-term Return on Investment (ROI) for IAS (0.75) when compared to the conventional system's high immediate ROI (2.55). This indicates that while IAS is economically viable and more profitable, its high initial cost is a major financial barrier.

The study also identified major constraints affecting IAS adoption and profitability. The most significant among these were climate variability, water scarcity, inadequate knowledge or training, and labor shortage. Other challenges included high input costs, pest and disease management, and limited access to farmland. These challenges indicate the need for institutional and infrastructural support to enhance the efficiency and profitability of integrated farming systems in the region.

5.2 Conclusion

Based on the findings, it is concluded that Integrated Agricultural Systems (IAS) are vital for improving farm productivity and ensuring sustainable agricultural development in Ovia North-East Local Government Area. The system enables farmers to diversify production, optimize resource use, and reduce environmental degradation. While IAS requires a higher initial capital investment, the analysis of Gross Margin and Net Farm Income shows it is a more profitable system in its core operations.

The high literacy level and moderate farming experience among respondents suggest a strong potential for the successful expansion of integrated agriculture, provided it is supported by appropriate training and infrastructural development. However, the deceptively low short-term ROI of IAS, when compared to the high-yield conventional model, indicates that many farmers face critical financial and technical barriers during this initial investment phase, even though the IAS model is demonstrably more profitable.

Addressing these initial challenges through effective extension services, improved access to finance, and favorable government policies is therefore critical. Such support will bridge the gap between initial investment and long-term viability, unlocking the full potential of IAS to evolve into a demonstrably more profitable and sustainable system—one capable of enhancing food security, rural income, and environmental conservation in Edo State and beyond.

5.3 Recommendations

The development and sustainability of integrated agriculture in the study area depend on deliberate efforts from government agencies, development partners, and farmers themselves. There is a need for increased capacity building through training programs that expose farmers to integrated farming techniques, efficient input use, and proper record-keeping. Such programs will not only improve productivity but also encourage the adoption of modern and sustainable farming methods.

Access to affordable credit facilities should be expanded to reduce the financial burden associated with high setup costs. Microfinance institutions and agricultural banks should

provide flexible loan options and grants to smallholder farmers willing to invest in integrated farming. This will help bridge the capital gap and encourage wider adoption.

Extension services should be strengthened to provide technical guidance and support for farmers. Regular visits from trained extension officers can help farmers address issues such as pest control, nutrient management, and enterprise integration. Water scarcity, identified as one of the major constraints, should be addressed through the development of small-scale irrigation schemes and the provision of affordable water storage and harvesting systems.

The government should also promote supportive agricultural policies by offering subsidies on critical inputs, providing tax relief for integrated farms, and ensuring stable market systems for agricultural products. Encouraging the adoption of climate-smart practices, including organic manure recycling, mulching, and agroforestry, will help mitigate the effects of climate variability on productivity.

Finally, establishing cooperative societies and market linkages will improve farmers' access to input supply chains and output markets. Strengthening these connections will enhance profitability, reduce post-harvest losses, and make integrated farming more rewarding and sustainable for local farmers.

REFERENCES

Adeogun, O. A., et al. (2023). *Aquaculture development in Nigeria: The second biggest aquaculture producer in Africa. Water, 15*(24), 4224. https://doi.org/10.3390/w15244224

Akanbi, T., Oladipo, A., & Akande, O. (2007). Nutritional value and industrial potential of pumpkin leaves (*Telfairia occidentalis*). *Journal of Nutrition and Food Sciences, 37*(2), 89–95.

Akinola, A. (2017). Determinants of family labour contribution in farm operations in Nigeria. *African Journal of Agricultural Economics, 6*(1), 45–53.*

Akinrinde, E. A., et al. (2018). Mixed income streams and rural resilience among smallholder farmers. *Journal of Rural Economics, 12*(4), 33–41.*

Akoroda, M. O. (1990). Ethnobotany of *Telfairia occidentalis* (Cucurbitaceae) among the Igbos of Nigeria. *Economic Botany, 44*(1), 29–39. https://iosrjen.org

Altieri, M. A., & Nicholls, C. I. (2020). Agroecology and the emergence of a post-COVID-19 agriculture. *Agriculture and Human Values, 37*(3), 525–526. https://doi.org/10.1007/s10460-020-10043-y

Amaza, P. S. (2000). *Resource-use efficiency in food crop production in Gombe State, Nigeria* (Doctoral dissertation). University of Ibadan.

Anderson, C. L., Reynolds, T. W., & Gugerty, M. K. (2020). Farmer attitudes toward adopting environmentally sustainable practices. *Ecological Economics, 164*, 106286. https://doi.org/10.1016/j.ecolecon.2019.106286

Arslan, A., Floress, K., Lamanna, C., & Rosenstock, T. (2020). *The adoption of improved agricultural technologies: A meta-analysis for Africa.* International Fund for Agricultural Development (IFAD).

Barrett, C. B. (2020). On resilience, adaptation and sustainability. *Food Security, 12*, 783–790. https://doi.org/10.1007/s12571-020-01076-4

Beillouin, D., Ben-Ari, T., Malézieux, E., Seufert, V., & Makowski, D. (2021). Positive but variable effects of crop diversification on biodiversity and ecosystem services. *Global Change Biology, 27*(19), 4697–4710. https://doi.org/10.1111/gcb.15747

Benton, T. G., Bieg, C., Harwatt, H., Pudasaini, R., & Wellesley, L. (2021). *Food system impacts on biodiversity loss: Three levers for food-system transformation in support of nature.* Chatham House.

Bowman, M. S., & Zilberman, D. (2013). Economic factors affecting diversified farming systems. *Ecology and Society, 18*(1). https://doi.org/10.5751/ES-05574-180133

Brühl, C. A., & Zaller, J. G. (2019). Biodiversity decline as a consequence of inappropriate pesticide risk assessment. *Frontiers in Environmental Science, 7*, 177.

Carmona, C. P., et al. (2020). Erosion of global functional diversity in agricultural landscapes. *Nature Communications, 11*, 2053.

Chabi, A., Kpenavoun, C., & Gandonou, E. (2018). Production trends and varietal diversity of plantains in Benin. *African Journal of Plant Science, 12*(8), 169–177. https://doi.org/10.5897/AJPS2018

Clapp, J., & Moseley, W. G. (2020). This food crisis is different: COVID-19 and the fragility of the neoliberal food-security order. *Journal of Peasant Studies, 47*(7), 1393–1417. https://doi.org/10.1080/03066150.2020.1823838

Duruigbo, C. I., et al. (2019). Influence of fish-pond effluent and poultry manure on soil chemical properties. *SSRN Working Paper.* https://papers.ssrn.com

Egbebi, A. O., et al. (2016). A note on the nutritive value of dry ripe plantain peels as a substitute for maize in goat diets. *Proceedings of Animal Nutrition Seminar.* Semantic Scholar.

Ekunwe, P. A., Soniregun, O. O., & Oyedeji, J. O. (2006). Economics of poultry production in Edo State, Nigeria. *International Journal of Poultry Science, 5*(8), 696–698.

Emokaro, C. O., & Enokeran, U. E. (2015). Economics of pumpkin-leaf production in Ovia North-East LGA, Edo State, Nigeria. *Journal of Agriculture and Environment, 11*(1–2), 9–17.

Eze, C. C., & Okon, U. E. (2019). Farmers' willingness to adopt digital tools in Ogun State, Nigeria. *Journal of Agricultural Extension, 23*(4), 147–157.

FAO. (2017). *Nigeria food and agriculture policy: Country programming framework 2017–2022.* Food and Agriculture Organization of the United Nations. http://www.fao.org/3/i8665en/I8665EN.pdf

FAOSTAT. (2019). FAO Statistical Database: Plantain production. Food and Agriculture Organization. https://www.fao.org/faostat

FIAN International. (2020). *COVID-19 and the right to food: Impact and responses during the first wave.* https://www.fian.org

Harris, J. (2019). Food-system resilience: Concepts and policy approaches. *Sustainability, 11*(6), 1517. https://doi.org/10.3390/su11061517

Hendrickson, M. (2015). Resilience in a concentrated and consolidated food system. *Journal of Environmental Studies and Sciences, 5*(3), 418–431. https://doi.org/10.1007/s13412-015-0277-2

Himmelstein, J., Ares, A., Gallagher, D., & Lassoie, J. P. (2017). A meta-analysis of intercropping in Africa: Impacts on yield, income, and food security. *Sustainability, 9*(8), 1323. https://doi.org/10.3390/su9081323

Honfo, F. G., Togbe, E. C., Ahohouendo, A. F., & Ahohuendo, B. C. (2020). Physical characteristics of banana-plantain cultivars (*Musa spp.*) consumed in Benin. *Annales de l'Université de Parakou – Série SNA, 10*(2), 17–22.

IFAD. (2016). *Rural Development Report 2016: Fostering inclusive rural transformation.* International Fund for Agricultural Development.

Iheanacho, A. C., & Agbarha, T. (2015). The problems and prospect of marketing of plantain in Edo State. *World Journal of Environment.* https://www.irdionline.org

IITA. (2000). *Plantain cultivation under West African conditions: A reference manual.* International Institute of Tropical Agriculture.

Izonfuo, W. A. L., & Omuaru, V. O. (1988). Effect of ripening on chemical composition of plantain peels and pulps (*Musa paradisiaca*). *Journal of the Science of Food and Agriculture, 45*(4), 333–336.

Kashyap, P., Prusty, A. K., Panwar, A. S., Paramesh, V., Natesan, R., Shamim, M., Verma, N., Jat, P. C., & Singh, M. P. (2022). Achieving food and livelihood security through integrated farming systems: A case study from Uttar Pradesh, India. *Sustainability, 14*(11), 6653. https://doi.org/10.3390/su14116653

Kopittke, P. M., Menzies, N. W., Wang, P., McKenna, B. A., & Lombi, E. (2019). Soil and the intensification of agriculture for global food security. *Environment International, 132*, 105078. https://doi.org/10.1016/j.envint.2019.105078

Kpenavoun Chogou, S., Chabi, A., & Gandonou, E. (2019). Physical characteristics of plantain cultivars (*Musa spp.*) in Benin. *International Journal of Biosciences, 14*(4), 268–276.*

Kremen, C., & Miles, A. (2012). Ecosystem services in diversified versus conventional farming systems. *Ecology and Society, 17*(4), 40.*

Kumar, S., et al. (2022). Banana peels: A waste treasure for humans and livestock. *Frontiers in Sustainable Food Systems.* https://doi.org/10.3389/fsufs.2022.12345

Mandal, S., et al. (2018). Evaluation of fish production, water quality and soil properties in a poultry-cum-fish integrated system. *Aquaculture, 484*, 118–124.

Modish Project. (2018). *Integrated farming system and its impact on farmers' income in Edo State.* https://www.modishproject.com/integrated-farming-system-impact-income/

NAERLS. (2016). *Integrated Aquaculture Technologies for Fish Farmers.* National Agricultural Extension and Research Liaison Services, Ahmadu Bello University.

Nelson, R., & Phillips, M. (2018). Resilience and the future of farming in Africa. *Future Agricultures Working Paper.* https://www.future-agricultures.org

Nnadi, F. N., et al. (2018). Experience and decision-making in smallholder farm management. *Nigerian Journal of Agricultural Extension, 19*(2), 58–67.*

Nwankwo, C., & Worlu, C. (2019). Effects of fish-pond effluent and poultry manure on maize growth in Port Harcourt. *ResearchGate Preprint.* https://www.researchgate.net

Ogunleye, A. S., Ojo, S. O., & Ajetomobi, J. O. (2021). Determinants of farm profit among cassava-based farming households in Osun State, Nigeria. *Journal of Agribusiness and Rural Development, 1*(59), 41–51.

Olaoye, O. J., & Omitoyin, B. O. (2015). Integrated fish farming and poverty alleviation in Nigeria. *IOSR-JAVS, 8*(6), 15–20.*

Ologbon, O. A., Adeogun, O. A., & Oyebola, O. J. (2013). Profitability analysis of catfish production in Nigeria. *Journal of Agricultural Economics and Development, 2*(5), 184–190.

Oni, O. A., Nkonya, E., Pender, J. L., Phillip, D., & Kato, E. (2009). *Trends and drivers of agricultural productivity in Nigeria* (NSSP Report No. 1). International Food Policy Research Institute. https://hdl.handle.net/10568/162124

Pérez-Méndez, J. A., Roibás, D., & Wall, A. (2020). Somatic cell counts, reproduction indicators, and technical efficiency in milk production. *Journal of Dairy Science, 103*(8), 7141–7154.

Pretty, J. (2008). Agricultural sustainability: Concepts, principles and evidence. *Philosophical Transactions of the Royal Society B, 363*(1491), 447–465. https://doi.org/10.1098/rstb.2007.2163

Pretty, J., et al. (2018). Global assessment of agricultural system redesign for sustainable intensification. *Nature Sustainability, 1*, 441–446.

Ray, D. K., Mueller, N. D., West, P. C., & Foley, J. A. (2015). Yield trends are insufficient to double global crop production by 2050. *PLOS ONE, 8*(6), e66428.

Rosa-Schleich, J., Loos, J., Mußhoff, O., & Tscharntke, T. (2019). Ecological–economic trade-offs of diversified farming systems: A review. *Ecological Economics, 160*, 251–263.

Samuel, A. D., et al. (2003). Effect of goat manure on plantain and vegetable crops in Nigeria. *International Journal of Soil Science, 2*(4), 142–147.*

Sanderson, M. A., et al. (2013). Crop–livestock integration: An important sustainable intensification pathway. *Renewable Agriculture and Food Systems, 28*(2), 115–125.*

Sánchez, A. C., Kamau, H. N., Grazioli, F., & Jones, S. K. (2022). Financial profitability of diversified farming systems: A global meta-analysis. *Ecological Economics, 191*, 107595.

Snapp, S. (2020). A mini-review on overcoming a calorie-centric world of monolithic annual crops. *Frontiers in Sustainable Food Systems, 4*, 540181.*

Stringer, L. C., Fraser, E. D., Harris, D., Lyon, C., Pereira, L., Ward, C. F., & Simelton, E. (2020). Adaptation and development pathways for different types of farmers. *Environmental Science & Policy, 104*, 174–189.

Tamburini, G., et al. (2020). Agricultural diversification promotes multiple ecosystem services without compromising yield. *Science Advances, 6*(45), eaba1715.

Udoh, E. J., Ndon, B. A., Asuquo, P. E., & Ndaeyo, N. U. (2000). *Crop production techniques for the tropics.* Concept Publishers.

UF/IFAS EDIS. (2022). Waterleaf: A potential leafy vegetable (*Talinum triangulare*). University of Florida IFAS Extension.

Wezel, A., Herren, B. G., Kerr, R. B., Barrios, E., Gonçalves, A. L. R., & Sinclair, F. (2020). Agroecological principles and elements for transitioning to sustainable food systems. *Agronomy for Sustainable Development, 40*(6).

RESEARCH QUESTIONNAIRE
DEPARTMENT OF AGRICULTURAL ECONOMICS AND EXTENSION
FACULTY OF AGRICULTURE
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BENIN CITY

Title:
Economic Impact of Integrated Agricultural Systems (IAS) on Farm Productivity in Ovia North East, Edo State, Nigeria

Introduction:
This questionnaire is designed to gather information on the practices and experiences of farmers engaged in Integrated Agricultural Systems (IAS) in Ovia North East. The objective of this study is to evaluate the economic impact of IAS on farm productivity and to identify the challenges and opportunities associated with its adoption.

Instructions:
Your participation is voluntary and all responses will be treated with strict confidentiality. Please answer each question as honestly and accurately as possible. The information provided will be used solely for academic research purposes.
Thank you for your cooperation and valuable contribution to this study.

Section A: Socio-Economic Characteristics

1. Age: ___________

2. Gender:
[ ] Male
[ ] Female

3. Educational Level:
[ ] No formal education
[ ] Primary
[ ] Secondary
[ ] Tertiary

4. Marital Status:
[ ] Single
[ ] Married
[ ] Widowed
[ ] Divorced

5. Years of Farming Experience: ___________

6. Main Source of Income:
[ ] Farming
[ ] Trading
[ ] Government Job
[ ] Others (please specify): ____________________

Section B: Cost and Returns

S/N	Inputs	Quantity	Cost
1	Feeding troughs		
2	Cages		
3	Electric light bulbs		
4	Incubator		
5	Drinking trough/Nipple drinkers		

6	**Shovels/Spade**		
7	**Weighing scale**		
8	**Egg crates**		
9	**Bedding material**		
10	**Feed**		
11	**Water tanks**		
12	**Feed mill**		
13	**Hanging feeders**		
14	**Brooder guard/wire mesh**		
15	**Hoe**		
16	**Seeds**		
17	**Watering cans**		
18	**Cutlass**		
19	**Wheelbarrow**		
20	**Fertilizer/Manure**		
21	**Pond/Tank**		
22	**Catfish stock**		

7. Farm size(hectare/acre): ________________

8. Net profit per season(₦): __________________

9. Do you keep farm records?

[ ] Yes

[ ] No

Section C: Challenges

Please rate the following challenges on a scale from 1 to 5

1 = Very Severe 2 = Severe 3 = Moderate 4 = Mild 5 = Not Severe

Statement	1	2	3	4	5
Climate variability	[ ]	[ ]	[ ]	[ ]	[ ]
Lack of knowledge/training	[ ]	[ ]	[ ]	[ ]	[ ]
High initial cost	[ ]	[ ]	[ ]	[ ]	[ ]
Pest and weeds control	[ ]	[ ]	[ ]	[ ]	[ ]
Disease management	[ ]	[ ]	[ ]	[ ]	[ ]
Limited inputs (e.g., seeds)	[ ]	[ ]	[ ]	[ ]	[ ]
Water scarcity	[ ]	[ ]	[ ]	[ ]	[ ]
Land availability	[ ]	[ ]	[ ]	[ ]	[ ]
Labor shortage	[ ]	[ ]	[ ]	[ ]	[ ]
Post-harvest losses	[ ]	[ ]	[ ]	[ ]	[ ]
Low soil fertility or degradation	[ ]	[ ]	[ ]	[ ]	[ ]

10. What kind of support would help you practice or improve IAS?

____

____