International Journal of Maritime and Interdisciplinary Research
©2024 IJMIR/VOL.6, ISSUE:2 | DECEMBER/2024 | ISSN: 2734-3286.
Journal Homepage: www.ijmir.edu.ng
Email: ijmir@nmu.edu.ng

A Review of Farm Record-Keeping Practices Among Fish Farmers in Nigeria

[1] Aladetohun, N. F., [2]Eyo, V. O., [3]Eriegha, O. J.

[1](Department of Fisheries Technology, Federal College of Fisheries and Marine Technology, PMB 80063, Victoria Island, Lagos State, Nigeria).
[2, 3](Department of Fisheries and Aquaculture, Faculty of Environmental Management, Maritime University, P.M.B. 1005, Okerenkoko, Delta State, Nigeria).

***Corresponding Author's email:** sirvick2003@yahoo.com*

Abstract

With its significant contributions to food security, employment generation, and economic progress, fish farming is an essential aspect of Nigeria's agricultural landscape. However, effective management of fish farming operations, particularly in record-keeping, poses significant challenges. This review evaluates the current record-keeping practices within Nigeria's fish farming sector, focusing on the importance, types of records maintained, and data collection methods. It emphasizes the positive impact that proper record-keeping can have on farm efficiency, financial health, and regulatory adherence, while also examining the barriers faced, such as insufficient awareness, limited access to technology, and cultural factors that hinder documentation. The paper categorizes essential records, including financial, production, health, environmental, and sales records, comparing traditional methods with modern digital alternatives. It further highlights the negative outcomes of inadequate record-keeping, such as decreased efficiency, profitability losses, and restricted access to financial services. Additionally, the review addresses the role of government and institutional support in enhancing record-keeping through training programs, extension services, and policy initiatives. In conclusion, strengthening record-keeping systems within Nigeria's fish farming industry is crucial for promoting productivity, sustainability, and growth. Recommendations for improving practices include more farmer education, the adoption of digital technologies, standardized templates, and stronger partnerships between public and commercial sectors.

***Keywords*:** *Record-keeping, Fish farming, Farm management, Fish farmers, Digital technologies.*

1.0 Introduction

1.1 Overview of the Nigerian fish farming industry

Nigeria stands as one of the top aquaculture producers in Africa, with fish farming making substantial contributions to the national economy and food security (Olaifa et al., 2022). As the demand for fish rises, fueled by population expansion and the need for sustainable protein, fish farming is becoming a

significant sector for both small and large-scale enterprises (Saba et al., 2024). The industry cultivates species like catfish (*Clarias gariepinus*, *Heterobranchus longifilis*), tilapia (*Oreochromis niloticus*), and shrimp (*Macrobranchus macrobranchion*), which are popular domestically and hold export potential (Okoko and Eyo, 2023). However, the sector confronts numerous difficulties and hurdles, including inadequate management practices, lack of digital record keeping technologies and applications, limited funding, and a lack of adequate infrastructure. One critical factor that is often overlooked is record-keeping. Keeping accurate and complete farm records is essential for monitoring farm activities and operations, making informed decisions, and enhancing farm productivity and sustainability (Basir et al., 2024). Record-keeping is vital in agriculture, including aquaculture, for managing resources and ensuring the sustainability of operations (James, 2019). Within fish farming, proper records enable farmers to track production, manage expenses, comply with regulations, and ascertain the level of profitability. Effective record-keeping offers valuable insights that can help improve farming practices (Ashley-Dejo et al., 2023). This paper reviews the current level of record-keeping among fish farmers in Nigeria, analyzing the types of records kept, methods employed, and challenges faced. It also investigates the consequences of inadequate record-keeping and recommends solutions to improve procedures within the sector.

2.0 Importance of Record-Keeping in Fish Farming

2.1 Role of record-keeping in farm management and decision-making

Effective farm management relies greatly on accurate record-keeping. Fish farmers need to keep track of different aspects of their operations, such as feeding schedules, water quality, stocking densities, and financial expenses. By keeping detailed records, farmers can make informed decisions that affect the health of the fish stock, the efficiency of the production cycle, and the financial sustainability of their farms (Tham – Agyekum et al., 2010). For example, record-keeping allows farmers to monitor feeding patterns and adjust feed quantities to optimize growth rates, thereby reducing waste and increasing profitability (Yadeta et al., 2020). It also helps in identifying trends in fish mortality or disease outbreaks, enabling prompt interventions. Record-keeping plays a critical role in the effective management of farms and is a fundamental tool for sound decision-making. Whether in smallholder farms or large-scale agricultural enterprises, accurate and organized records provide essential data that helps farmers track their operations, plan future activities, and make informed choices that improve productivity, profitability, and sustainability Basir et al., (2024).

2.2 Benefits of effective record-keeping: financial, operational, and regulatory compliance

2.2.1. Farm Management Efficiency

Accurate record-keeping is central to improving the day-to-day management of a farm (James, 2019). Fish farmers must track various operations such as stocking, pond fertilization, feeding schedules, water

replacement, and harvesting. Keeping detailed records ensures that farm inputs (like seeds, feed, table size, broodfish) are used efficiently, which directly impacts crop or livestock yields and profitability. Table 1: shows the details and purpose/benefits of different records in a fish farm. As noted by Ashley–Dejo et al., (2023), the absence of reliable data makes it challenging for farmers to determine which practices are working and which need adjustment, thereby making management more guesswork than strategy. Detailed records of input usage, labor, and outputs provide farmers with the data necessary to optimize their processes (Undutimi, 2013). Farmers can also use records to monitor fish health and growth conditions. By tracking this information over time, farmers can adjust their practices to improve outcomes. For example, record-keeping allows fish farmers to adjust feeding regimes or identify patterns in disease outbreaks and intervene early (Saini, 2016). As such, good record-keeping practices reduce uncertainty and help farmers plan with more accuracy, leading to more efficient and productive fish farm management.

2.2.2 Decision-Making and Planning

Decision-making in farming is often complex, requiring a careful balancing of inputs, environmental conditions, labor, and financial investments. Record-keeping serves as a valuable tool to provide the data necessary for evidence-based decisions (Undutimi 2013). Records help farmers analyze historical trends, evaluate the success of past practices, and predict future outcomes (Aladejebi and Oladimeji, 2019). For instance, production records can provide insights into which fish species perform better in different culture conditions, while financial records can help assess the profitability of each fish production cycle (Saini, 2016). This data-driven approach enables farmers to allocate resources more efficiently and reduce risks associated with uncertainties. Additionally, record-keeping helps in forecasting future production cycles (Carlson, 1988). Based on past records, farmers can predict the best times for stocking or harvesting and make decisions about expanding farm operations (Rutto et al., 2016). Without historical data, farmers are forced to rely on intuition, which can lead to suboptimal outcomes.

2.2.3. Financial Management

One of the primary functions of record-keeping is financial tracking. Keeping detailed financial records enables farmers to monitor income, expenses, profitability, and cash flow (Wimkler, 2008). This is critical not only for understanding the current financial status of the fish farm but also for making strategic decisions regarding investments, loans, and expenditures. Studies have shown that farmers who maintain thorough financial records tend to perform better financially, as they are able to pinpoint cost-saving opportunities and avoid unnecessary expenses (Gloy and LaDue, 2003). Financial records also play a crucial role when applying for credit or external financing (Gloy et al., 2002). Lenders typically require clear documentation of a farm's financial health before approving loans. Without proper records, farmers

may struggle to secure the financial resources necessary to grow their businesses. In Nigeria, for example, many farmers face challenges accessing loans because they lack the financial documentation required by banks. Therefore, keeping up-to-date financial records is key to accessing external financial support and expanding farm operations.

2.2.4. Regulatory Compliance

Record-keeping is also essential for regulatory compliance, especially in sectors where environmental or health standards are tightly controlled (Kusserow, 2020). Farmers are often required to keep records to demonstrate compliance with regulations concerning chemical use, animal health, labor laws, and environmental protection. Failure to maintain proper records can result in fines, legal consequences, or even the closure of farm operations (Kusserow, 2020). In countries like Nigeria, where regulations around fish farming and agriculture are increasing, maintaining accurate records can help farmers avoid penalties and remain in business. Additionally, for farms to obtain sustainability certifications, keeping records is mandatory to demonstrate compliance with sustainable practices (Article, 2023). This is particularly important as consumers increasingly demand transparency in food production, and traceability systems require farms to maintain detailed records of inputs, production methods, and outputs.

2.2.5. Monitoring and Evaluating Farm Performance

Regular record-keeping helps farmers evaluate the performance of their farm operations by comparing actual outcomes against goals or benchmarks. For instance, by comparing year-on-year production or financial records, farmers can assess whether their farm is becoming more or less productive. This ability to monitor progress over time allows for better control of farm operations and the opportunity to fine-tune strategies to achieve better results (Eitzinger et al., 2023). Through production records, a farmer can assess the efficiency of various management strategies. For example, a farmer might discover that changing the stocking date or that switching feed suppliers for livestock has improved weight gain. Such insights can only be obtained through consistent and accurate record-keeping.

Table 1. Details and purpose/benefits of different records in a fish farm

Record Type	Key Details	Purpose/Benefits
Profit and Loss Statements	- Tracks farm profitability and cash flow - Helps with budgeting and financial planning - Provides documentation for loans, taxes	- Helps monitor financial health - Supports financial planning and loan acquisition
Production Records	- Stocking rates (number of fish stocked per pond/tank) - Feeding schedules - Harvest yields	- Monitors fish growth and feed efficiency - Optimizes stocking and feeding strategies - Tracks overall production performance

Health and Environmental Records	- Water quality (pH, temperature, oxygen levels) - Disease outbreaks - Treatment records -	Ensures optimal water conditions for fish health - Manages disease outbreaks - Provides data for improving health management practices
Feed Records -	- Quantity and type of feed used - Feed costs - Feeding frequency and amounts - Pellet size of feed	Monitors feed usage and cost-efficiency - Optimizes feeding to reduce waste and enhance growth
- Labor and payroll Records	- Hours worked by employees - Tasks performed - Wages and benefits paid	- Tracks labor costs - Helps manage employee performance and productivity
Sales and Marketing Records	- Sales volume and prices - Customer details - Market trends	- Tracks revenue and sales performance - Sets competitive prices - Provides insights for future marketing strategies
Breeding Records	- Parent stock details - Mating dates - Hatching and spawning rates	- Tracks breeding performance and fish genetics - Helps plan future breeding cycles
Inventory Records	- Feed stock levels - Equipment and supplies inventory - Fish stock (size, number)	-Prevents understocking/overstocking of supplies - Ensures timely restocking and equipment availability
Regulatory Compliance Records	- Environmental permits - Health and safety compliance - Food safety documentation	- Ensures compliance with government regulations - Provides proof of adherence to industry standards
Mortality Records	- Number of fish deaths - Cause of death - Timing and circumstances	- Identifies patterns in fish mortality - Supports efforts to reduce losses and improve management
Loan and credit records	- Date borrowed, amount borrowed, source of loan, pond number or lease used for, loan increment, terms of loan, length, interest rate	- For pond construction, fingerlings production, hatchery set-up, purchase of feed etc.

3.0 Types of Records Kept by Fish Farmers

3.1 Financial Records (Income, Expenses, Profitability)

Financial records document the income generated from fish sales and the expenses incurred in running the farm, including the cost of feed, labor, and equipment. These records are essential for assessing the farm's profitability and financial sustainability (Rutto et al., 2016; Andarsari & Dura 2018).

3.1.1 Farm receipts

These are records with the intent of providing management with an accurate list of products sold. As each lease or pond is harvested, the following items should be recorded; date of harvest, species harvested, amount harvested, price received per unit, and the disposition of the product. Gross revenue of the

production should include the cash and credit sales of the products and the imputed values of the quantities consumed on the farm (Amos & Bolorunduro, 2000).

3.1.2 The cash book and payment receipt

This is a farm record book of all financial transactions, both the income and expenditure, of the farm. With it, a farm manager can access loans, detect fraudulent practices and know the state of the business. In addition, the farm manager can make productive decision based on the figures present in the record. A cash book is a financial journal that contains all cash receipts and disbursements, including bank deposits and withdrawals. Cash books provide a systematic record of all cash transactions, allowing businesses to monitor their liquidity and financial health on a daily basis (Johnson et al., 2024). This is the main area where businesses record any and all cash-related information. Entries are normally divided into cash payments and receipts. All of these are posted in the general ledger of the farm.

3.1.3 Payroll and Labor Record

This is another cogent farm record book. It shows the amount and types of labor hired or employed to work on the farm. Also present in this record is the rate and wages paid, this record enhances transparency on the farm. Payroll records are the combined documents pertaining to payroll that businesses must maintain for each individual that they employ. This includes pay rates, total compensation, tax deductions, hours worked, benefit contributions and more.

3.1.4 Farm Diary

Farm diary record (Fig. 1a and Fig. 1b) is the farm record book that houses the daily activities of a farm and the farmer. This farm record keeping book is very important as it serves as a reference book to obtain past information on the farm. It is very normal for. It includes the record of important events that happen in the farm such as daily summary, (temperature, precipitation, humidity, and wind speed), stocking records, feeding records, physicochemical parameters, health records, disease and mortality records and harvesting records.

Fish Farm Diary Template

Name of Farm: _____
Location of Farm: _____
Farm Owner:_____
Farm Manager: _____
Date:_____

1. Daily Summary
Temperature: _____°C
Precipitation: _____ (Yes/No)
Average Weather Conditions:
Humidity: _____%
Wind Speed: _____ km/h
General Observations:
(Note and record any significant changes, observations, or event regarding fish behavior, water quality, or any other farm operations.)
_____
_____

2. Stocking Records
Pond Type:_____
Pond/Tank Number: _____
Date of Stocking:_____
Type of Species Stocked:_____
Number of Fish Stocked: _____
Average Size at Stocking:_____ g
Source of fish stocked:_____
Behavior of fish during Stocking:_____

3. Feeding Records
Type of Feed Used:_____
Pellet Size of feed:_____
Feeding Time and Frequency:_____
Quantity of Feed Given:_____ g
Feeding Observations:
(Note any changes in feeding behavior or leftover feed.)
_____
_____

4. Water Quality Monitoring
Pond/Tank Number:_____
pH Level:_____
Dissolved Oxygen Level:_____ mg/L

Figure 1a. Fish farm Dairy Template

Temperature:_____°C
Ammonia Level:_____ mg/L
Additional Notes:
(Note and record any treatments applied or water quality issues observed)
_____
_____

5. Health Monitoring
Fish Observations:
(Note any signs of disease, stress, or unusual behavior.)
_____
_____
Treatments Administered:
Type of Treatment:_____
Date Administered:_____
Dosage:_____
(Note and record any observation related to fish health)
_____
_____

6. Mortality Records
Number of Deaths: _____
Cause of Death (if known): _____
Date of Mortality:_____
Observations on dead fish:_____

7. Harvest and Post-Harvest Records
Pond/Tank Number:_____
Harvest Date:_____
Total Weight Harvested:_____ kg
Average Size at Harvest:_____ g
Time of the day during harvest_____
Gear used in Harvesting:_____
Post-Harvest Observations:_____
Additional Notes
(Any other relevant information, reminders, or observations for future reference.)
_____
_____

Name of Farm Manager: _____
Signature:
Date:_____

Figure 1b. Fish farm Dairy Template

3.1.5 Loan and Credit Account

Loan and credit records are also important aspect of the financial records. Sample record of loans; date borrowed, amount borrowed, source of loan, purpose of loan, pond number or lease used for, loan increment, terms of loan, length, interest rate are crucial information that should be captured in the loan and credit account.

3.2 Production Records

Production records capture data on the number of fish stocked, the quantity of feed used, and the amount of fish harvested. These records help farmers monitor the growth and health of their fish stock and plan for future production cycles (Saini, 2016; Ashley–Dejo et al., 2023). The identification records of farm facilities and fish brood stock are essential for farm manager to track the production, sale, breeding performance of individual fish and to give instructions to farm workers. Other important aspects of the production records should capture the following:

i. Species wise, variety wise and sex wise number of brood stock used.
ii. Sex ratio of brood fish should also be recorded.
iii. Details of hormones used (type & dosage).
iv. Breeding indices (species wise & variety wise fertilization, hatching and survival rates) be recorded carefully.
v. Details of feeds used in nursery pond – type and quantity.
vi. Water quality in hatching and, nursery tanks/ponds.
vii. Stocking density in the culture system- species & variety wise.
viii. Duration rearing & harvesting details.
ix. Survival percentage in the nursery system.
x. Total value of harvested seed, etc. be recorded in log book for each and every cycle of breeding and nursery.

Table 2 highlights every key aspect of the fish production and breeding process, ensuring a comprehensive overview of the production and breeding cycle, the performance of parent stock, and the success rate of each generation.

3.3 Health and Environmental Records (Water Quality, Disease Management)

Fish farmers must keep records of water quality parameters such as pH, temperature, and oxygen levels, as well as any disease outbreaks and treatments administered. This information is crucial for maintaining a healthy environment for the fish and preventing disease-related losses (Abd El-Hack et al., 2022).

3.4 Marketing and Sales Records

Marketing and sales records include data on the quantity of fish sold, the prices received, and the buyers' details (Wolff et al., 2024). These records help farmers track sales performance and identify market trends.

3.5 Inventory records

This is a record of all the assets of a farmer which reveals the state or conditions of each asset. Items in an inventory include ponds, farm buildings, land, machinery and equipment, produce in store, fishes and other items. The farmer lists these items and tries to evaluate them in a monetary term.

4.0 Record-Keeping Methods Used by Fish Farmers in Nigeria

4.1 Traditional/Manual Methods (Paper-Based)

Many fish farmers in Nigeria still rely on traditional, paper-based record-keeping methods. These include handwritten ledgers, notebooks, or simple forms where data is manually entered (Maddali et al., 2018). While easy to implement, these methods are prone to errors, misplacement, and can be cumbersome to maintain (Kuteesa and Kyotalimye, 2019).

Table 2. Record-Keeping Methods Used by Fish Farmers in Nigeria

Production and Breeding Record	Details	Purpose/Benefits
Stocking Rates	- Size and weight of fish at stocking -Number of fish stocked per pond or tank - Date of stocking - Fish species and strain	- Helps monitor the stocking density and optimize fish growth - Prevents overcrowding, which can impact health and growth rates
Pond/Tank Details	- Size of pond/tank (volume, area) - Water source (e.g., borehole, river) - Water quality parameters (pH, temperature, oxygen levels)	- Ensures the right conditions for fish production - Monitors-pond/tank suitability for various stages of growth
Feeding Schedule	- Type of feed used (e.g., pellets, live feed) - Feeding frequency (number of feedings per day) - Quantity of feed per feeding (grams or kilograms) - Food consumed (FC) - Feed conversion ratio (FCR)	- Monitors feed efficiency and cost-effectiveness - Helps prevent overfeeding or underfeeding - Optimizes growth through proper nutrition
Growth Records	- Initial size and weight of fish at stocking - Periodic measurements of fish size and weight (weekly or monthly) - Average daily gain (ADG) - Growth rate (GR) - Specific growth rate (SGR) - Weight gain	- Tracks growth trends over time - Identifies growth problems early for corrective action - Helps predict harvest times

Health Monitoring	- Health status of fish (any signs of illness) - Disease outbreaks (type of disease, affected fish, date) - Treatments applied (medication, dosage, dates)	- Keeps track of fish health and treatment responses - Helps reduce mortality rates and improve production outcomes
Harvest Yields	- Date of harvest - Total weight of fish harvested - Average size and weight of fish at harvest - Percentage of fish harvested from initial stocking	- Provides insights into production efficiency - Helps assess the success of the production cycle - Aids in financial planning and revenue forecasting
Feed Conversion Efficiency	- Feed intake vs. weight gain - Calculation of feed conversion ratio (FCR) for each batch - Overall feed cost for the production cycle	- Monitors how efficiently fish convert feed into body mass - Helps reduce feed costs by improving feed management
Harvest Data	- Harvest methods used (netting, draining) - Total number of fish harvested - Post-harvest handling and processing (sorting, grading, packaging)	- Ensures proper harvest management and fish quality - Reduces post-harvest losses and maximizes product quality
Production Performance Summary	- Overall survival rate (from stocking to harvest) - Total production cost per cycle (feed, labor, water, etc.) - Profit margins and financial performance	- Provides an overview of production efficiency and profitability - Helps in making informed decisions for future production cycles
Parent Stock Details	- Species of parent fish - Age of parent fish - Size and weight of parent fish - Health status (disease history, vaccinations, etc.) - Genetic lineage	- Tracks the genetic quality of the fish - Helps maintain a healthy and productive breeding stock
Mating Date	- Exact date of mating - Mating method (natural or artificial) - Male-to-female ratio during breeding	- Allows tracking of breeding cycles - Optimizes timing for future breeding
Spawning Date	- Date of egg-laying or spawning - Number of eggs laid - Fertilization success rate	- Monitors breeding success - Helps in assessing reproductive health of the stock
Hatching Date	- Date when eggs hatch - Number of eggs hatched	- Tracks the efficiency of hatching

	- Hatching success rate (percentage of fertilized eggs that hatch)	- Monitors environmental conditions affecting hatching
Spawning Tank Details	- Size and type of spawning tank - Water quality parameters (pH, temperature, oxygen levels) - Any treatments used before or after spawning	- Ensures optimal conditions for spawning - Helps identify issues that may impact breeding success
Larval Rearing Records	- Date of first feeding - Type and quantity of feed used - Survival rate of larvae - Growth rate of larvae (size over time)	- Monitors early growth stages - Ensures high survival rates through proper feeding and care
Juvenile Transfer Date	- Date when larvae/juveniles are transferred to grow-out tanks or ponds - Number of juveniles transferred - Size and weight of juveniles at transfer	- Tracks transition from larvae to juvenile stage - Monitors survival and growth through different stages
Mortality Records	- Number of fry or juvenile deaths - Cause of death (if known) - Date and environmental conditions during mortality	- Identifies patterns in early-stage fish mortality - Supports efforts to reduce losses in the breeding process
Breeding Performance	- Number of successful number of breeding per year - Average egg yield per female - Average hatch rate and survival to juvenile stage	- Provides a clear picture of breeding efficiency - Helps make decisions on which parent stocks to continue using
Treatment Records	- Any medications or treatments given to parent stock or fry - Dates of treatments and dosages - Health outcomes post-treatment	- Helps manage disease outbreaks - Provides data on the effectiveness of treatments in breeding stock
Environmental Conditions	- pH, temperature, dissolved oxygen, ammonia levels during breeding and rearing	- Ensures optimal water conditions for spawning and hatching - Helps correlate environmental factors with breeding success

4.2 Digital Methods (Spreadsheets, Specialized Software)

A growing number of farmers are adopting digital tools such as spreadsheets or farm management software to keep records (Kaluvakuri amd Amin, 2018). These tools offer advantages such as automated

calculations, easy data retrieval, and backup options to prevent data loss. While the adoption of digital record-keeping methods is increasing, it remains limited to farmers with access to technology and training (Rotz et al., 2019; Cui & Wang, 2023). The use of mobile apps and cloud-based software is becoming more popular as internet access expands in rural areas. Very recently, Dr. Jean Gonzales and her team from the Southern Philippines Agribusiness and Marine and Aquatic School of Technology (SPAMAST), Malita, Davao Occidental developed FishHav, An Android based Application for Enhancing Aquaculture Efficiency. Manual systems are simple and accessible to all farmers, but they are less efficient and more error-prone. Digital systems, on the other hand, are more accurate, time-saving, and offer greater functionality but require access to technology and training.

5.0 Challenges Faced by Fish Farmers in Record-Keeping

5.1 Lack of Awareness and Training

Many fish farmers in Nigeria are not aware of the importance of record-keeping or lack the training required to maintain accurate records. This leads to poor documentation practices and limits the ability to manage farm operations effectively (Ibrahim et al., 2018; Omotesho et al., 2022).

5.2 Limited Access to Technology

Access to digital tools and the internet remains a challenge in many rural areas, making it difficult for farmers to adopt modern record-keeping methods (Ashley–Dejo et al., 2023).

5.3 Time and Labor Constraints

Farmers often face time and labor constraints that make it difficult to prioritize record-keeping (Ashley–Dejo et al., 2023). The daily demands of farm operations may leave little time for maintaining detailed records (Amos & Bolorunduro, 2000).

5.4 Financial Limitations

The cost of purchasing record-keeping tools, whether digital or manual, can be a barrier for small-scale farmers with limited financial resources.

5.5 Cultural Barriers and Perceptions

In some cases, farmers may view record-keeping as unnecessary or too complex, especially if they have been operating without it for years (Agbebi, 2012).

6.0 The Impact of Poor Record-Keeping on Fish Farming in Nigeria

6.1 Loss of Efficiency and Profitability

Poor record-keeping leads to inefficiencies in farm management, such as overfeeding, underfeeding, or mismanaging farm resources. This can result in reduced profitability.

6.2 Inability to Access Credit and Financial Services

Banks and financial institutions often require detailed records when assessing loan applications. Farmers without proper records may struggle to access the financial support needed for farm expansion or improvements.

6.3 Poor Decision-Making and Management of Farm Resources

Without accurate records, farmers may make uninformed decisions about stocking densities, feed quantities, or harvesting schedules, leading to suboptimal production outcomes.

6.4 Regulatory and Compliance Issues

Poor record-keeping can lead to non-compliance with government regulations, which may result in penalties or the closure of the farm.

7.0 Recommendations for Improving Record-Keeping Practices

Agricultural extension services play a crucial role in educating fish farmers about the importance of record-keeping and providing training on how to maintain accurate records. The Nigerian government has introduced several policies aimed at improving farm management practices, including record-keeping, as part of broader agricultural reforms. Government programs and private sector initiatives offer financial incentives and support to farmers who demonstrate good management practices, including record-keeping. Efforts should be made to increase awareness and provide training on the importance of record-keeping. Capacity-building programs can help farmers develop the skills needed to maintain accurate records. The government and private sector should work together to promote the adoption of digital record-keeping tools. Subsidies or financial assistance for purchasing these tools could help increase uptake among small-scale farmers. Creating standardized templates for record-keeping would simplify the process and ensure that all farmers maintain consistent and comparable records. Collaboration between government agencies, financial institutions, and the private sector can provide the necessary support and resources to improve record-keeping practices.

8. Conclusion

Record-keeping is a critical component of effective farm management, yet many fish farmers in Nigeria struggle with maintaining accurate records due to various challenges. Poor record-keeping negatively impacts farm productivity, profitability, and compliance with regulations. Improving record-keeping

practices is essential for the continued growth and sustainability of Nigeria's fish farming industry. It will enable farmers to make better decisions, access financial services, and comply with regulatory requirements. Further research is needed to explore the most effective methods for promoting record-keeping among fish farmers, particularly in rural areas with limited access to technology. Additionally, the impact of government and institutional interventions on record.

References

Abd El-Hack, M. E., El-Saadony, M. T., Nader, M. M., Salem, H. M., El-Tahan, A. M., Soliman, S. M. and Khafaga, A. F. (2022). Effect of environmental factors on growth performance of Nile tilapia (*Oreochromis niloticus*). *Int J Biometeorol.* 66 (11): 2183 – 2194. doi: 10.1007/s00484-022-02347-6.

Agbebi, F.O. (2012). Assessment of the Impact of Extension Services on Fish Farming in Ekiti State, Nigeria. *Asian J. Agric. Rur. Dev.,* 1(2): 62-68.

Aladejebi, O. and Oladimeji, J. A. (2019). The Impact of Record Keeping On the Performance of Selected Small and MediumEnterprises in Lagos Metropolis. Journal of Small Business and Entrepreneurship Development, 7 (1): 28 – 40.

Amos T. T. and Bolorunduro P.I (2000). Economics of aquaculture production. Extension Bulletin No 107, Fisheries Series No. 5, National Agricultural Extension and Research Liaison Services, Ahmadu Bello University, Zaria, 1 – 30..

Andarsari, P. R. and Justita, D. (2018). Implementation of financial records in small and medium enterprises. Jurnal Ilmiah Bisnis dan Ekonomi Asia, 12: 59–65.

Article, G. (2023) What farmers should know about achieving sustainable certification. Medium. https://medium.com/@generalarticle/what-farmers-should-know-about-achieving-sustainable-certification-8a1695cb08c8

Ashley-Dejo, S. S., Oyetunji, O. T., Sule, S. O. and Fabiyi, O. O. (2023). Factors Influencing choice of record keeping among small-scale fish farmers in Osun State Nigeria. Nigerian J. Anim. Sci., 25 (3): 47-56.

Basir, M.S., Buckmaster, D., Raturi, A. and Zhang, Y. (2024). From pen and paper to digital precision: a comprehensive review of on-farm recordkeeping. Precision Agric., 25: 2643–2682. https://doi.org/10.1007/s11119-024-10172-7

Carlson, J. E. (1988). Farmers' Perceptions about the Management of Their Farms. The Journal of the American Society of Farm Managers and Rural Appraisers, 52: 91-96.

Cui, L. and Wang, W. (2023). Factors Affecting the Adoption of Digital Technology by Farmers in China: A Systematic Literature Review. *Sustainability,* 15(20):14824. https://doi.org/10.3390/su152014824.

Eitzinger, A., Cock, J., Atzmanstorfer, K., Binder, C. R., Läderach, P., Bonilla-Findji, O., Bartling, M., Mwongera, C., Zurita, L. and Jarvis, A. (2023). GeoFarmer: A monitoring and feedback system for agricultural development projects. Computers and Electronics in Agriculture, 158: 109-121. https://doi.org/10.1016/j.compag.2019.01.049.

Gloy, B.A. and LaDue, E.L. (2003), "Financial management practices and farm profitability". Agricultural Finance Review, 63: 157-74

Gloy, B.A., Hyde, J. and LaDue, E.L. (2002). Dairy farm management and long-term farmfinancial performance". Agricultural and Resource Economics Review, 31: 233 – 247.

Ibrahim, M. K., Adisa, R.S., Ahmed, T. A. and Ebenehi, O. (2018). Determinants of farm record keeping among small scale poultry farmers in Kogi State, Nigeria. Int. J. Agric. Sci. Res. Technol. Exten. Edu. Syst., 8(4): 185-189.

James, S. O. (2019). Farm records, bookkeeping and agricultural data: a case study of small scale farmers in Nasarawa State, Nigeria. PAT, 15 (1): 23-32.

Johnson, O. J., Ore, O. O., Onmakpo, E. G., Onyenandu, N. N. and Ugochi, C. N. (2024). Impact of cash book maintenance on the performance of small and medium-scale enterprises (SMES) in Lagos State, Nigeria. African Banking and Finance Review Journal, 17 (17): 299 – 308.

Kaluvakuri, S. and Amin, R. (2018). From Paper Trails to Digital Success: The Evolution of E-Accounting. Asian Accounting and Auditing Advancement, 9 (1): 73 – 88.

Kusserow, R. P. (2020). Effective Compliance Records Management Program. https://www.compliance.com/resources/effective-compliance-records-management-program/ – accessed 17th October, 2024.

Kuteesa, A. and Kyotalimye, M. (2019). Documentation and data handling: How can Africa promote record keeping and investment in data management? Afr. J. Food Agric. Nutr. Dev., 19(1):14171-14189 DOI: 10.18697/ajfand.84.BLFB1014

Maddali, K., Roy, I., Sinha, K., Gupta, B., Hexmoor, H. and Kaluvakuri, S. (2018). EfficientAny Source Capacity-Constrained Overlay Multicast in LDE-Based P2P Networks. IEEE International Conference on Advanced Networks and Telecommunications Systems (ANTS), Indore, India, 1-5. https://doi.org/10.1109/ANTS.2018.8710160.

Okoko, A. C. and Eyo, V. O. (2023). Entrepreneurship in fish production for sustainable livelihood and economic growth in Akwa Ibom State, Nigeria. IN: Ayandele, I. A.; Udom, G. N.; Effiong, E. O.; Etuk, U. R.; Ekpo, E. I.; Inyang, U. G.; Edet, G. E.; and Moffat, I. (Editors). Contemporary discourse on Nigeria's economic profile, A Festschrift in honour of Prof. Nyaudoh, U. Ndaeyo. A publication of the University of Uyo, Uyo, Akwa Ibom State, pp. 553 – 561.

Olaifa, E. S., Osabuohien, E. S. and Issahaku, H. (2022). Enhancing fish production for food security in Nigeria. Materials Today: Proceedings, 65 (3): 2208 – 2214. https://doi.org/10.1016/j.matpr.2022.06.243

Omotesho, K. F., Fatodu, P. A. and Ajibade, T.B. (2022). Farm record keeping behaviour of rural farming youths in Ekiti State, Nigeria. Sarhad Journal of Agriculture, 38(1): 92-102. https://dx.doi.org/10.17582/journal.sja/2022/38.1.92.102

Rotz, S., Duncan, E. Small, M., Botschner, J., Dara, R., Mosby, I., Reed, M. and Fraser, E.D.G. (2019). The Politics of Digital Agricultural Technologies: A Preliminary Review. Sociol. Rural, 59: 203–229.

Rutto, D. K. L., Koome, M. & Kibusi, L. F. (2016). Assessment of the Efficiency of Farm Record Keeping In Kenya: A Case Study of Farmers in Cherangani Division Trans-Nzoia East District, Kenya. International Journal of Scientific Research in Science and Technology (IJSRST), 2 (6): 101 – 105.

Saba, A. O., Eyo, V. O., Elegbede, I. O., Fakoya, K. A., Ojewole, A. E., Dawodu, F. O., Adewale, R. A., Amal, M. N. (2024). Sustaining the Blue Bounty: Fish Food and Nutrition Security in Nigeria's Evolving Blue Economy. AIMS Agriculture and Food, 9(2): 500–530. http://dx.doi.org/10.3934/agrfood.2024029

Saini, S. (2016). Record keeping at ornamental fish production and marketing establishments. In book: Best Management Practices for Freshwater Ornamental Fish Production, Chapter: 12, Publisher: NFDB Hyderabad. Editors: A.K.Jain V P Saini anf Vaneet I K, Pg. 154 – 164.

Tham-Agyekum, E. K., Appiah, P., and Nimoh, F. (2010). Assessing Farm Record Keeping Behaviour among Small-Scale Poultry Farmers in the Ga East Municipality. Journal of Agricultural Science, 2(4). https://doi.org/10.5539/jas.v2n4p52

Undutimi, J.D. (2013). Record Keeping Among Small Farmers in Nigeria: Problems and Prospects. International Journal of Scientific Research in Education, 6(2): 214 – 220.

Winkler, M.M. (2008). Farm Accounting from the Viewpoint of the Farmer Manager. Journal of the American Society of Farm Managers and Rural Appraisers, 2: 27

Wolff, F., Salladarré, F. and Baranger, L. (2024). A classification of buyers in first-sale fish markets: Evidence from France. Fisheries Research, 275:107022. https://doi.org/10.1016/j.fishres.2024.107022

Yadeta, W., Habte, D., Kassa, N., Befekadu, B. and Fetene, E. (2020). Dairy Farm Record Keeping with Emphasis on its Importance, Methods, Types, and Status in Some Countries. International Journal of Research Studies in Biosciences, 8 (4): 16 – 25.

IJMIR