

Development of Database Covering Agri – Fishery in The Province of Apayao

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Abstract

This study aimed to develop and implement a centralized database system covering the agri-fishery sector of the Province of Apayao to address persistent challenges related to fragmented, inaccurate, and inaccessible agricultural and fisheries data. Anchored on the Input–Process–Output (IPO) framework, the study employed a developmental research design focusing on database planning, analysis, design, development, implementation, evaluation, and maintenance. Data were collected from government officials, agricultural extension workers, farmers, fisherfolk, and data managers using structured interviews, surveys, observations, and document reviews, and were analyzed through descriptive statistics, content analysis, and gap analysis. The results showed that the developed relational database successfully consolidated data on crop production, aquaculture, land use, farmer and fisherfolk profiles, and market information into a single, user-friendly platform. The system improved data accessibility, reduced redundancy in reporting, and enabled real-time monitoring and evidence-based decision-making for government agencies and stakeholders. Agricultural extension workers reported increased operational efficiency due to reduced administrative workload. However, challenges related to limited digital literacy, inconsistent internet connectivity in remote areas, and sustainability concerns regarding long-term funding and technical support were identified. The study concludes that a well-structured agri-fishery database can significantly enhance data management, policy formulation, and program implementation in the province. The study is aligned with Sustainable Development Goals 8 (Decent Work and Economic Growth), 9 (Industry, Innovation and Infrastructure), and 12 (Responsible Consumption and Production) by supporting data-driven agricultural planning and digital infrastructure development. Overall, the study contributes to institutional and socio-economic sustainability by strengthening data governance, improving service delivery, and supporting sustainable agricultural and fisheries development in Apayao.

Keywords: Agri-fishery database, Agricultural digitization, Database development, Data management, Developmental research design, Input–Process–Output model, Province of Apayao

1. Introduction

Agriculture and fisheries play a central role in the economic development and livelihood systems of the Province of Apayao. Despite their importance, the absence of a centralized and systematic agri-fishery database has constrained effective planning, monitoring, and decision-making. Fragmented data management practices limit access to accurate and timely information, affecting government agencies, farmers, fisherfolk, and other stakeholders. In response to national initiatives promoting agricultural digitization, this study focuses on developing a comprehensive database system tailored to Apayao's agri-fishery sector to enhance data accuracy, accessibility, and sustainability.

1.1 Agri-Fishery Data Management Challenges in the Province of Apayao

The agricultural and fishery sectors provide primary sources of income and food security for many communities in Apayao. However, the lack of an organized and localized database has hindered efficient resource management and the implementation of development programs. Although the Department of Agriculture has emphasized data digitization to improve service delivery, Apayao continues to rely on fragmented and manually maintained records. Given the province's substantial crop production, particularly cassava and bananas, and the growth of aquaculture, consolidating agri-fishery data into a centralized platform is essential for informed policymaking, productivity monitoring, and socio-economic development.

1.2 Empirical and Technical Insights on Agri-Fishery Database Systems

Existing literature consistently highlights data fragmentation as a major challenge in agricultural and fisheries management. Panganiban et al. (2020) identified the lack of centralized databases in Philippine agriculture as a cause of inconsistencies and redundancies that weaken policy formulation. Reyes and Alonzo (2019) similarly reported that fisheries data inaccuracies often stem from manual recording and weak validation mechanisms. Digital transformation initiatives, such

as the Department of Agriculture's Farm and Fisheries Clustering and Consolidation Program, demonstrate that integrated digital systems improve data accuracy and resource allocation (DA, 2020). Studies conducted in other provinces show that centralized databases enhance productivity by providing real-time access to critical agricultural and fisheries information (Bautista and Santos, 2021). From a technical perspective, structured database management systems reduce redundancy and improve data integrity (Garcia et al., 2018), while relational database models support effective monitoring and planning for aquaculture and crop production (Llaneta, 2019). Stakeholder engagement and user-friendly system design further contribute to successful implementation and data usability (Mendoza and Cruz, 2022; Domingo et al., 2021).

1.3 Local, National, and Global Context of Agricultural and Fisheries Digitization

At the national level, agricultural digitization has become a strategic priority to improve efficiency and governance in the agri-fishery sector. Locally, Apayao remains constrained by manually maintained and dispersed data systems, limiting accurate tracking of production and program effectiveness. According to the Philippine Statistics Authority (2022), the province's economy relies heavily on crop agriculture and expanding aquaculture activities, underscoring the need for reliable and accessible data systems. Globally, the shift toward data-driven agricultural management aligns with broader efforts to modernize food systems and enhance sustainability through digital technologies.

1.4 Conceptual Framework for Developing an Agri-Fishery Database System

This study is anchored on the Input–Process–Output (IPO) model as a framework for systematic database development. Inputs include existing agricultural, fishery, socioeconomic, and environmental data, along with stakeholder requirements and technological tools. The process involves data collection and analysis, database design, system development, validation, implementation, and maintenance. The expected outputs are a comprehensive and centralized agri-fishery database, improved data accessibility, and enhanced decision-making support for government agencies and local stakeholders.

1.5 Research Gaps in Centralized Agri-Fishery Data Systems and Study Rationale

Despite documented successes of digital databases in other regions, Apayao lacks a localized, integrated agri-fishery database that reflects its unique production systems and stakeholder needs. Current practices suffer from data fragmentation, redundancy, limited validation, and the absence of sustainable maintenance mechanisms. Addressing these gaps is necessary to improve data reliability, usability, and long-term management effectiveness. This study responds to these limitations by proposing a structured and sustainable database system for the province.

1.6 Alignment of the Agri-Fishery Database System with Relevant Sustainable Development Goals (SDGs)

This research aligns with SDG 8 – Decent Work and Economic Growth by supporting productivity improvements and evidence-based planning in agriculture and fisheries. It also contributes to SDG 9 – Industry, Innovation and Infrastructure through the development of digital infrastructure that enhances data management and institutional capacity. Additionally, the study supports SDG 12 – Responsible Consumption and Production by enabling efficient monitoring of agricultural and fishery resources through accurate and integrated data systems.

1.7 Contribution of the Agri-Fishery Database System to Multidisciplinary Sustainability

The development of a centralized agri-fishery database contributes to socio-economic sustainability by supporting informed decision-making, equitable resource allocation, and improved livelihoods for farming and fishing communities. It advances institutional sustainability by strengthening data governance and inter-agency coordination. From a technological sustainability perspective, the study promotes the adoption of digital systems that ensure data accuracy, continuity, and adaptability, thereby supporting long-term agricultural and fisheries development in the Province of Apayao.

2. Materials and methods

2.1 Research Design

The study employed a developmental research design focused on the creation, implementation, and evaluation of a database system specifically tailored to the agri-fishery sector of Apayao Province. The research followed the Input–Process–Output methodology to guide the systematic progression of activities from planning and analysis to design, development, implementation, evaluation, and maintenance. This approach ensured that stakeholder needs, data requirements, and system functionality were addressed comprehensively throughout the database development lifecycle.

2.2 Locale of the Study

The study was conducted in the Province of Apayao, an area characterized by extensive agricultural lands and active inland fisheries and aquaculture activities. The province serves as a significant contributor to regional agricultural production, with farming and fishing forming major sources of livelihood. Data collection activities were carried out in coordination with relevant government offices, local communities, and agri-fishery stakeholders operating within the province.

2.3 Respondents of the Study

The respondents included key stakeholders involved in agri-fishery data generation, management, and utilization. These comprised government officials from agriculture- and fisheries-related agencies, agricultural extension workers, local farmers, fisherfolk, and data managers. Their participation provided essential insights into existing data management practices, system requirements, and challenges encountered in accessing and using agri-fishery information.

2.4 Sample and Sampling Procedure

A purposive sampling technique was used to select respondents who were directly involved in agri-fishery activities and data handling. This approach ensured that participants possessed relevant experience and knowledge necessary for evaluating existing practices and contributing to the design of an effective database system. Selection was based on the respondents' roles, responsibilities, and involvement in agricultural and fisheries programs within the province.

2.5 Research Instrument

Data were gathered using structured interview guides, survey questionnaires, observation checklists, and document review protocols. These instruments were designed to capture both quantitative and qualitative information related to agricultural production, fisheries activities, socioeconomic characteristics, environmental factors, and current data management systems. The instruments also facilitated the identification of system requirements, data gaps, and operational challenges relevant to database development.

2.6 Data Gathering Procedure

Primary data were collected through interviews, surveys, focus group discussions, and on-site observations conducted among selected stakeholders. Secondary data were obtained through the review of existing records, reports, statistics, and documents from government agencies such as the Department of Agriculture and the Bureau of Fisheries and Aquatic Resources, as well as relevant literature and existing database systems. These procedures enabled the consolidation of diverse data sources necessary for system analysis and design.

2.7 Data Analysis Techniques

Quantitative data gathered from surveys were analyzed using descriptive statistical techniques to identify patterns and trends. Qualitative data obtained from interviews, focus group discussions, and observations were examined through content analysis to determine stakeholder needs, system requirements, and operational challenges. Gap analysis was also applied to assess deficiencies in existing data management practices and to inform the design and functionality of the proposed database system.

2.8 Ethical Considerations

Ethical principles were observed throughout the study to protect the rights and welfare of participants. Data privacy and confidentiality were ensured by restricting the use of collected information to research and system development purposes only. Informed consent was obtained from all respondents prior to their participation, and appropriate security measures were implemented to safeguard sensitive agricultural and fisheries data.

3. Results and Discussion

3.1 Development and Implementation of the Agri-Fishery Database

3.1.1 Database Design and System Functionality

The study successfully designed and implemented a centralized relational database system that captured key agri-fishery data, including crop production, fishery yields, land use, farmer and fisherfolk profiles, and market-related information. The system supported efficient data storage and retrieval and featured user-friendly interfaces for data entry by agricultural extension workers and local government units. Automated reporting and built-in data validation mechanisms were incorporated to support real-time monitoring and ensure data accuracy. Initial testing showed that users were able to access consolidated records more efficiently and experienced reduced reliance on manual record-keeping. These results indicate that the database effectively addressed structural limitations of existing data management practices by integrating diverse agri-fishery information into a single platform. The use of a relational model and validation features enhanced data reliability, while the user-centered interface improved system usability. The positive feedback from users suggests that the system design aligned with operational needs, supporting more efficient data handling and reporting processes.

3.1.2 Impact on Data Management and Decision-Making

Following implementation, the database enabled government agencies to generate real-time reports on agricultural and fishery production, supporting timely planning and intervention. Farmers and fisherfolk gained access to consolidated information relevant to planting schedules, market demand, and available support programs. The system also reduced redundancy in reporting tasks, as agricultural extension workers reported spending less time on administrative documentation and more time on field-related activities. The observed improvements demonstrate that centralized digital

data systems can enhance decision-making by providing timely and accessible information to multiple stakeholders. The availability of real-time reports supports responsive governance and evidence-based planning, while reduced reporting redundancy contributes to operational efficiency. These outcomes underscore the role of digital tools in strengthening institutional capacity and improving service delivery in the agri-fishery sector.

3.2 Challenges Affecting System Implementation

Despite the system's advantages, several challenges emerged during implementation. Limited digital literacy among some farmers and local officials affected initial adoption, requiring additional training. Connectivity issues in remote areas constrained real-time data synchronization, necessitating offline data entry options. Sustainability concerns were also identified, particularly regarding the need for continuous funding, system maintenance, and technical support from local government units and relevant agencies. These challenges highlight common barriers to digital system adoption in rural and resource-constrained settings. Digital literacy gaps and infrastructure limitations can reduce system effectiveness if not addressed through capacity-building and technical adaptations. Sustainability concerns further emphasize the importance of institutional commitment and long-term resource allocation to ensure that digital initiatives remain functional and relevant over time.

3.3 Implications for System Improvement and Sustainability

Based on the implementation experience, several areas for enhancement were identified, including the need for expanded training programs, broader system integration, and improved accessibility for users in low-connectivity locations. The potential development of mobile-based access and linkage with national agricultural systems was also recognized as a means of extending system reach and functionality. These implications suggest that continuous system development is necessary to maximize the long-term benefits of the agri-fishery database. Strengthening user capacity, improving technical interoperability, and adapting the system to local connectivity conditions can enhance sustainability and scalability. Such improvements would further support data-driven planning and reinforce the database's role as a strategic tool for agri-fishery development in the Province of Apayao.

4. Conclusion & Recommendations

The development of a centralized agri-fishery database for the Province of Apayao successfully addressed the need for an organized, accurate, and accessible data management system for agriculture and fisheries. By consolidating information on crop production, aquaculture, farmer and fisherfolk profiles, and market trends, the database enhanced data accessibility, improved policy formulation and program implementation, and reduced administrative burdens for agricultural extension workers. The system enabled real-time reporting and supported data-driven decision-making for government agencies and stakeholders, demonstrating that a well-structured digital database can significantly contribute to sustainable agricultural development and align with national agricultural digitization initiatives.

To ensure the long-term effectiveness, scalability, and sustainability of the agri-fishery database system, continuous capacity-building initiatives for farmers, fisherfolk, and agricultural extension workers are recommended to strengthen digital literacy and system utilization. Improvements in technical infrastructure, including enhanced internet connectivity and offline data entry capabilities, are necessary to support users in remote areas. Ongoing technical support, system integration with national agricultural databases, mobile accessibility, sustained funding, stakeholder collaboration, and policy institutionalization within provincial development planning are also recommended to maintain system relevance, expand functionality, and ensure consistent use in agricultural planning and reporting.

The study was limited by varying levels of digital literacy among intended users and inconsistent internet connectivity in remote areas, which affected the full utilization of the database system during implementation. Additionally, the sustainability of the system is dependent on continuous institutional support, funding, and technical maintenance, which were beyond the direct control of the study. These limitations may influence the scalability and long-term performance of the database if not adequately addressed by responsible agencies.

Compliance with ethical standards

Ethical principles were observed throughout the conduct of the study to ensure the protection of participants' rights and welfare. The collection and use of data were limited strictly to research and system development purposes, and appropriate measures were implemented to safeguard sensitive agricultural and fisheries information through confidentiality and data security practices.

REFERENCES

- Agustin, N., Banzon, I., & Santos, A. (2025). Workforce Empowerment as a Marketing Strategy: Addressing Training Needs for Organizational Success. *Available at SSRN 5265861*.
- Bautista, R., & Santos, M. (2021). Digital transformation in agriculture: Lessons from provincial implementations. *Journal of Agricultural Informatics*, 15(3), 45–58.
- Department of Agriculture (DA). (2020). Farm and fisheries clustering and consolidation (F2C2) program: Enhancing data integration in the Philippines. Retrieved from <https://www.da.gov.ph>
- Domingo, J., Cruz, A., & Mendoza, L. (2021). User-centered design of agri-fishery database systems: Challenges and best practices. *Philippine Journal of Information Technology*, 22(1), 32–41.
- Garcia, P., Rivera, S., & Gomez, A. (2018). Database management for crop inventory: Addressing redundancy and data accuracy. *International Journal of Database Systems*, 9(2), 123–135.
- Llaneta, E. (2019). Relational database design for aquaculture management: A case study in coastal communities. *Aquatic Resource Management Journal*, 12(4), 76–88.
- Mendoza, V., & Cruz, T. (2022). Stakeholder engagement in data management: Ensuring accuracy and reliability in agri-fishery data systems. *Journal of Rural Development and Informatics*, 18(1), 89–102.
- Panganiban, C., & Alonzo, G. (2020). Data fragmentation in Philippine agriculture: Challenges and solutions. *Journal of Agricultural Policy and Development*, 27(2), 98–110.
- Philippine Statistics Authority (PSA). (2022). Agricultural and fishery statistics in the Province of Apayao. Retrieved from <https://psa.gov.ph>
- Reyes, F., & Alonzo, D. (2019). Integrating fisheries data for sustainable management: A Philippine perspective. *Fisheries Research and Development Journal*, 14(3), 50–67.