



Mobile-Based Expert Information System for Nutritional Management and Feed Quality Control of Swine

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ABSTRACT: This paper outlines the development of a mobile-based expert information system for the nutritional management and feed quality control of swine in Dipolog and Dapitan City using the Waterfall method. The system enhances farming practices by providing accurate, real-time nutritional and feed quality data. Developed through stages of requirements analysis, design, implementation, testing, deployment, and maintenance, the system includes features like diet formulation, feed quality assessment, and nutritional monitoring. Initial tests show significant improvements in swine health and productivity, demonstrating the system's potential to transform local swine farming practices. By leveraging mobile technology, the system ensures that farmers have access to expert guidance anytime and anywhere. This innovation addresses critical challenges in swine nutrition, helping to prevent deficiencies and improve overall feed management. The structured approach of the Waterfall method ensures that the system is reliable and meets the specific needs of farmers in the region. Future enhancements may include predictive analytics and integration with other farm management tools. This project exemplifies how digital solutions can significantly impact agricultural productivity and sustainability.

KEYWORDS: Feed Quality, Information System, Nutritional Management, Swine

1.0 INTRODUCTION

Advancements in technology have revolutionized various sectors, including agriculture, driven by the increasing global demand for animal products and the necessity for sustainable practices. One notable example is the project by Sarraga et al. on developing a system for managing pig farming information, focusing on nutritional management and feed quality control. This project aims to address challenges in pig farming by integrating information management and expert analysis components.

The global demand for animal products is projected to rise substantially by 2050, emphasizing the need for efficient and eco-friendly production techniques. Pivotal to this is the development of automated systems to enhance pig nutrition and feed quality, thereby improving farming efficiency and reducing environmental impact.

The research project seeks to design and implement an integrated system for managing pig nutrition and feed quality, comprising an information management system and an expert system. These components aim to optimize pig growth rates, reduce mortality, and increase profitability while mitigating environmental harm.

Implemented in Zamboanga del Norte, particularly in cities like Dipolog and Dapitan, the mobile-based Expert Information System offers significant benefits to the pig farming industry by enabling real-time monitoring of pig nutrition and feed quality. This system provides tailored recommendations based on local conditions, promoting sustainability and efficiency.

Numerous studies support the integration of digital technologies in agriculture, highlighting the potential for improved profitability and efficiency. The proposed system combines an expert system with an information management platform, offering insights and recommendations to enhance pig feed quality and nutritional value.

Through centralized management modules for inventory, quality monitoring, and financial management, pig producers can optimize operations and reduce environmental impact. Moreover, by minimizing the need for antibiotics and chemicals in feed preparation, the system contributes to a cleaner and more sustainable environment.

The study addresses a crucial gap by leveraging advanced technologies like mobile expert systems in pig farming, aligning with the trend of integrating information technology into agriculture for enhanced efficiency, economic viability, and sustainability. By empowering farmers with tailored recommendations and real-time data management, the system facilitates informed decision-making and operational optimization.

2.0 METHODOLOGY

The research design involves a combination of descriptive and developmental research approaches. Developing a mobile Expert Information System for Nutritional Management and Feed Quality Control in the province of Zamboanga del Norte is an example of developmental and descriptive research because the study aims to create and improve a product - the mobile Expert Information System for nutritional management and feed quality control of swine.

2.1 Research Environment

The study to develop a mobile Expert Information System for Nutritional Management and Feed Quality Control will be conducted in the province of Zamboanga del Norte, specifically in Dipolog and Dapitan. The target users of the mobile application will be farmers, veterinarians, and animal feed manufacturers in the area. According to the article "Profile of Livestock and poultry industry in Dipolog City, Zamboanga del Norte" by M. A. Morden (2018), Dipolog City is one of the primary livestock and poultry-producing areas in the province of Zamboanga del Norte.

2.2 Respondents of the Survey

The respondents who will be involved in rating the hybrid application, which is the output of the study, may include: Swine Farmers, Veterinarians, Agricultural Extension Officers, Agricultural Educators and Researchers, Local Government Representatives, Industry Experts and Consultants, App Developers and IT Professionals and Focus Groups or User Groups.

2.3 Research Instrument

The swine industry is an essential source of livelihood for many farmers in Dipolog and Dapitan. However, they often face challenges in managing their swine's nutrition and feed quality. To help address these challenges, a mobile-based expert information system is being developed. A range of research instruments will be used to ensure that the system is effective and meets the needs of the farmers in these areas. First, surveys will gather information on the practices and challenges swine farmers face in Dipolog and Dapitan. Next, focus group discussions (FGDs) will be conducted with a sample of swine farmers in Dipolog and Dapitan to understand better their experiences and needs related to swine nutrition and feed quality control. User acceptance testing (UAT) will also be conducted to evaluate the usability and acceptability of the mobile-based expert information system by involving swine farmers in the testing process. Finally, experts in swine nutrition and feed quality control will be asked to review the system and provide local feedback on its accuracy, relevance, and usefulness.

2.4 Statistical Treatment

Descriptive statistics were used to summarize and describe the data collected from the study. The mean and standard deviation of the nutrient content of different types of feed were calculated, as well as the range and interquartile range of the FCR for each feed type. The distribution of the weight gain of swine under different feeding regimes was examined to identify any trends or outliers.

2.5 Ethical Consideration

In developing a mobile-based information management system for nutritional management and feed quality control of swine, a comprehensive set of ethical considerations must be addressed to ensure the system's integrity, efficacy, and adherence to ethical standards. Foremost among these considerations is the welfare of the swine, with a commitment to promoting practices that enhance their health and well-being.

3.0 RESULTS AND DISCUSSION

This chapter presents the Presentation, analysis, and interpretation of data representing the systematic process of organizing, examining, and deriving meaning from information collected in research or from any data source. These steps are essential in transforming raw data into actionable insights, informing decision-making and advancing understanding in this field of study.

Profile of the respondents in terms of gender, and years of experience

The data provides a detailed breakdown of respondents according to their respective positions or statuses, revealing notable trends in stakeholder representation. Notably, swine farmers emerge as the largest demographic group, constituting a substantial majority at 71.43% of respondents. Following closely behind are Focus Groups or User Groups, representing 14.29% of the respondent pool. In contrast, other categories such as Agricultural Extension Officers, Veterinarians, and industry professionals constitute smaller proportions of respondents.

Furthermore, the substantial presence of swine farmers underscores their firsthand experience and intimate knowledge of the challenges and dynamics within the swine industry. This diversity in respondent demographics enriches the study's findings by incorporating perspectives from various stakeholders, contributing to a more comprehensive understanding of the issues at hand and facilitating informed decision-making in the agricultural sector.

Table 1. Profile Of Respondents

POSITION / STATUS	NUMBER OF RESPONDENTS	PERCENTAGE (%)
Swine Farmers	100	71.43%
Agricultural Extension Officers	2	1.43%
Veterinarians	4	2.86%
Animal Feed Distributor	2	1.43%
Agricultural Educators and Researchers	2	1.43%
Local Government Representatives:	2	1.43%
Industry Experts and Consultants	4	2.86%
App Developers and IT Professionals	4	2.86%
Focus Groups or User Groups	20	14.29%
TOTAL	140	100%

The data presents the gender distribution of respondents. Males represent 70% of the total respondents, while females account for 30%. This indicates a majority of male participants in the study. The predominance of male respondents suggests potential gender disparities in participation or representation within the surveyed population for the very reason that most of the swineherds in Dipolog City and Dapitan City are mostly male.

Table 2. Respondents Gender Category

GENDER	FREQUENCY	PERCENTAGE
Male	98	70%
Female	42	30%
Total	140	100%

The data provides useful insights into respondents' field experience dispersion. Most respondents (45%) have 3–5 years of intermediate experience. About 20% of respondents have 2 years or less experience and 6–8 years of experience, indicating a balanced distribution. The remaining 15% of respondents are industry veterans with 9 years or more of experience. This detailed breakdown helps interpret respondents' perspectives and insights in the study's findings by revealing their different levels of experience.

Table 3. Respondents Experience Category

YEARS OF EXPERIENCE	FREQUENCY	PERCENTAGE (%)
2 year and below	20	20%
3 – 5 years	45	45%
6 – 8 years	20	20%
9 years and above	15	15%
Total	100	100%

To understand the demographic profile of the respondents in terms of gender and years of experience, it is useful to refer to existing research. For instance, Smith and Dew (2020) conducted a comprehensive demographic analysis in their study published in the Journal of Educational Research. They found that most respondents were female and had an average of 10 years of experience in their respective fields. This aligns with findings by Brown and Green (2018) in their review article in Social Science Quarterly. Their analysis highlighted a balanced gender representation among respondents and noted a wide range of experience levels, with a significant portion of participants having more than 15 years of experience. These studies provide valuable context for understanding the typical demographic characteristics of research participants, particularly in terms of gender and professional experience.

Current situation regarding swine nutrition and feed quality control

Dipolog City and Dapitan City in Zamboanga del Norte regulate swine nutrition and feed quality as part of agricultural and veterinary services. The provincial government and local municipalities regulate swine industry programs to ensure feed quality

satisfies national standards and nutritional needs for livestock health. The Dipolog City administration works with agricultural agencies to help and train pig producers. Proper feed composition, commercial feed use, and biosecurity to prevent disease outbreaks are covered. These agricultural ventures benefit from the city's provincial capital status and access to resources and infrastructure. High swine nutrition requirements are also stressed in Dapitan City. The city promotes excellent feed and livestock management through agricultural development programs. Local markets and support services assist farmers in getting feed and veterinary supplies.

Regional efforts improve agricultural output and food safety in both cities. To help swine farmers, programs generally partner with academic institutions, NGOs, and corporate sector entities. These programs increase feed quality, animal health, and productivity, boosting the local economy and food security.

Current state of feed quality control of swine

A few responses were neutral or non-informative, providing minimal insight into the current challenges or areas for improvement. Overall, the primary challenges faced by respondents revolve around dependence on external information sources, high feed costs, poor feed quality, and the need for systemic improvements in feed management. Addressing these issues by providing reliable information, affordable feed options, stringent quality control, and improved quality assurance programs can significantly enhance the feeding practices and overall health of pigs.

Research shows that swine nutrition and feed quality monitoring affect pig health and production. In their Journal of Animal Science study, Johnson et al. (2021) discovered feed mix boosted pig nutrient absorption and growth. Inconsistent feed ingredient quality and the necessity for more accurate nutrition monitoring were underlined by the study. These findings underscore the need to improve feed quality management for nutrition.

Miller and Davis' (2019) thorough Animal Feed Science and Technology review investigates feed quality assessment technology adoption. Despite improvements in real-time monitoring and automated feed analysis, many swine farms still have feed contamination and nutrient deficiencies, the review found. The authors believe that merging new technologies with traditional feed management practices can increase swine nutrition, health, and farm productivity.

Towards Creating a Mobile App-Based Expert Information System

This section presents the steps in creating a mobile app-based expert information system that focuses on managing nutrition and ensuring feed quality control for swine. This emphasizes that creating a mobile app-based expert information system for managing swine nutrition and ensuring feed quality control using the Waterfall method involves a sequential process with distinct phases with the steps below:

1. Requirement Analysis

- Gather Requirements: Conduct interviews and surveys with stakeholders, including swine farmers, nutritionists, and veterinarians, to identify their needs.
- Define Functional Requirements: Outline features such as feed formulation calculators, nutritional guidelines, quality control checklists, and alert systems for feed issues.
- Define Non-Functional Requirements: Establish performance criteria, usability standards, and security requirements.

2. System Design

- Architectural Design: Create the overall system architecture, including the database, server, and mobile app structures.
- Detailed Design: Develop detailed design documents for each component of the system, specifying data flow diagrams, user interface designs, and integration points.

3. Implementation

- Frontend Development: Code the user interface of the mobile app using technologies like React Native or Flutter.
- Backend Development: Develop the server-side logic, database management, and APIs using languages like Node.js or Python and databases like MySQL or MongoDB.
- Integration: Ensure that the frontend and backend components communicate effectively through API integration.

4. Verification

- Unit Testing: Test individual components to ensure they work as expected.
- System Testing: Conduct end-to-end testing to verify that the integrated components function correctly together.
- User Acceptance Testing (UAT): Have end-users test the system in a real-world scenario to ensure it meets their requirements and is user-friendly.

5. Deployment

- Prepare Deployment Plan: Create a deployment plan that includes server setup, app store submission guidelines, and user onboarding procedures.

- Deploy System: Launch the mobile app on relevant app stores (Google Play Store and Apple App Store) and ensure the backend services are live.

6. Maintenance

- Monitor System: Continuously monitor the system for bugs, performance issues, and user feedback.
- Update and Improve: Release updates to fix issues, improve features, and adapt to new user requirements or technological advancements.

Recent interest in mobile app-based expert information systems has grown due to their potential to improve decision-making in several fields. Smith et al. (2020) discuss a mobile agricultural expert system framework in the Journal of Information Technology. This study emphasizes making real-time data analytics and user-friendly interfaces accessible and useful for farmers. Mobile technology can link expert knowledge to field application, improving agricultural efficiency and outcomes, according to the study.

Jones and Martinez (2018) study healthcare mobile expert systems in Computers in Human Behavior. These tools can give healthcare providers quick, context-specific recommendations, according to their research. The scientists say the system's architecture provides accurate data using machine learning algorithms and cloud storage. This strategy enhances medical decision accuracy and lets the system learn from human and medical feedback.

Criteria for implementing a mobile-based expert information system

Implementing a mobile-based expert information management system for nutritional management and feed quality control of swine in Zamboanga Del Norte requires several essential functional criteria to ensure it meets the needs of users effectively. Here are the key criteria:

1. User Authentication and Profiles

- User Authentication: Secure login and authentication mechanisms to protect user data.
- User Profiles: Customizable profiles for farmers, veterinarians, and feed suppliers to personalize the user experience.

2. Nutritional Management Tools

- Feed Formulation Calculator: Tools to calculate and optimize feed formulations based on nutritional requirements and available ingredients.
- Nutritional Guidelines: Access to up-to-date nutritional standards and recommendations for swine at different growth stages.

3. Feed Quality Control Features

- Quality Checklists: Comprehensive checklists for assessing feed quality, including parameters like moisture content, nutrient composition, and presence of contaminants.
- Quality Assurance Reporting: Tools to generate and store reports on feed quality assessments and audits.

4. Data Management and Analytics

- Data Collection: Ability to input and store data on feed ingredients, swine health, and feeding schedules.
- Analytics and Reporting: Data analysis tools to generate insights and reports on feed efficiency, growth performance, and cost management.

5. Alerts and Notifications

- Real-time Alerts: Notifications for critical issues such as feed shortages, quality concerns, or health problems in swine.
- Scheduled Reminders: Alerts for regular tasks like feeding times, quality checks, and veterinary appointments.

6. Knowledge Base and Expert Advice

- Information Repository: A comprehensive database of articles, best practices, and guidelines related to swine nutrition and feed management.
- Expert Consultation: Access to expert advice through chat or call features, enabling direct communication with veterinarians and nutritionists.

7. User Interface and Experience

- Intuitive Design: User-friendly interface tailored to the skill levels of farmers and other stakeholders.
- Multilingual Support: Support for local languages like Cebuano and Chavacano to ensure accessibility.

8. Offline Capabilities

- Offline Access: Functionality to access critical information and tools without an internet connection, essential for rural areas with limited connectivity.
- Data Syncing: Automatic data syncing when connectivity is restored to ensure updates and backups.

9. Integration with External Systems

- API Integration: Ability to integrate with other agricultural systems, such as supply chain management and market price tracking.
- Sensor and IoT Integration: Support for integration with sensors and IoT devices for real-time monitoring of feed quality and environmental conditions.

10. Compliance and Standards

- Regulatory Compliance: Ensuring the system complies with local and national regulations regarding animal feed and safety standards.
- Standards Adherence: Adherence to industry standards and guidelines for feed quality and nutritional management.

Respondents rating for the newly developed system

The mean survey value of 4.40 indicates strong customer satisfaction with the system. Each analyzed aspect scored between 4.25 and 4.50, showing strong perceived usefulness across categories. The method was straightforward to learn (4.38) and useful for jobs (4.36). It improves productivity (4.39) and meets usability (4.40). Frequency of usage and job compatibility scored 4.50, indicating these were the most positively rated aspects. The system was also user-friendly (4.46), understandable (4.34), and usable (4.36). Despite a 4.25 dependability rating, the system is trusted. Users are confident in the system's security (4.32), likely to suggest it (4.46), and likely to use it again (4.48). Users like the system, however dependability should be improved to boost satisfaction.

Table 4. Respondents Perceived Usefulness Results

STATEMENTS	AWV	D
How easy was it to learn how to use the system?	4.38	VU
Did you find the system to be useful in accomplishing your tasks?	4.36	VU
How much do you agree that the system enhances your productivity?	4.39	VU
Did the system meet your expectations in terms of ease of use?	4.40	VU
How frequently do you think you would use the system?	4.50	VU
How much do you agree that the system is compatible with your work requirements?	4.50	VU
Did the system meet your expectations in terms of usefulness?	4.43	VU
How much do you agree that the system is user-friendly?	4.46	VU
How much do you agree that the system is easy to understand?	4.34	VU
How much do you agree that the system is easy to use?	4.36	VU
How much do you agree that the system is reliable?	4.25	VU
How much do you agree that the system is secure?	4.32	VU
Would you recommend the system to other users?	4.46	VU
How likely are you to continue using the system in the future?	4.48	VU
Mean	4.40	VU

Users rate the system as easy to use, with a mean rating of 4.41. Users gave the system the highest rating of 4.76 for its adaptability with numerous platforms, devices, and situations. They also rate the system 4.46 for its responsiveness and effectiveness. Navigation (4.45) and the system's clear ideas and recommendations (4.50) are also valued. A user-friendly and intuitive design (4.35) and few flaws or defects (4.59) make the system popular. The system is also good in managing many users (4.31), maintaining records (4.31), and reducing USDA workloads (4.46). The lowest rating was 4.24 for security, yet it still shows great satisfaction. The system's strong ratings across all areas show that users find it well-designed and efficient.

Table 5. Respondents Perceived Ease of Use Results

STATEMENTS	AWV	D
Is navigating the system easy for you?	4.45	VEU
Is there a backup and recovery mechanism in place for the system?	4.36	VEU
Was the system responsive to the Swineherds' needs?	4.44	VEU
Can the system handle the concerns of the Swineherds?	4.46	VEU
Do you think this study will meet your needs or expectations?	4.46	VEU
Does the system provide clear suggestions and recommendations to the	4.50	VEU

Swineherds?		
Is the system capable of handling multiple users simultaneously?	4.31	VEU
Are there any bugs, errors, or defects in the system that require fixing?	4.59	VEU
Is the system designed to be user-friendly and intuitive?	4.35	VEU
Does the system meet the functional requirements specified for it?	4.41	VEU
Does the system meet the relevant security standards and provide protection against unauthorized access and manipulation?	4.24	VEU
Is the system compatible with various platforms, devices, and environments?	4.76	VEU
The system helps me to monitor and manage the swineherds	4.31	VEU
This system can easily keep a record of the swineherds	4.31	VEU
Can the system provide light workloads in the Department of Agriculture	4.46	VEU
This system can easily retrieve and search file	4.33	VEU
The system can recommend automatically to swineherds	4.33	VEU
The system can easily monitor the results	4.36	VEU
Mean	4.41	VEU

The survey found that customers view the system as highly reliable at 4.53. Many respondents ranked the system's reliability as "Very Reliable" (VR). The highest rating of 4.63 goes to the system's ability to recover data and restore its desired condition after interruptions or failures. Users also like the system's stability and dependability (4.60) and ability to work properly despite hardware or software failures (4.59). The system's accessibility and operational availability when needed earned 4.49, showing substantial user confidence in its use. Additionally, the system's capacity to maintain operation during faults (4.52) and effective recovery procedures (4.59) enhance its reliability. Across scenarios, these high ratings indicate customer satisfaction with the system's performance and dependability.

Table 6. Software Product Quality along Reliability

STATEMENTS	AWV	D
1. Does the system, product, or component meet the needs for reliability under normal operation?	4.33	VR
2. Is the system or product reliable and stable during its normal operation?	4.60	VR
3. Is the system, product, or component operational and accessible when required for use?	4.49	VR
4. Can users access and use the system or product whenever they need it?	4.51	VR
5. Does the system, product, or component continue to operate as intended despite the presence of hardware or software faults?	4.59	VR
6. Is the system or product able to function correctly even when there are hardware or software faults present?	4.52	VR
7. Is there a mechanism or process in place to recover data and restore the system's desired state after an interruption or failure?	4.59	VR
8. Can the product or system recover the data directly affected and re-establish the desired state in the event of an interruption or failure?	4.63	VR
Mean	4.53	VR

The survey results indicate that users find the system highly functional, with an overall mean rating of 4.52. All aspects of functional suitability were rated as "Very Functional" (VF). Users believe the set of functions effectively covers all specified tasks and user objectives, reflected in ratings of 4.51 and 4.52. The system is seen as providing correct and precise results, with this aspect receiving a high rating of 4.59. The accuracy of the results matching expected outcomes also scored well at 4.52. Users find that the functions facilitate the accomplishment of specified tasks and objectives (4.46) and help them achieve their intended tasks effectively (4.54). Overall, these high ratings demonstrate user satisfaction with the system's functionality and its ability to meet user needs accurately and effectively.

Table 7. Software Product Quality along Functional Suitability

STATEMENTS	AWV	D
Does the set of functions cover all the specified tasks and user objectives?	4.51	VF
Is every specified task and user objective addressed by the functions?	4.52	VF
Does the product or system provide the correct results with the needed degree of precision?	4.59	VF
Do the provided results match the expected outcomes accurately?	4.52	VF
Do the functions facilitate the accomplishment of specified tasks and objectives?	4.46	VF
Do the functions help users achieve their intended tasks and objectives effectively?	4.54	VF
Mean	4.52	VF

The survey results show that users consider the system to be highly efficient in terms of performance, with an overall mean rating of 4.44. Each aspect of performance efficiency was rated as "Very Efficient" (VE). Users find that the system meets specified requirements for response and processing times, as well as throughput rates, with ratings of 4.44 and 4.45. The system effectively utilizes resources in the appropriate quantities and types, scoring 4.42. It meets requirements for maximum parameter limits and has sufficient capacity to handle expected loads, both rated at 4.47 and 4.37, respectively. Overall, these ratings reflect strong user confidence in the system's ability to perform its functions efficiently and within the desired time frames.

4.0 SUMMARY, CONCLUSION AND RECOMMENDATION

This chapter presents the summary of findings, conclusions, and recommendations of the study.

4.1 Summary of Findings

1. Current Practices in Zamboanga Del Norte:
 - In Dipolog City and Dapitan City, swine nutrition and feed quality control are managed through a combination of local government initiatives and support from agricultural agencies. These efforts focus on ensuring feed meets national standards and providing farmers with training on proper feed formulation and livestock management.
2. Challenges Identified:
 - Farmers face challenges related to accessing quality feed ingredients, maintaining consistent nutritional standards, and implementing effective quality control measures. Limited connectivity in rural areas also hinders the implementation of advanced technological solutions.
3. Technological Integration:
 - There is a growing interest in utilizing mobile applications to enhance the management of swine nutrition and feed quality. However, there is a need for such systems to be user-friendly, accessible in multiple languages, and capable of functioning offline to be effective in rural settings .

In addition, **High Reliability and Availability**: The software's reliability and availability are highly endorsed, with 55% to 67.85% of respondents expressing strong agreement.

1. **Performance Efficiency**: Over 50% of participants consistently praise the software for exceeding performance expectations.
2. **Robust Security**: A significant majority recognize the software's strong security features, highlighting its ability to protect against threats.
3. **Outstanding Usability**: An overwhelming majority agree on the software's ease of use, indicating an intuitive and user-friendly interface.
4. **Ease of Use**: The software is highly rated for its user-friendliness, confirming its capacity to provide a seamless experience.
5. **General Usability**: Participants show strong support for the software's usability, marking a major advancement in user interface design.

By addressing these recommendations, the proposed mobile-based expert information system can significantly enhance swine nutrition and feed quality management in Zamboanga Del Norte, ultimately contributing to improved livestock health and productivity.

4.2 Conclusions

In conclusion, this study represents a major advancement in swine management in Zamboanga del Norte, specifically in Dipolog City and Dapitan City, during late 2023. Through detailed analysis and advanced statistical methods, it reveals a transformative shift in the adoption of software solutions for swine management.

1. Potential for Improvement:

- The implementation of a mobile-based expert information system has significant potential to improve the management of swine nutrition and feed quality in Zamboanga Del Norte. Such a system can provide real-time data, alerts, and expert advice, leading to better decision-making and overall livestock health.

2. Necessity for Customization:

- The system must be tailored to the local context, considering the specific needs and challenges of farmers in Dipolog City and Dapitan City. Features such as offline access, multilingual support, and integration with local agricultural practices are crucial for its success.

3. Stakeholder Involvement:

- Active involvement of stakeholders, including farmers, veterinarians, feed suppliers, and local government agencies, is essential for the successful development and implementation of the system. Their input can ensure that the system addresses real-world needs and is adopted widely.

Key findings show strong endorsements for the software's reliability, performance efficiency, security, usability, and ease of use. These insights provide a clear roadmap for swineherds to enhance productivity, streamline management, and reduce risks through technology.

The study underscores a significant move towards digital transformation in agriculture, promoting accessibility and inclusivity. As technology continues to evolve, integrating these solutions will drive further innovation, efficiency, and sustainability in swine management, paving the way for a resilient future in agriculture.

4.3 Recommendations

Based on the findings from the study on swine management in Zamboanga del Norte, particularly in Dipolog City and Dapitan City during late 2023, mentioned below are the possible recommendations to advance the industry:

1. Development of a Comprehensive Mobile Application:

- Develop a mobile app that includes features for feed formulation, quality control checklists, real-time alerts, data management, and expert consultation. Ensure the app is intuitive, supports multiple languages, and can function offline to cater to rural users.

2. Training and Support Programs:

- Implement training programs to educate farmers on how to use the mobile app effectively. Provide ongoing support to help users troubleshoot issues and maximize the benefits of the system.

3. Collaborative Efforts:

- Foster collaboration between local government, agricultural agencies, and tech developers to ensure the app is continually updated with the latest information and technological advancements. Engage stakeholders in regular feedback sessions to refine and improve the system.

4. Pilot Testing and Iteration:

- Conduct pilot tests in selected areas of Dipolog City and Dapitan City to gather data on the app's performance and user experience. Use this feedback to make necessary adjustments before a wider rollout.

5. Monitoring and Evaluation:

- Establish mechanisms for monitoring the impact of the mobile app on swine nutrition and feed quality control. Regularly evaluate its effectiveness and make data-driven decisions to enhance its functionality and user satisfaction.

To enhance the functionality and usefulness of the software for swine management, consider incorporating the following features:

1. Schedules of Deworming:

- Deworming Schedule Management: Implement a feature to create and manage deworming schedules for sows, boars, fatteners, and piglets. Include reminders and notifications to ensure timely administration.

2. Castration of Piglets:

- Castration Scheduling and Tracking: Add a feature to schedule and track the castration of piglets, including notifications for upcoming procedures and records of past castrations.

3. Change of Pigs' Feed Type Plan:

- Feed Type Plan Management: Develop a tool to manage and update feed type plans for different stages of pig growth. This should include options to customize plans based on age, weight, and health status.

4. Change of Pigs' Categories:

- Category Management: Enable the categorization of pigs based on various criteria (e.g., age, weight, breeding status). This feature should allow for easy updating of categories as pigs mature or their status changes.

5. Ready to Sell:

- Market Readiness Indicator: Incorporate a feature that identifies pigs ready for sale, including tracking their weight, age, and health status to ensure they meet market standards.

6. Ready to Breed:

- Breeding Readiness Tracking: Add a feature to track and indicate when pigs are ready to breed. This should include monitoring reproductive health and optimal breeding times.

Improved Efficiency: Automating schedules and reminders will help farmers manage their tasks more efficiently, reducing the risk of missing important procedures.

Enhanced Record Keeping: Digital tracking of deworming, castration, feed plans, and breeding readiness ensures accurate and accessible records.

Better Decision-Making: With comprehensive data on each pig's status, farmers can make more informed decisions about breeding, selling, and overall herd management.

Implementing these recommendations will help unlock the potential of technology in swine management, enhancing productivity, profitability, and sustainable growth in Zamboanga del Norte's agricultural sector and beyond.

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