

# Barangay Information Management System with Automated Mobile Messaging for Improved Community Engagement

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## **Abstract**

The study entitled “Barangay Information Management System with Automated Mobile Messaging for Improved Community Engagement” aimed to enhance the efficiency of local data management and strengthen communication between barangay officials and residents. The proposed system integrates essential barangay processes such as resident profiling, record management, and report generation into a centralized digital platform, thereby reducing manual workload, minimizing data inconsistencies, and improving operational accuracy.

An automated mobile messaging feature was incorporated to facilitate real-time communication. The system enables barangay officials to send announcements, reminders, and urgent notifications directly to residents’ mobile devices. Likewise, residents can transmit messages to the system, which undergo automated server-level validation to ensure authenticity by verifying that they originate from registered contact numbers. Once validated, messages are evaluated to determine whether they are emergency-related.

Non-emergency messages are recorded without triggering further action. However, emergency-related messages are analyzed using a rule-based method to classify their nature and determine the appropriate response. Depending on the type of emergency such as crime, fire, or disaster, then the system automatically notifies the designated members of the Emergency Response Team, including the Barangay Chairman, Barangay Police, Philippine National Police, Bureau of Fire Protection, and the Municipal Disaster Risk Reduction and Management Council. After dispatching notifications, the system sends a confirmation message to the sender to acknowledge that the appropriate authorities have been informed.

Using a developmental research design, the system was developed following standard software engineering principles and evaluated by barangay personnel and community members based on functionality, usability, reliability, and effectiveness. The findings indicate that the proposed system significantly improves administrative efficiency and enhances community engagement through timely, structured, and responsive communication mechanisms.

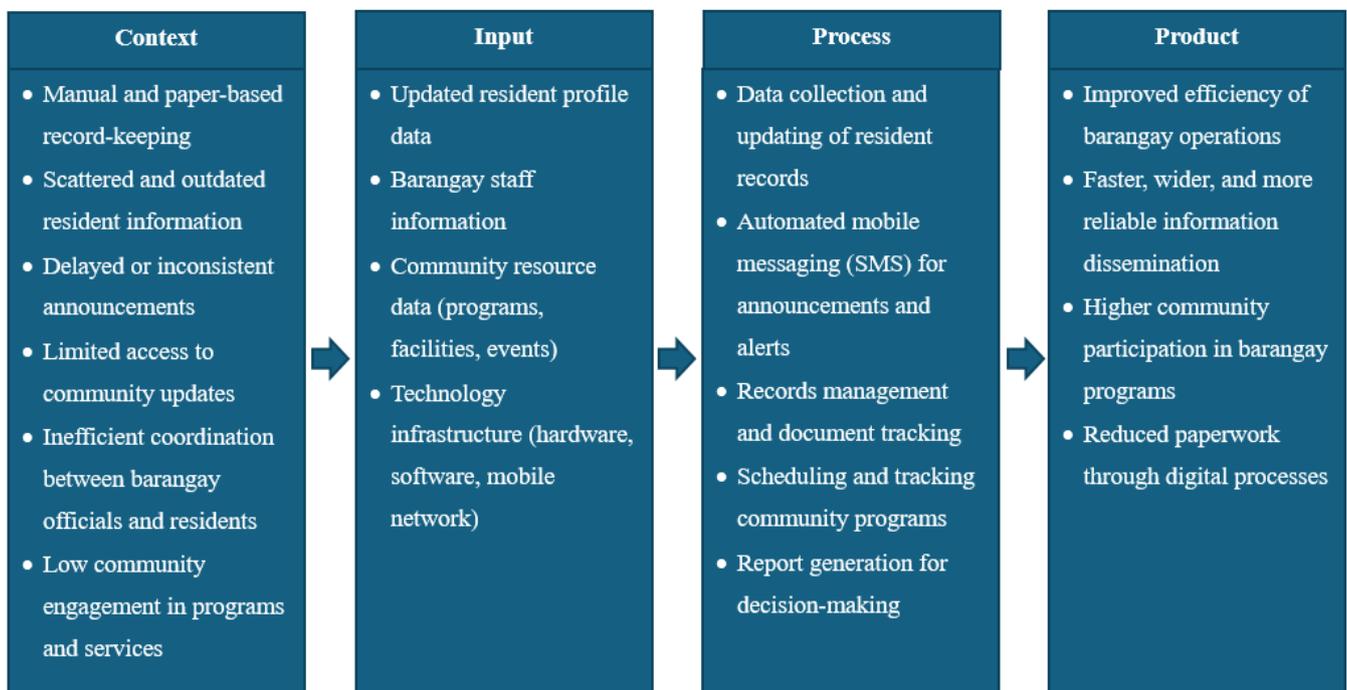
**Keywords:** Automated Mobile Messaging, Resident Profiling, Record Management, Digital Platform, Emergency Response Team

## 1. Introduction

The barangay is the basic administrative and political unit of government in the Philippines under the Local Government Code of 1991, responsible for public service delivery, peace and order, and issuance of local certifications. Despite this vital role, many barangays continue to rely on manual systems, leading to inefficiencies, delayed information dissemination, and limited community engagement.

To address these challenges, this study proposes a Barangay Information Management System with Automated Mobile Messaging implemented in Barangay Motibot, Sindangan, Zamboanga Del Norte, Philippines. The system digitizes core functions such as resident profiling, document processing, records management, and report generation while enabling real-time SMS notifications for announcements, reminders, and emergency alerts. By leveraging widely accessible mobile technology, the system aims to bridge communication gaps, enhance transparency, and strengthen citizen participation.

Anchored in the CIPP Evaluation Model (Context, Input, Process, Product), the study identifies operational challenges, utilizes necessary technological and human resources, implements automated data and messaging processes, and evaluates outcomes such as improved efficiency, faster information dissemination, increased community engagement, and reduced paperwork. Guided by relevant digital governance theories, the research presents a scalable and cost-effective model for modernizing grassroots governance.



**Figure 1: Schema of the Study**

This study focuses on developing and evaluating a Barangay Information Management System that integrates automated mobile messaging to address communication gaps and improve engagement with residents. Specifically, the study sought to answer the following questions:

1. What is the current profile of the barangay system?
2. What advanced Barangay Information System can be developed to enhance existing system?

3. What features that can be integrated into a composite system?
4. What is the performance of the existing and the proposed system as to functionality, reliability, efficiency, and usability?
5. Is there a significant difference to the usability of the existing and the proposed system?

The implementation of a Barangay Information Management System with Automated Messaging holds substantial significance in enhancing community engagement, improving service delivery, and promoting responsive governance at the grassroots level. This study addresses common issues in barangay administration such as inefficient communication, lack of timely updates, and limited citizen participation. By integrating automated messaging, the system fosters better information dissemination and proactive civic involvement.

## 2. Literature Review

Several studies have examined the status and development of barangay information systems in the Philippines. The Barangay Management Information System (2018) found that many barangays still rely on manual or semi-manual processes, resulting in fragmented records, slow transactions, and errors. The SMS Notification through IoT for Barangay Labas (2019) noted that while SMS is widely used for communication, it is often not integrated with resident databases, limiting automation and analytics. More recent studies on Web-based Resident/Project Management Systems and Digital Inclusion (2022–2024) show gradual adoption of digital features such as project monitoring, geolocation, and chatbots, though challenges like limited digital literacy and budget constraints remain.

Dela Cruz and Santiago (2021) proposed integrating GIS mapping into BMIS to improve disaster preparedness and infrastructure planning. Villanueva et al. (2020) developed a BMIS platform with an automated SMS gateway and AI chatbot to enhance communication and reduce in-person visits. A pilot project by the Department of Information and Communications Technology (DICT) (2023) introduced a cloud-based BMIS supporting online document requests, remote access, and data sharing.

David and Soriano (2019) identified resident profiling as the core feature of BMIS, supporting services such as certificate issuance and project tracking. Villanueva et al. (2020) emphasized integrated SMS notifications, while Cruz and Bautista (2021) highlighted automated reporting and role-based security controls as essential features.

Empirical studies confirm the effectiveness of digital systems. Santos and Dizon (2020) reported improved efficiency and accuracy using the ISO 9126 model. Villafuerte et al. (2021) recorded a SUS score of 85 and reduced transaction time by 40%. Garcia and Lim (2019) demonstrated high system uptime and SMS reliability. De Guzman and Ramos (2020), Mendoza, Villanueva, and Santos (2021), and Cruz and Villanueva (2019) all found statistically significant improvements in usability, efficiency, and community engagement, validating the shift from manual to integrated, technology-driven BMIS platforms.

## 3. Methodology

The study utilized the developmental research methodology in designing and implementing the proposed Barangay Information Management System with Automated Mobile Messaging. As defined by Richey and Klein (2019), developmental research involves systematically designing, developing, and evaluating

technological solutions to address specific problems. This approach was appropriate for creating a hybrid system for resident profiling, document processing, and automated SMS notifications tailored to the Barangay Local Government Unit of Motibot.

The system followed iterative phases: requirements gathering, analysis, design, development, testing, deployment, and evaluation. Data were collected through interviews, observations, and document analysis to identify issues in existing semi-manual processes. The design included database structures and user interfaces based on usability principles, while testing covered both functionality and user evaluation before deployment.

To evaluate system quality, the descriptive research method was applied using the ISO/IEC 25010 software quality model. Purposive sampling selected 30 respondents, including barangay personnel, residents, and technical experts. This ensured a comprehensive assessment of the system's functionality, reliability, usability, performance efficiency, and overall effectiveness in the barangay setting.

**Table 1. Distribution of Respondents**

Respondent Groups	No. of Respondents	%
Barangay Personnel	6	20
Barangay Residents	21	70
IT Experts	3	10
<b>Total</b>	<b>30</b>	<b>100</b>

In this study, the primary research instrument used is a structured survey questionnaire designed to evaluate and compare the Current Barangay Information Management System and the Proposed Barangay Information Management System. The questionnaire is intended to gather the perceptions of respondents based on their actual experiences with the current system and their expectations for the proposed system. The questionnaire is divided into three sections. The first section, Assessment of the Current Profile of the Barangay Information Management System, contains statements related to the system's core operations, such as efficiency in managing resident records, effectiveness in issuing clearances and permits, accessibility of data for staff, timeliness and accuracy of reports, management of complaints, data protection measures, and user-friendliness.

The second section, Assessment of Advanced Features for Enhancing the Barangay Information Management System, evaluates the presence and usefulness of potential system enhancements, such as integration with a camera for identity verification, automated Short Message Service (SMS) notifications for improved communication, real-time emergency alerts for public safety, analytics for better decision-making, and advanced security measures for data protection.

The third section, Assessment of Usability Performance of the Existing and Proposed Barangay Information Management System, focuses on the system's functional usability and performance. It includes statements measuring the adequacy of features for daily operations, the contribution of new features to

process improvement, efficiency in performing intended functions, ease of navigation and understanding, system reliability, and accuracy of outputs.

Through this structured questionnaire, the study aims to obtain measurable data that will facilitate a comparative analysis between the current and proposed systems, providing insights into the improvements and benefits that the enhanced system may bring to the barangay's operations.

**Table 2: Statistical Measure of Internal Consistency and Reliability of Cronbach Alpha**

Cronbach's Alpha Value	Interpretation
$\alpha \geq 0.90$	Excellent Internal Consistency
$0.80 \leq \alpha < 0.90$	Good Internal Consistency
$0.70 \leq \alpha < 0.80$	Acceptable Internal Consistency
$0.60 \leq \alpha < 0.70$	Questionable Internal Consistency
$0.50 \leq \alpha < 0.60$	Poor Internal Consistency
$\alpha < 0.50$	Unacceptable Internal Consistency

The study employed multiple data-gathering methods, including document analysis, face-to-face interviews, direct observations, and structured questionnaires. After securing formal administrative approval, these instruments were administered to selected respondents to collect relevant operational data, user perceptions, and system requirements. The collected data were processed using statistical software to generate meaningful conclusions through both descriptive and inferential statistical analyses. Frequency counts and percentages were used to describe the distribution of respondents, identify operational challenges, and determine the desired system features. Additionally, the weighted mean was computed to assess respondents' perceptions and evaluate the overall effectiveness, accuracy, and acceptance of the system's functional and non-functional components.

- 1) Frequency Distribution =  $n / T * 100\%$   
Where:  $n$  = Number of respondents  
 $T$  = Total number of respondents
- 2) Weighted mean(x) =  $f (X1 + X2 + \dots + Xn) n / N$   
Where:  $n$  = Total numbers of criteria

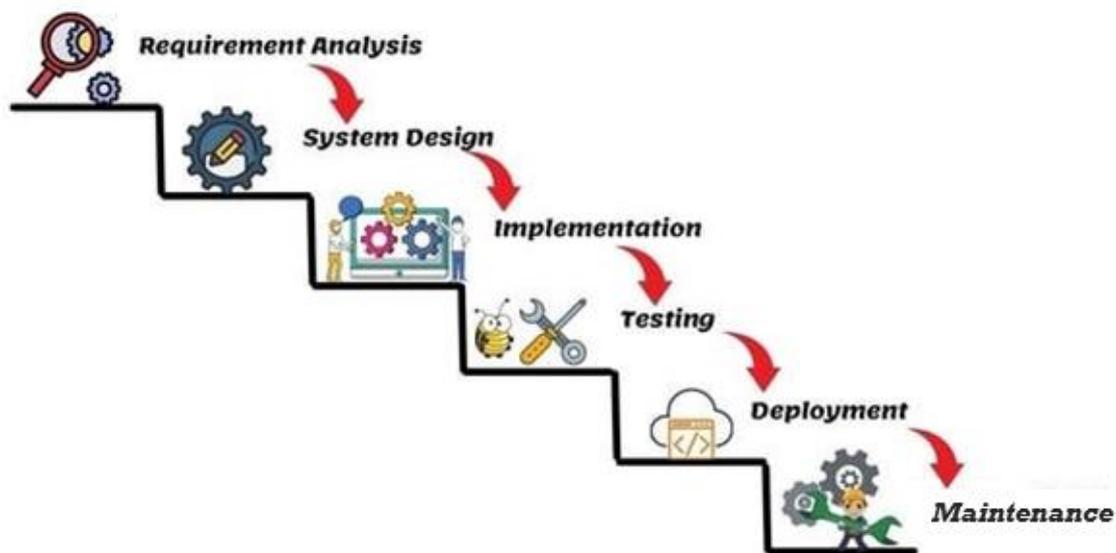
The system was developed using the Waterfall Model, a linear and sequential approach that ensured each phase was completed before proceeding to the next.

During requirements gathering and analysis, interviews and meetings with barangay officials, staff, and residents identified key issues such as inaccurate record-keeping, slow manual document processing, limited communication, and the need for a centralized automated system. These findings defined the system's functional and non-functional requirements.

In the design phase, an Entity Relationship Diagram (ERD), database structures, and user interface wireframes were created. The system architecture included integration with an SMS gateway for automated messaging.

Development was carried out using JavaScript and HTML for the frontend, JavaScript for the backend, and PostgreSQL as the database. SMS functionality was implemented through a GSM modem with AT commands or a third-party SMS API.

Testing included unit, integration, system, and User Acceptance Testing (UAT) to ensure functionality and usability. After successful testing, the system was deployed in the barangay office, including server setup, SMS gateway configuration, account creation, and user training. Continuous monitoring, maintenance, and documentation of future enhancements—such as real-time analytics and a mobile app version—were conducted to ensure long-term reliability and improvement.



**Figure 2: Waterfall Model (SDLC)**

#### **4. Result and Discussion**

The results of the study reveal that the current Barangay Information Management System performs adequately in basic operations, as evidenced by its acceptable ratings in data accuracy and system reliability; however, its overall evaluation indicates only average performance, particularly in terms of usability, interface design, task efficiency, and security. While respondents acknowledged that the system runs smoothly and records information accurately, they expressed neutral perceptions regarding ease of use, clarity of interface, protection of sensitive data, and access control, and they strongly indicated that advanced features such as real-time Short Message Service (SMS) announcements, automated message evaluation, and photo capture for authentication are either insufficient or not effectively implemented. These findings suggest that although the existing system fulfills essential functions, it lacks modern capabilities necessary for improved operational efficiency and enhanced community engagement.

Furthermore, the data demonstrate strong support for the development of an advanced Barangay Information System, as respondents agreed that the current platform requires major improvements and that modernization and automation would significantly enhance barangay operations. The high ratings given to proposed features such as real-time data updates, online services, automated reporting and analytics, mobile accessibility, stronger security mechanisms, and secure cloud-based backup indicate that stake-

holders recognize both the limitations of the existing system and the potential benefits of digital transformation. Notably, respondents strongly agreed that an upgraded system would greatly benefit the community, thereby confirming organizational readiness and user willingness to adopt a more innovative and technology-driven solution.

In addition, the evaluation of proposed composite features further reinforces the demand for a modernized system, since respondents strongly supported the integration of real-time Short Message Service (SMS) notifications and automated message processing to improve communication efficiency, while also endorsing photo capture for document authenticity, online transaction capabilities, data encryption, secure backup and recovery, and multi-device accessibility. These results imply that effective communication, strengthened security, accessibility, and system credibility are key priorities for system enhancement.

Comparative analysis of system performance and usability also indicates that although the existing system is already perceived as reliable, efficient, and user-friendly, the proposed system demonstrates significantly higher ratings across functionality, stability, workload reduction, accuracy, and overall usability. While the current system received strong evaluations in reliability and task support, the proposed system achieved even stronger agreement in ease of use, navigation, interface design, and operational efficiency, thereby confirming a substantial improvement in user experience. Taken together, these findings establish that the proposed Barangay Information System offers a more comprehensive, secure, efficient, and user-centered solution, and therefore provides a justified and evidence-based response to the identified limitations of the existing system.

**Table 3: Current Profile of the Barangay System**

<b>Indicator</b>	<b>Mean Value</b>	<b>Interpretation</b>
1. The system is easy to use.	3.2	Neutral
2. The system's interface is clear and well organized.	3.2	Neutral
3. The system provides the necessary features to support barangay operations.	3.5	Agree
4. The system helps users accomplish tasks faster than manual processing.	3.2	Neutral
5. The system records and stores information accurately.	3.9	Agree
6. The system runs smoothly without frequent errors or crashes.	4.0	Agree
7. The system properly protects confidential and sensitive information.	3.1	Neutral
8. Only authorized users can access restricted data.	3.2	Neutral
9. The system uses secure login or authentication procedures.	3.7	Agree
11. The system helps provide faster and better services to residents.	3.8	Agree
<b>Total Mean</b>	<b>3.5</b>	<b>Agree</b>

**Table 4: Advance Barangay Information System Can Be Developed to Enhance Existing System**

Indicator	Mean Value	Interpretation
1. The current Barangay Information System requires major improvements.	4.3	Agree
2. A more modern and automated system would enhance barangay operations.	4.2	Agree
3. The system should include real-time data updates.	3.8	Agree
4. The system should offer online services.	4.0	Agree
5. The system should include automated reports and analytics.	3.8	Agree
6. The system should support mobile access for users.	3.8	Agree
7. The enhanced system must provide stronger security features.	3.7	Agree
8. The system should have secure data backup and cloud-based storage.	3.7	Agree
9. Users are ready to adopt an advanced Barangay Information System.	3.7	Agree
10. The barangay is prepared to transition to a more advanced system.	3.8	Agree
11. An upgraded Barangay Information System will benefit the community.	4.7	Strongly Agree
<b>Total Mean</b>	<b>4.0</b>	<b>Agree</b>

**Table 5: Features That Can Be Integrated into a Composite System**

Indicator	Mean Value	Interpretation
1. The system can send real-time announcement through SMS.	4.9	Strongly Agree
2. The system can evaluate the message received from sender.	4.8	Strongly Agree
3. The system is able to capture a requestor's photo to be attached in the printing of document to make it credible and authentic.	4.2	Agree
4. The system allow online user transactions or requests.	4.0	Agree
5. The system include strong data encryption and security protocols.	4.2	Agree
6. The system provide secure data backup and recovery features.	4.1	Agree
7. The system is accessible across different devices (desktop, mobile, tablet).	4.3	Agree
<b>Total Mean</b>	<b>4.3</b>	<b>Agree</b>

**Table 6: Performance of the Existing System as to Functionality, Reliability, Efficiency, and Usability**

Indicator	Mean Value	Interpretation
1. The system provides more complete and advanced functions.	4.0	Agree
2. The system supports users in completing required tasks.	4.3	Agree
3. The system's features can enhance overall system capability.	4.1	Agree
4. The system operates consistently without frequent errors.	4.7	Strongly Agree
5. The system produces accurate and dependable results.	4.6	Strongly Agree
6. The system offers greater stability and system uptime.	3.9	Agree
7. The system processes tasks in a timely manner.	4.5	Strongly Agree
8. The system helps reduce workload and manual effort.	4.6	Strongly Agree
9. The system supports fast retrieval and updating of data.	4.0	Agree
10. The system is easy for users to understand and operate.	4.2	Agree
<b>Total Mean</b>	<b>4.3</b>	<b>Agree</b>

**Table 7: Performance of the Proposed System as to Functionality, Reliability, Efficiency, and Usability**

Indicator	Mean Value	Interpretation
1. The system provides more complete and advanced functions.	4.7	Strongly Agree
2. The system supports users in completing required tasks.	4.5	Strongly Agree
3. The system's features can enhance overall system capability.	4.4	Agree
4. The system operates consistently without frequent errors.	4.8	Strongly Agree
5. The system produces accurate and dependable results.	4.6	Strongly Agree
6. The system offers greater stability and system uptime.	4.5	Strongly Agree
7. The system processes tasks in a timely manner.	4.4	Agree
8. The system helps reduce workload and manual effort.	4.8	Strongly Agree
9. The system supports fast retrieval and updating of data.	4.5	Strongly Agree
10. The system is easy for users to understand and operate.	4.8	Strongly Agree
<b>Total Mean</b>	<b>4.6</b>	<b>Strongly Agree</b>

**Table 8: Usability of the Existing System**

Indicator	Mean Value	Interpretation
1. The system is easy to use.	3.6	Agree
2. The system allows users to complete tasks without difficulty.	3.8	Agree
3. The system is easy to navigate.	3.7	Agree
4. Users can learn how to use the system quickly.	3.5	Agree
5. The layout and interface of the system are user-friendly.	3.9	Agree
<b>Total Mean</b>	<b>3.7</b>	<b>Agree</b>

**Table 9: Usability of the Proposed System**

Indicator	Mean Value	Interpretation
1. The system is easy to use.	4.8	Strongly Agree

2. The system allows users to complete tasks without difficulty.	4.8	Strongly Agree
3. The system is easy to navigate.	4.7	Strongly Agree
4. Users can learn how to use the system quickly.	4.6	Strongly Agree
5. The layout and interface of the system are user-friendly.	4.7	Strongly Agree
<b>Total Mean</b>	<b>4.7</b>	<b>Strongly Agree</b>

#### 4.1 Findings

The findings of the study are presented in a systematic manner and are structured to directly respond to the research questions and evaluate the formulated hypotheses.

1. The current Barangay Information Management System performs adequately in terms of reliability and data accuracy, as respondents agreed that it records and stores information correctly and operates without frequent errors. However, its overall evaluation indicates only moderate acceptability, particularly in areas related to usability, interface design, task efficiency, and information security.
2. Advanced communication and authentication features such as real-time Short Message Service (SMS) announcements, automated message evaluation, and photo capture for document verification are either lacking or not effectively implemented in the existing system, as reflected in their low ratings. This highlights significant functional gaps in the current platform.
3. Respondents strongly agree that the current system requires major improvements, and they support the development of a more modern and automated Barangay Information Management System. There is clear recognition that digital transformation would enhance operational efficiency and service delivery.
4. The proposed advanced features, including real-time data updates, online services, automated reports and analytics, mobile accessibility, stronger security mechanisms, and secure cloud-based backup, received high levels of acceptance. This indicates that stakeholders value modernization, accessibility, and data protection.
5. Communication-centered functionalities, particularly real-time Short Message Service (SMS) notifications and automated message processing, emerged as the most highly supported features, demonstrating the importance of efficient information dissemination and community engagement.
6. Comparative evaluation shows that while the existing system is already considered usable and functional, the proposed system significantly outperforms it in terms of functionality, reliability, efficiency, and usability. The proposed system received higher ratings in stability, workload reduction, ease of use, navigation, and interface design.
7. Both users and the barangay organization are ready to adopt and transition to a more advanced system, suggesting strong institutional and user preparedness for implementation.

#### 5. Conclusion and Recommendation

The findings of the study confirm that the proposed Barangay Information Management System significantly improves upon the existing system in terms of functionality, reliability, efficiency, usability, and advanced technological features. Although the current system is already considered usable, accurate, and reliable, it still exhibits limitations in interface design, overall system capability, advanced communication functions, and data security measures. The proposed system effectively addresses these gaps, as evidenced by consistently higher evaluation ratings across all performance categories. Respondents strongly agreed

that the proposed system offers more advanced functions, improved stability, faster processing, enhanced security, better real-time communication, mobile accessibility, and a more user-friendly interface.

In light of these findings, it is therefore concluded that the proposed Barangay Information Management System is more effective, modern, secure, and user-centered, and it is well-aligned with the operational needs of the barangay and the expectations of the community. Its implementation is expected to substantially improve service delivery, data management, decision-making, and overall administrative efficiency.

Based on these conclusions, it is recommended that the barangay fully adopt and implement the proposed system to maximize operational benefits and service quality. Continuous enhancement of the user interface and visual design should be pursued to maintain ease of use, particularly for non-technical users. Stronger security measures, including advanced encryption, multi-factor authentication, role-based access controls, and secure cloud-based backups, should be integrated to ensure data protection and system reliability. The inclusion of real-time Short Message Service (SMS) notifications, automated alerts, online services, mobile compatibility, automated reporting, and analytics should be prioritized to support efficient communication and informed decision-making. Furthermore, regular user training, continuous system monitoring and maintenance, structured feedback mechanisms, and proper technical infrastructure preparation should be established to sustain system effectiveness.

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