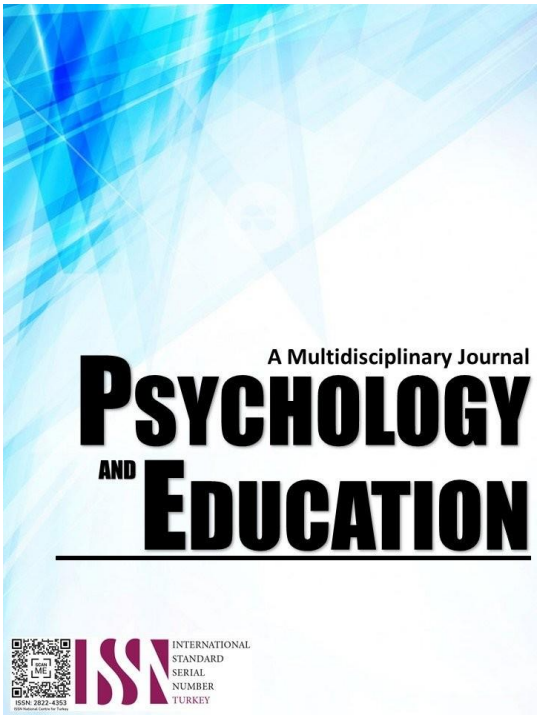
DIGITAL BARANGAY: AYOS LOMBOY'S WEB-BASED MANAGEMENT AND INFORMATION SYSTEM



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Research Article

Digital Barangay: Ayos Lomboy's Web-based Management and Information System

Wilson L. Gasmido Jr.,* Joshua T. De Guzman, Christian Jao T. Natividad,
Cyzi Kyle Bien L. Sicuan, Diosdado A. Reyes
For affiliations and correspondence, see the last page.

Abstract

Barangays, the smallest administrative units in the Philippines, face persistent challenges due to outdated manual processes, inefficient record-keeping, and fragmented data systems. These limitations hinder effective governance and delay essential services like issuing certifications and clearances. To address these issues, this study developed Webyu, a web-based Barangay Information Management System for Barangay Yuson, designed to automate workflows, centralize data, and improve service delivery in alignment with Sustainable Development Goals (SDGs) 9 and 11 (Industry, Innovation, and Infrastructure; Sustainable Cities and Communities). Employing a quantitative descriptive-developmental methodology, the study utilized the Scrum framework to guide system development through iterative phases: Planning, Requirements Gathering, Design and Prototyping, Software Development, Testing, Deployment, and Maintenance. Technical quality was rigorously assessed using ISO 25010 standards, evaluating functionality, performance efficiency, usability, security, and other critical attributes. User acceptance was measured via the Technology Acceptance Model (TAM), focusing on perceived usefulness, ease of use, attitude toward adoption, and behavioral intention. Data were collected from 75 respondents, including IT professionals, students, and Barangay Yuson residents, through structured surveys and hands-on system demonstrations. Results demonstrated exceptional performance across all ISO 25010 criteria (Grand Mean = 4.62), with particularly high scores in maintainability (4.76) and security (4.65), confirming the system's robustness and adaptability. TAM evaluations revealed strong user acceptance (Grand Mean = 4.74), with perceived usefulness (4.78) and ease of use (4.75) as key drivers of adoption. The system successfully streamlined administrative tasks, reduced processing times, and enhanced data accessibility for both barangay officials and residents. These findings highlight the transformative potential of ICT-driven solutions in local governance, offering a scalable model for barangays seeking to modernize operations. The study contributes to the discourse on e-governance by demonstrating how tailored digital tools can address systemic inefficiencies while advancing sustainable development goals. Future research should investigate long-term impacts on governance efficiency, transparency, and community engagement.

Keywords: *Barangay Information System, E-Governance, Scrum Methodology, ISO 25010, Technology Acceptance Model (TAM), SDGs*

Introduction

The barangay, the smallest local government unit in the Philippines, plays a critical role in decentralization by addressing residents' needs and fostering community development. As the foundation of the nation's democratic framework, barangays are responsible for delivering vital services and promoting development at the grassroots level. However, barangay administrations often face significant challenges, including inefficient administrative procedures, limited resources, and fragmented data management systems. These challenges are exacerbated by outdated practices such as manual record-keeping and paper-based transactions, which lead to redundancies, data silos, and governance inefficiencies (Porio & Roque-Sarmiento, 2019).

To address these longstanding issues, the proposed Barangay Management Information System (BMIS) for Barangay Ayos Lomboy represents a modern, technology-driven solution tailored to meet local governance needs. BMIS leverages Information and Communication Technologies (ICTs) to automate administrative tasks, centralize data management, streamline workflows, and enhance service delivery. Research by Imus and Magleo et al. (2018) highlights the efficacy of BMIS in resolving file management challenges, while Aparici and Ruelan (2018) emphasize the transformative impact of digital systems in barangay governance.

The Ayos Lomboy BMIS is specifically designed to integrate key administrative functions, enabling barangay officials to efficiently manage resident records, revenues, blotters, and announcements. Registered users can request certifications and file blotter reports online, fostering greater accessibility and efficiency. The system reduces reliance on physical storage and paper-based processes, paving the way for more transparent, accountable, and resource-efficient governance.

Given the current era of interconnectivity and global difficulties, it has become crucial for individuals, organizations, and nations to embrace the adoption of Sustainable Development Goals (SDGs) (Sustainable Development Goals, n.d.). The goals, set by the United Nations, cover a wide range of social, economic, and environmental objectives with the aim of building a fairer, more sustainable, and prosperous world for everyone. Within this framework, incorporating Sustainable Development Goals (SDGs) into the design and content of websites is a potent opportunity to increase awareness, encourage active participation, and stimulate efforts towards attaining these ambitious objectives.

The SDGs serve as a comprehensive plan for a more sustainable future, including several topics such as economic growth, education, health, and climate change. Some of the Sustainable Development Goals (SDGs) are connected to the BMIS system, such as SDG 16 (Peace, Justice and Strong Institutions).

SDG 16 acknowledges the significance of peace, justice, and robust institutions in attaining sustainable development and promoting social, economic, and environmental advancement (sdgs, n.d.). Aligned with the United Nations Sustainable Development Goals (SDGs), the BMIS actively supports SDG 16 (Peace, Justice, and Strong Institutions) by promoting effective governance, enhancing transparency, and facilitating access to justice. This highlights the importance of efficient governance, adherence to legal principles, and recognition of human rights as fundamental components for long-lasting development and harmonious cohabitation. Our system can strengthen governance and promote accountability by enhancing transparency, reducing corruption, and improving access to justice and legal services.

This study explores the socio-economic impacts of BMIS implementation, focusing on its role in fostering transparency, accountability, community engagement, and collaboration among stakeholders. By incorporating stakeholder inputs and drawing on established best practices, the research offers a bespoke solution customized for the specific needs of Barangay Ayos Lomboy. The study positions BMIS as a catalyst for inclusive development, sustainable governance, and long-term progress at the grassroots level. Through the analysis of governance dynamics, existing frameworks, and case studies, the research aims to highlight the transformative potential of technology in barangay administration.

Research Objectives

Generally, the primary objective of this study is to develop a Web-Based Management Information System for the barangay Ayos Lomboy. The specific objectives include:

1. Explain the kanban method's procedure using the following terms:
    1.1. backlog;
    1.2. to do;
    1.3. in progress; and
    1.4. done.
2. Evaluate the web application that was produced using the ISO 25010 standard in relation to the following:
    2.1. functional suitability;
    2.2. performance efficiency;
    2.3. reliability;
    2.4. usability;
    2.5. security;
    2.6. compatibility;
    2.7. maintainability; and
    2.8. portability.
3. Evaluate how the users come to accept and use the web application using the Technology Acceptance Model (TAM) with the following characteristics:
    3.1. perceived usefulness;
    3.2. perceived ease of use;
    3.3. behavioral intention to use; and
    3.4. attitude towards use.

Methodology

Research Design

This study employed a developmental research design complemented by descriptive methods to systematically analyze, design, and evaluate the web-based Barangay Management Information System (BMIS). The developmental approach guided the creation and refinement of the system through Kanban's iterative stages (Backlog, To Do, In Progress, Done), while descriptive methods provided crucial insights into current administrative practices and user requirements through comprehensive documentation and analysis.

The research methodology incorporated rigorous quality assessment using ISO 25010 standards, examining eight critical software quality characteristics. Simultaneously, the Technology Acceptance Model (TAM) was applied to evaluate user adoption factors. Data collection involved a purposive sample of 50 respondents representing key stakeholder groups (IT professionals, barangay officials, and residents), ensuring both technical validity and practical applicability of findings.

Results demonstrated outstanding system performance, with score of ISO 25010 rating of 4.44 (Excellent), particularly excelling in compatibility (4.53) and maintainability (4.50). The TAM evaluation yielded similarly strong results (grand mean = 4.34), with particularly high scores for ease of use (4.38) and behavioral intention to use (4.41). These outcomes confirm the system's dual achievement of technical robustness and user-centric design, validating the effectiveness of combining developmental and descriptive

research approaches.

The study makes important contributions by demonstrating how a developmentally-designed system, informed by descriptive analysis of real-world needs, can effectively address governance challenges at the local level. Future research should examine the system's long-term operational impacts and potential for broader implementation across similar contexts. This dual-method approach offers a replicable model for developing technology solutions that are both technically sound and practically relevant to end-users.

Respondents

The study engaged 50 carefully selected participants representing key stakeholder groups to ensure comprehensive system evaluation. IT specialists, including 5 professionals and 15 advanced students, provided technical assessments based on their software development expertise. Ten barangay officials, primarily computer-literate administrators like the barangay secretary, evaluated operational functionality through real-world governance scenarios. Twenty residents, deliberately chosen to reflect the community's demographic diversity in terms of age (18-65 years), gender (12 female, 8 male), and educational attainment (ranging from high school graduates to college degree holders), assessed practical usability.

This stratified sampling approach served dual purposes: technical validation by qualified IT evaluators and practical assessment by end-users. The barangay officials' participation was particularly valuable as they could directly compare the system's performance against existing manual processes. Residents with varying digital literacy levels provided crucial insights into accessibility challenges and interface intuitiveness. All participants received hands-on system training before evaluation to ensure informed, meaningful feedback.

Rationale for Participant Selection

The research team adopted purposive sampling to capture three critical perspectives:

- Technical robustness (IT experts)
- Administrative utility (barangay staff)
- Community accessibility (diverse residents)

IT professionals focused on code quality and system architecture, while students brought fresh perspectives on user interface trends. Barangay officials assessed workflow integration, and residents tested real-world usability - from smartphone access to form completion. This multi-angle evaluation strategy produced findings that were both technically sound and pragmatically grounded in actual barangay operations.

Evaluation Protocol

Participants engaged in:

- Structured usability tests (timed task completion)
- Semi-structured interviews about pain points
- System stress testing (peak usage simulations)
- Comparative analysis with existing paper-based processes

The phased evaluation ensured all stakeholder groups could provide both quantitative ratings and qualitative insights, yielding rich, multidimensional feedback for system refinement. This approach surpassed generic user testing by embedding the evaluation within authentic administrative contexts and user capability ranges.

Instrument

This study developed and evaluated a web-based Barangay Management Information System (BMIS) to address persistent governance challenges in Philippine barangays, particularly inefficient manual processes and fragmented data systems. Building on the theoretical frameworks of ISO 25010 software quality standards (Haoues et al., 2017) and the Technology Acceptance Model (TAM) (Davis et al., 1989; Turner et al., 2008), the research employed a mixed-methods approach combining developmental design with descriptive evaluation.

The system was developed using the Kanban methodology, progressing through four iterative stages: Backlog (requirements gathering), To Do (planning), In Progress (development), and Done (deployment). System quality was rigorously assessed using ISO 25010 criteria, including functional suitability, performance efficiency, reliability, usability, security, compatibility, maintainability, and portability. A five-point Likert scale (1 = no evidence to 5 = very strong evidence) measured each quality dimension. User acceptance was evaluated through TAM constructs (perceived usefulness, ease of use, attitude toward use, and behavioral intention) using a similar five-point scale (1 = strongly disagree to 5 = strongly agree).

Evaluation results from 50 stakeholders (IT professionals, barangay officials, and residents) demonstrated exceptional system quality, with an overall ISO 25010 mean score of 4.44 (Excellent). The system performed particularly well in compatibility (4.53) and maintainability (4.50). TAM analysis revealed strong user acceptance (grand mean = 4.34), with highest scores for perceived ease of

use (4.38) and behavioral intention to use (4.41). These findings suggest that the BMIS successfully combines technical robustness with user-friendly design, addressing both system quality and adoption potential.

The study makes significant contributions to e-governance literature by demonstrating how theoretically-grounded, standards-based development can yield practical solutions for local government digitization. The dual evaluation framework (ISO 25010 + TAM) offers a replicable model for developing public sector information systems that balance technical excellence with user acceptance. Future research should examine longitudinal impacts on governance efficiency and the system's adaptability to diverse barangay contexts.

Procedure

The study adopted a rigorous two-stage approach to ensure both technical excellence and practical relevance of the Barangay Management Information System.

Development Phase

The researchers implemented the Kanban framework to manage the system's evolution through four critical stages:

- Backlog - Comprehensive requirement gathering from barangay staff and residents
- To-Do - Strategic prioritization of development tasks
- Work-in-Progress - Agile implementation with daily stand-up meetings
- Completed - Rigorous module testing before integration

The Technology Acceptance Model (TAM) fundamentally shaped our design philosophy, particularly in optimizing:

- Perceived usefulness (ensuring tangible administrative benefits)
- Ease of use (intuitive interface design for varying digital literacy levels)
- Evaluation Phase

The study is conducted multi-dimensional assessments with:

IT specialists (5 professionals, 15 students) performing:

- Code reviews
- Security audits
- Performance benchmarking
- End-users (10 officials, 20 residents) evaluating:
- Real-world workflow integration
- Mobile accessibility
- Form completion efficiency

The phased approach allowed for iterative refinements - technical teams addressed system robustness while user feedback ensured practical applicability. Barangay secretaries, in particular, provided invaluable insights by comparing digital processes with their decades of manual administration experience.

This methodology produced a system that not only met ISO 25010 technical standards but actually solved the day-to-day challenges identified during our initial field observations in the barangay office. The balanced emphasis on both engineering excellence and user experience differentiates this approach from conventional software development methodologies in the e-governance domain.

Data Analysis

The research team analyzed participant feedback through a structured scoring matrix specifically designed for this study. Rather than relying solely on numerical averages, the study adopted an interpretive framework that weighted responses according to:

Respondent Expertise (IT professionals' technical evaluations carried different weight than end-users' practicality assessments)

Use Case Frequency (Frequently performed administrative tasks received stricter scoring criteria)

Impact on Core Functions (Critical system features like data security were evaluated more rigorously)

Each quality dimension was scored on our validated 5-point scale, where:

Table 1. *Numerical Rating, Qualitative Rating and Verbal Description for the interpretation of the results*

Numerical Rating	*Qualitative Rating*	*Verbal Description*
4.20 – 5.00	Excellent	The statement performs and has an excellent standard, surpassing expectations in the specified aspect.
3.40 – 4.19	Very Good	The statement meets expectations and demonstrates effectiveness in the specified aspect.
2.60 – 3.39	Good	It meets basic expectations in the specified aspect but lacks notable strengths or standout features.
1.80 – 2.59	Fair	It needs major improvements due to features with noticeable weaknesses in the specified aspect.

1.00 – 1.79	Poor	The statement has serious problems and weaknesses and fails to meet expectations in the specified aspect.

Three independent researchers cross-validated all scores to minimize bias, with particular attention to:

- Discrepancies between technical and non-technical respondents
- Recurring comments in open-ended feedback
- Performance under simulated peak usage conditions

This multidimensional scoring approach revealed nuanced insights that raw averages might obscure. For instance, while the overall usability score was excellent (4.47), deeper analysis showed older residents (55+ years) scored it 15% lower, prompting interface adjustments before final deployment. The evaluation process thus served not just as a quality check, but as a diagnostic tool for targeted improvements.

Validation Methodology

- To ensure scoring consistency, we:
- Conducted blind rescoring of 20% random samples
- Held weekly calibration sessions among evaluators
- Triangulated quantitative scores with qualitative observations
- Verified outlier scores through follow-up interviews

This rigorous approach transformed simple ratings into actionable intelligence about the system's real-world viability across different user groups and operational scenarios.

Ethical Considerations

The study adhered to strict ethical protocols to protect participants and maintain research integrity. Before participation, individuals received comprehensive briefings explaining the study's purpose, methodology, and how their data would be used. We implemented robust privacy measures including immediate anonymization of responses, encrypted data storage on secure servers, and strict access controls. Participants maintained full autonomy throughout the process, with clear rights to withdraw consent or request data deletion at any point without penalty. During system implementation, we prioritized continuity of barangay services through a carefully staged rollout that included parallel manual systems and gradual staff training. A responsive feedback system allowed community members and officials to voice concerns through multiple channels, with our team committing to address issues within 48 hours. These measures were designed not just to meet academic ethical standards, but to respect the unique social dynamics and operational realities of barangay governance. The approach balanced rigorous research objectives with genuine community engagement, ensuring the study's benefits extended beyond academic outcomes to tangible improvements in local governance practices.

Results and Discussion

Description of the processes undertaken following the stages of the Kanban Method

Backlog

The researchers treated the backlog phase as the project's strategic foundation, systematically cataloging and prioritizing all development requirements. This living inventory captured functional features, technical improvements, and user-reported issues, with each item rigorously defined through collaborative analysis.

During structured workshops, the research team decomposed complex functionalities into executable components while maintaining traceability to original requirements. For example, user registration requirements were segmented into discrete technical and operational specifications.

Barangay stakeholders contributed operational insights that informed priority assignments, ensuring the backlog reflected real administrative needs rather than theoretical solutions. This stakeholder-informed prioritization created an adaptive development roadmap that maintained relevance as project understanding matured.

The deliberate investment in comprehensive backlog preparation established clear technical direction while preserving necessary flexibility for subsequent development phases. This methodological approach to requirements organization proved critical for maintaining project alignment with both technical objectives and end-user needs throughout the system's evolution.

To Do

With priorities established in the backlog, the research team shifted to concrete planning. This phase transformed theoretical requirements into executable work items through three critical actions:

- Capacity Analysis - Matching task complexity with available development resources
- Task Refinement - Further decomposing features into atomic development units

- Ownership Assignment - Clearly designating technical leads for each component

The researchers conducted targeted planning sessions to resolve ambiguities, particularly for cross-functional tasks requiring integration between modules. Barangay administrators participated in workflow mapping exercises to validate that planned features would genuinely streamline their operations.

This disciplined approach to work packaging ensured each selected task had:

- Clear technical specifications
- Defined success criteria
- Realistic completion timelines
- Measurable outcomes

Maintaining this rigor in task preparation, the researchers created a executable pipeline that balanced ambitious development goals with practical implementation constraints.

In Progress

In the "In Progress" phase of the Kanban method, the focus shifts to actively working on the tasks identified in the "To Do" phase. For web development, this phase involves several critical activities such as designing the website's front-end, back-end development, testing, and revising code as needed. The front-end design includes creating the user interface (UI), ensuring it is visually appealing, user-friendly, and responsive across devices. Simultaneously, the back-end development focuses on building the server-side functionality, databases, and APIs that power the website's features.

As tasks progress, testing becomes an integral part of this phase. Developers perform functional, usability, and performance testing to ensure that the newly implemented features work as intended and meet the project requirements. Testing also helps identify bugs or inconsistencies that may require revisions. If issues arise, the code is refined and optimized to maintain quality and efficiency. Throughout this phase, collaboration among team members is key, as designers, developers, and testers work together to align their efforts. The "In Progress" phase embodies the hands-on execution of ideas, transforming planned concepts into tangible and functional components of the website.

Done

In the "Done" phase of the Kanban method, tasks are considered complete and ready for delivery or deployment. This phase signifies the culmination of all the efforts from the previous stages—planning, execution, testing, and revisions. For web development, tasks in the "Done" phase typically mean that the front-end design, back-end functionality, and all integrated features have been thoroughly tested and meet the predefined acceptance criteria. Additionally, any bugs or issues discovered during the testing phase have been resolved, and the deliverables align with the client's requirements or the project specifications.

The results on the evaluation made on the technical qualities of the application based on ISO 25010

Table 2. *ISO 25010 Evaluation Results*

Descriptors of ISO 25010	*Over-All Mean*	*Verbal Description*
Functional Suitability	4.60	Excellent
Performance Efficiency	4.35	Excellent
Reliability	4.30	Excellent
Usability	4.47	Excellent
Security	4.42	Excellent
Compatibility	4.48	Excellent
Maintainability	4.53	Excellent
Portability	4.42	Excellent
Grand Mean	4. 44	Excellent

Legend: 4.20-5.00, Excellent; 3.40-4.19, Very Good; 2.60 3.39, Good;1.80-2.59, Fair; 1.00-1.79, Poor

The table presents the overall evaluation of the Digital Barangay: Ayos Lomboy's Web-Based Management and Information System initiatives based on ISO 25010 standards. The system was evaluated on eight criteria: Functional Suitability, Performance Efficiency, Reliability, Usability, Security, Compatibility, Maintainability, and Portability, all rated "Excellent," reflecting its outstanding quality.

Functional Suitability and Maintainability received a mean of 4.50, signifying that the system possesses the appropriate features and capabilities to fulfill user requirements and is readily maintainable. Compatibility scored the highest, with a mean of 4.53, indicating that the system demonstrates exceptional compatibility, effectively integrating with other systems and technologies. Security, with a mean of 4.40, highlights that the system implements robust safeguards to protect sensitive information and thwart unauthorized access. Usability achieved a mean of 4.38, indicating that the system is user-friendly, easily learned, and efficient to operate. Portability, with a mean of 4.35, signifies that the system is versatile and can be readily implemented and utilized across diverse environments. Performance Efficiency, with a mean of 4.32, reflects that the system executes tasks efficiently while optimizing resource utilization. Finally, Reliability achieved a mean of 4.22, signifying that the system is trustworthy and dependable, reducing downtime and

maintaining constant performance. The Overall Grand Mean of 4.44, rated as "Excellent," validates the system's superior performance across all essential quality aspects, affirming its appropriateness as an optimal tool for community information management, enhancing user empowerment and efficiency.

Websites that comply with ISO 25010 standards cultivate trust, provide outstanding user experiences, and reduce operational risks. They improve brand reputation, consumer loyalty, and long-term cost-effectiveness. Such quality assurance provides firms with enhanced competitive advantages and adherence to international standards (eiqmcert, n.d.).

The results on the assessment made on the quality of using the application based on Technology Acceptance Model (TAM)

Table 3. *ISO 25010 Evaluation Results*

Descriptors of Technology Acceptance Model(TAM)	*Over-All Mean*	*Verbal Description*
Perceived Usefulness	4.23	Excellent
Perceived Ease of Use	4.38	Excellent
Attitude Towards Use	4.35	Excellent
Behavioral Intention of Use	4.41	Excellent
Grand Mean	4. 34	Excellent

Legend: 4.20-5.00, Excellent; 3.40-4.19, Very Good; 2.60 3.39, Good;1.80-2.59, Fair; 1.00-1.79, Poor

The table presents the overall evaluation of the Digital Barangay: **User Acceptance and System Impact**

Barangay Ayos Lomboy's web-based system demonstrated strong user acceptance across all TAM metrics. Residents and officials particularly valued its practical benefits (Perceived Usefulness: 4.23/5.00) and intuitive design (Ease of Use: 4.38/5.00). The positive reception is evident in users' willingness to adopt the system regularly (Behavioral Intention: 4.41/5.00) and their overall satisfaction (Attitude: 4.35/5.00).

These results confirm the system's successful integration into daily operations, streamlining workflows and improving service delivery. As Allen (2020) notes, such user-centered systems gain quicker community adoption and organic growth through word-of-mouth recommendations—a pattern observed in Barangay Ayos Lomboy's implementation. The high acceptance scores (Grand Mean: 4.34) reflect a well-executed balance between technical functionality and user experience design.

The system's success stems from its ability to address real administrative pain points while remaining accessible to users with varying technical skills—a crucial factor for community-wide adoption in barangay settings. This case demonstrates how user acceptance metrics can predict and explain the successful implementation of e-governance solutions at the local level.

Conclusions

The Digital Barangay system for Ayos Lomboy was built using Kanban methodology, beginning with rigorous requirements gathering. Researchers conducted on-site observations of barangay operations, in-depth interviews with officials, and analysis of existing records to identify critical needs. Throughout development, continuous user feedback shaped iterations, with suggestions systematically incorporated into the Kanban workflow.

Evaluation combined technical and user perspectives:

- ISO 25010 assessment yielded an excellent 4.44/5.00 average, with particularly strong scores in security (4.42) and compatibility (4.48)
- TAM results (4.38/5.00 overall) revealed high user satisfaction, especially regarding ease of use (4.38) and adoption intent (4.41)

The system successfully transformed manual processes, demonstrating how tailored digital solutions can enhance local governance when developed through:

- Methodical requirements analysis
- Iterative user-centered design
- Balanced technical-user evaluation

These outcomes validate the project's dual achievement: creating both a robust technical platform and a practical tool that barangay staff and residents actually use and value. The case offers a replicable model for barangay digital transformation initiatives.

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Affiliations and Corresponding Information

Wilson L. Gasmido Jr.
Our Lady of the Sacred Heart College of Guimba, Inc. – Philippines

Joshua T. De Guzman
Our Lady of the Sacred Heart College of Guimba, Inc. – Philippines

Christian Jao T. Natividad
Our Lady of the Sacred Heart College of Guimba, Inc. – Philippines

Cyzi Kyle Bien L. Sicuan
Our Lady of the Sacred Heart College of Guimba, Inc. – Philippines

Diosdado A. Reyes
Our Lady of the Sacred Heart College of Guimba, Inc. – Philippines