BARANGAY EMPOWERMENT THROUGH E-BT SYSTEM

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Abstract

The integration of a computerized system empowers barangays towards good governance, fostering a more resilient and productive community. This study aimed to enhance the barangay computerized system in one barangay in the Zamboanga Peninsula to improve the efficiency of barangay transactions. Its main objective is to redesign and develop a barangay computerized system to cater to additional barangay records. This study used the developmental research method and rapid application development approach in system development. The evaluators used a rubric to assess the ISO/IEC 25010:2011 software quality characteristics of the system. The study revealed that the new electronic barangay transaction system has greater functionality than the existing barangay computerized system used in one of the barangays in the Zamboanga Peninsula. The system has additional features, such as processing and generating barangay inhabitants, barangay officials, barangay resolutions, and socio-demographic reports, with a high level of system usability. Both evaluators' groups confirmed the system's reliability and efficiency, indicating its high acceptability for adoption at the barangay level. Aligned with Sustainable Development Goals (SDG) 9: Industry, Innovation, and Infrastructure; and SDG 16: Peace, Justice, and Strong Institutions, the researchers recommended adopting the e-BT system to strengthen service delivery and enhance citizen trust. The researchers also recommended continuous evaluation and the exploration of mobile-based features to ensure the e-BT system's long-term relevance and impact, while facilitating greater citizen engagement.

Keywords: *e-governance, barangay systems, digital transformation, design and development, SDG, ISO/IEC 25010:2011*

Introduction

The complexity of tasks performed by computers is evident across different fields. From its inception to the present, it has continually improved the lives of people around the world. Many organizations are pursuing digital transformation, which requires strong leadership from management, stakeholder engagement, and robust governance frameworks to ensure transparency, efficiency, and accountability in service delivery. According to Escobar, Almeida, and Varajão (2023), success in digital transformation depends on redesigning processes, aligning strategies with citizen needs, and fostering an innovative organizational culture.

Over a decade, the literature on digital governance has progressed from an initial focus on the basic computerization of records to the development of integrated e-government platforms. More recent studies emphasize a shift toward citizen-centered, data-driven systems, reflecting a broader global movement toward participatory, transparent digital governance. This body of work demonstrates a clear scholarly trajectory from simple digitization of administrative processes to enhancing service efficiency and ultimately to building inclusive systems that empower end users and actively engage communities in governance.

Many ASEAN countries are now focusing on digital governance to make government services more efficient and responsive. Research has shown that in Indonesia and other ASEAN countries, empowering local communities and involving them in decision-making are key factors in ensuring the success of digital transformation efforts (Aminah & Saksono, 2021; Astuti et al., 2024). These studies illustrate a regional trend in Southeast Asia where digital transformation increasingly emphasizes not only technological adoption but also institutional reform and public engagement. This emerging ASEAN pattern shows that policymakers now view community involvement and grassroots empowerment as essential components of sustainable digital initiatives.

The United Nations Sustainable Development Cooperation Framework (UN-SCDF) Philippines 2024–2028 highlights digital transformation as a crucial enabler of transparent and accountable governance, particularly in strengthening public institutions and modernizing administrative services (United Nations, 2024). The Republic Act No. 8792 of the Philippines, also known as the Electronic Commerce Act of 2000, has driven the development of digital platforms in local government units (LGUs). According to Islam et al. (2025), e-governance plays a vital role in reforming public administration and improving service delivery outcomes in both developed and developing countries. Today, policymakers and institutions regard it as a key indicator for evaluating government reforms. Implementing digital governance requires integrating ICTs to strengthen citizen trust and stakeholder participation as well as improve performance and efficiency (David et al., 2023; Zhao et al., 2024; Manoharan et al., 2023).

In the Philippines, the trajectory of digital governance research shows a progression from early technology adoption driven by national mandates (such as RA 8792) toward more complex digital platforms at the municipal and city levels. Current studies

increasingly highlight citizen engagement, digital inclusion, and government accountability as central pillars of the recent digital transformation.

The local government units in the Philippines are the provinces, districts, municipalities, and barangays, the smallest unit and the foundation of local governance and national development. Recent research indicates that local governments enhance transparency, accountability, and service delivery efficiency when they strategically adopt digital technologies (David et al., 2023). Barangays can increase institutional openness, expedite administrative processes, and guarantee fair citizen access to necessary public services by digitizing clearances, tax records, and resolutions. The advent of digital technology opens up greater opportunities for barangays to better serve their constituents by computerizing the documents they produce, such as barangay clearances, community tax clearances, barangay business clearances, barangay resolutions, and others. Emerging research indicates that ICT-based participatory platforms enable grassroots units to foster accountability, enhance communication, and generate knowledge for collaborative decision-making (Suranto, 2025; Detthamrong, 2025; Elmatsani et al., 2024).

However, even with the growing research on digital governance at the national and regional levels, very little work has examined how digital transformation unfolds in barangays. This gap is most noticeable in areas such as digital record management, frontline service delivery, and transparency at the community level (Lapuz, 2023; Astuti, 2024). Strengthening barangay-level systems is therefore essential to advancing the country's broader digital governance agenda. Digital record management is a critical component of this effort, as evidence shows that digitized systems reduce processing delays, prevent data loss, improve accountability, and enhance administrative efficiency— functions central to local government operations (Aminah & Saksono, 2021).

In one of the barangays in the Zamboanga Peninsula, adopting a computerized system has become a competitive advantage for good governance. The system allows efficient storage and retrieval of community tax certificates, barangay clearances, business permits, complaints, and blotter records. These limitations prompted the researchers to design, develop, and evaluate an alternative computerized system to effectively capture and safeguard barangay records. It also aimed to evaluate the functionality, reliability, efficiency, and usability of the computerized system based on the software quality characteristics of International Organization for Standardization / International Electrotechnical Commission (ISO/IEC) 25010:2011. This study promotes accountability and transparency in line with Sustainable Development Goal (SDG) 16, advancing digital innovation and infrastructure aligned with SDG 9.

Methods and Materials

Research Design

The researchers employed a developmental research method in conducting the study. They applied the Rapid Application Development (RAD) approach in developing the system, placing less emphasis on extensive planning and more on an adaptive, iterative

process. The RAD approach consists of four phases: requirements planning, user design, construction, and cutover.

During the planning phase, the researchers visited one of the barangays in the Zamboanga Peninsula. They assessed the capabilities of its existing computerized system. The researchers also identified the different barangay transactions that require electronic processing. In the next stage, the researchers conceptualized a design to enhance their current system. They presented it to the concerned barangay officials to solicit comments and corrections. After the researchers and the barangay officials agreed on the specifications of the enhanced system, the researchers proceeded with the system development and evaluation.

Participants and Sampling Procedure

The study participants were five Information Technology (IT) professionals and five barangay officials. The researchers selected the IT professionals through purposive sampling based on their educational qualifications and professional experience. All IT Professionals held a Master of Science in Information Technology (MSIT) degree and possessed relevant expertise in system development and evaluation.

The researchers applied total enumeration to the barangay officials, who represented the actual system users. The barangay officials selected were active in handling office transactions. Their participation enabled the assessment of the system's functionality, reliability, and usability in real administrative operations. Only the IT professionals evaluated the system's efficiency.

Data Collection Procedure

The researchers secured permission from the Barangay Captain of Barangay Uno, Katipunan, Zamboanga del Norte, through a formal request letter to conduct the study. After receiving approval, they investigated how the staff conducted barangay transactions. They observed the barangay operations and interviewed the staff.

The researchers informed barangay officials of the purpose of the system evaluation and of voluntary participation during its conduct. The researchers supervised the system evaluation to ensure the Accuracy of the collected data.

Research Instrument

The respondents evaluated the developed system using ISO/IEC 25010:2011 software quality characteristics. The evaluation focused on four primary attributes: functionality, reliability, usability, and efficiency.

The system's functionality, accuracy, and security were evaluated by observing respondents' actual performance manipulating the system across five trials, with results recorded.   The researchers used a rubric to evaluate the system's reliability and usability. The evaluation instrument used in this study was an institutionally recognized rubric issued by the university's Research Office at the time of the study. The rubric was adapted without

modification to ensure consistency and comparability with prior system evaluation studies conducted within the institution.

Validation and Reliability

The researchers submitted the instrument to IT professionals for content validation. They incorporated all the experts' suggestions into the final version of the tool. Although the study did not compute an internal consistency coefficient such as Cronbach's alpha, the researchers fully integrated all end-user processes into the instrument. The instrument's reliability relied on its institutional acceptance at both the college and university levels. The researchers also tested the instrument on non-participants in a single trial to validate its clarity.

Data Analysis

The data collected for the evaluation of software functionality, reliability, usability, and efficiency obtained from the five performance trials of the respondents were tabulated and analyzed.

For the functionality criterion, the researchers used descriptive statistics, specifically mean scores for each respondent type. For the usability criteria, the researchers evaluated the software's understandability, learnability, and operability. The rubrics for usability categorized the respondents as proficient, apprentice, and novice, with corresponding ratings of 100%, 88%, and 75%, respectively. A proficient respondent who performed tasks independently, efficiently, and accurately. An apprentice respondent who demonstrated tasks with occasional help from the researchers, while a novice requires constant guidance from the researchers.

To assess software efficiency, the average time, in minutes, to process each order was recorded. Efficiency was measured using the formula: 60 minutes divided by the number of records per hour. The researchers computed the software's efficiency using the average of the five performance trials conducted by the IT professionals.

Ethical Consideration

The researchers requested permission to conduct research from the Local Government Unit (LGU) of Barangay Uno, Municipality of Katipunan, Zamboanga del Norte, through its Barangay Captain. They also secured permission to perform the system evaluation to ensure transparency and adhere to community protocols. The researchers informed all stakeholders about the objectives, scope, and potential implications of the study, and they respected stakeholders' voluntary participation throughout the process.

The researchers complied with ethical standards for community-based research by actively observing the principles of respect for persons, beneficence, and justice. They safeguarded data privacy and the confidentiality of the data collected. They disclosed no personal or sensitive information without consent, and they used all data solely for academic and developmental purposes.

Results and Discussions

The Electronic Barangay Transaction (e-BT) System

The presentation on the design and development of the Barangay e-Transaction System used a use case diagram and corresponding screen designs. The use case diagram illustrated the system's expected functionalities from the end users' perspective.
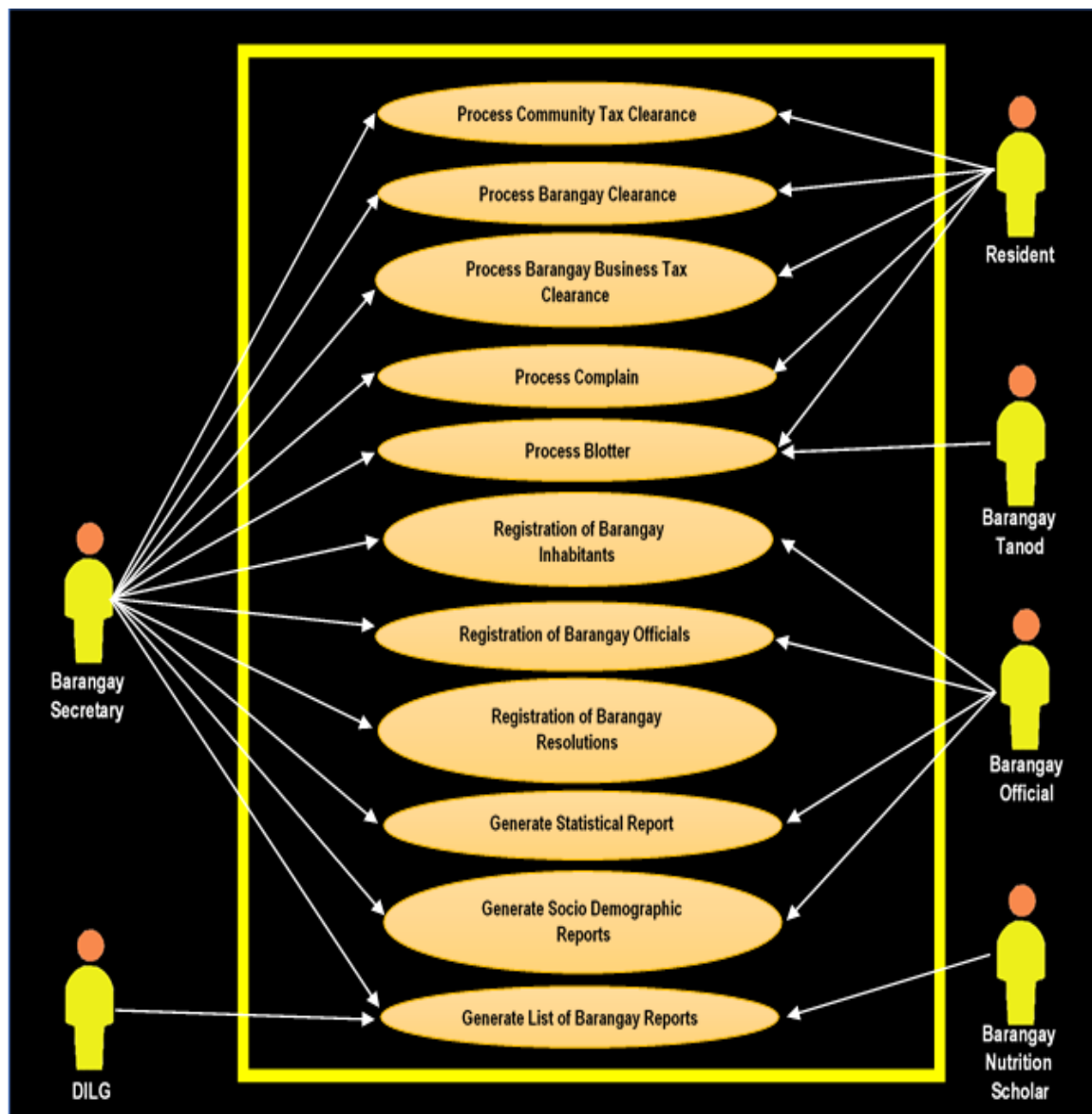

Fig. 1. Use case diagram of Barangay e-Transaction System.

Figure 1 describes the scope of the electronic barangay transaction system. Six entities or actors were represented in the study and interacted with the computerized system. The Barangay Secretary serves as the central administrator responsible for

processing community tax clearances, barangay clearances, business tax clearances, complaints, blotter records, and registrations of inhabitants, officials, and resolutions. The system also enables the generation of statistical, socio-demographic, and barangay reports. End-users—including residents, barangay tanods, barangay officials, and barangay nutrition scholars—access specific outputs depending on their roles. At the same time, the Department of the Interior and Local Government (DILG) receives consolidated reports. This diagram highlights the system's multi-user design, its capacity to streamline administrative functions, and its role in improving accountability and service delivery at the barangay level.

Table 1

Software Capabilities of Two Computerized Barangay Systems

Capabilities	Existing Barangay System	Electronic Barangay Transaction System
Store and retrieve community tax clearance	✓	✓
Process and generate barangay clearance	✓	✓
Process and generate barangay business tax clearance	✓	✓
Process blotter	✓	✓
Process complaint	✓	✓
Generates a list of complaint records	✓	✓
Generates the blotter records' list	✓	✓
Process the resident's registration records.		✓
Generates a residents' list by the household or master list.		✓
Store and retrieve barangay officials.		✓
Store and retrieve barangay resolutions.		✓
Generates a list of barangay resolution records.		✓
Generate a statistical report of the population.		✓
		✓

Table 1 shows the difference between the electronic barangay transaction system and the current barangay system utilized by one of the barangays in Zamboanga Peninsula. The comparison between the existing barangay system and the Electronic Barangay Transaction System indicates that, while both platforms support basic functions such as processing clearances, business permits, blotter records, and complaints, the enhanced system delivers significantly broader and more integrated capabilities. The existing system manages only selected transactions and limited record-generation features. In contrast, the new system includes expanded functionalities such as resident registration processing,

generation of household or master lists, creation of socio-demographic reports, and more comprehensive records management for barangay officials and resolutions.

Interviews with barangay staff revealed several operational gaps—including the absence of automated population statistics and socio-demographic profiling—which the enhanced system directly addresses. Workflow observations and reviews of both digital and paper records further clarified that many procedures in the previous system remained manual, resulting in inconsistencies, duplicate work, and processing delays. By synthesizing insights from interviews, document reviews, and workflow observations, the researchers designed an improved electronic system that responds to actual administrative needs, enhances data consistency, and strengthens decision-making. This integration of system capabilities with real-world operational demands results in a more comprehensive, functional, and user-aligned digital solution that supports efficiency, transparency, and modernized local governance.

The succeeding figures represent the different screen designs used in the software development of the barangay e-transaction system.
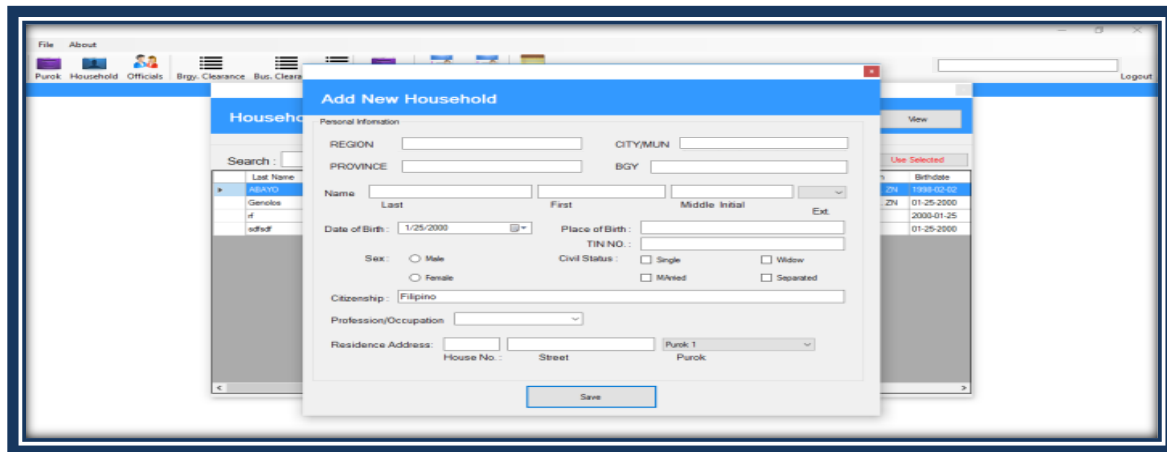

Fig. 2.   Sample screen design for adding a new household in the electronic barangay transaction system.
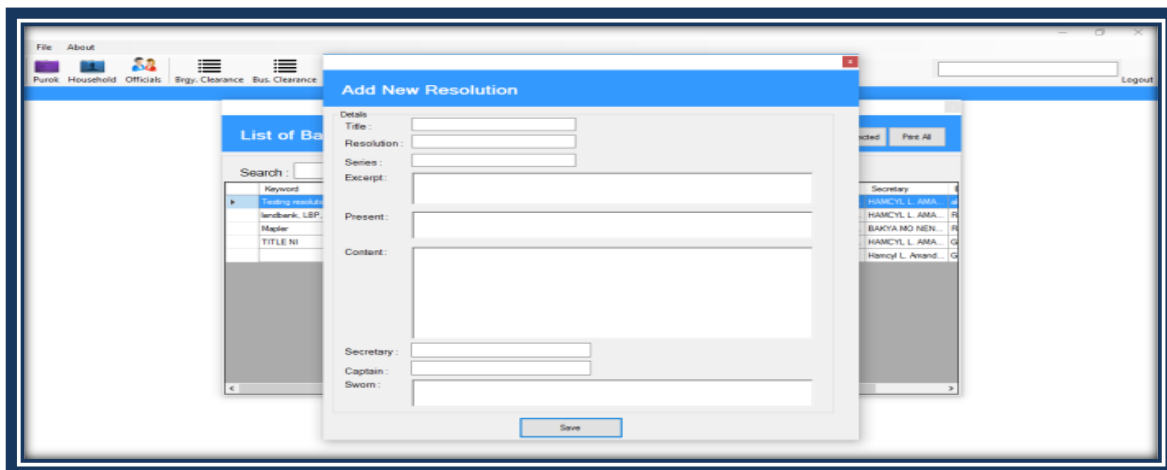

Fig. 3. Sample screen design for adding a new barangay resolution in the electronic barangay transaction system.

System Evaluation

Table 2

Functionality evaluation result based on the number of records produced per hour

| Indicators | Average Number of Records produced per hour | | | |
| | Electronic Barangay Transaction System | | Current Barangay Computerized System | |
	Barangay Officials	*IT Experts*	*Barangay Officials*	*IT Experts*
A. Suitability of the System				
Create a barangay community tax clearance record and generate a report.	9	16	8	15
Create a barangay clearance record and generate a list report.	12	16	10	16
Create a barangay business clearance record and generate a list report.	11	22	11	22
Create a complaint record and generate a report.	12	24	11	23
Create a blotter record and generate a report.	6	20	6	20
Create a resident record and generate an individual master list and a household report	7	23	Not applicable	Not applicable
Create the barangay officials' record and generate a list.	11	25	Not applicable	Not applicable
Create a barangay resolution and generate a list.	1	6	Not applicable	Not applicable
Generate socio-demographic reports	13	22	Not applicable	Not applicable
B. Accuracy of data produced	**Number of data fields recorded**			
data fields inputted for the resident's individual record	18	18	Not applicable	Not applicable
data fields inputted for the community tax clearance record	10	10	10	10
data fields inputted for barangay clearance record	15	15	15	15
data fields inputted for barangay business tax clearance records	13	13	13	13
data fields inputted for blotter	10	10	10	10
data fields inputted for the complaint	8	8	8	8
data fields inputted for barangay officials' records	8	8	Not applicable	Not applicable
data fields inputted for barangay resolutions records	9	9	Not applicable	Not applicable
C. Security of the system				
Create a system security account	applicable	applicable	applicable	applicable
Create digital backup records	applicable	applicable	applicable	applicable

Table 2 shows that the Electronic Barangay Transaction System significantly outperforms the existing computerized system in terms of suitability, accuracy, and processing efficiency. Both barangay officials and IT experts were able to produce more records per hour using the enhanced system, particularly for generating clearances, business permits, blotter reports, and socio-demographic outputs, which were not available in the old system. This improved productivity aligns with evidence from digital governance research showing that user-centered, integrated systems streamline administrative work, reduce manual tasks, and enhance the responsiveness of government operations (Escobar et al., 2023; Manoharan et al., 2023). The system's ability to generate household lists, resident registrations, and population statistics further aligns with ASEAN evidence showing that digital transformation strengthens community-level governance and supports data-driven planning (Aminah & Saksono, 2021; Lapuz, 2023; Astuti et al., 2024).

The study also showed that data accuracy improved with the enhanced system. It confirmed the role of structured digital workflows in reducing errors and improving information reliability (David et al., 2023; Detthamrong et al., 2025). Interviews and workflow observations support these results by revealing that many tasks remained manual in the previous system, contributing to delays.
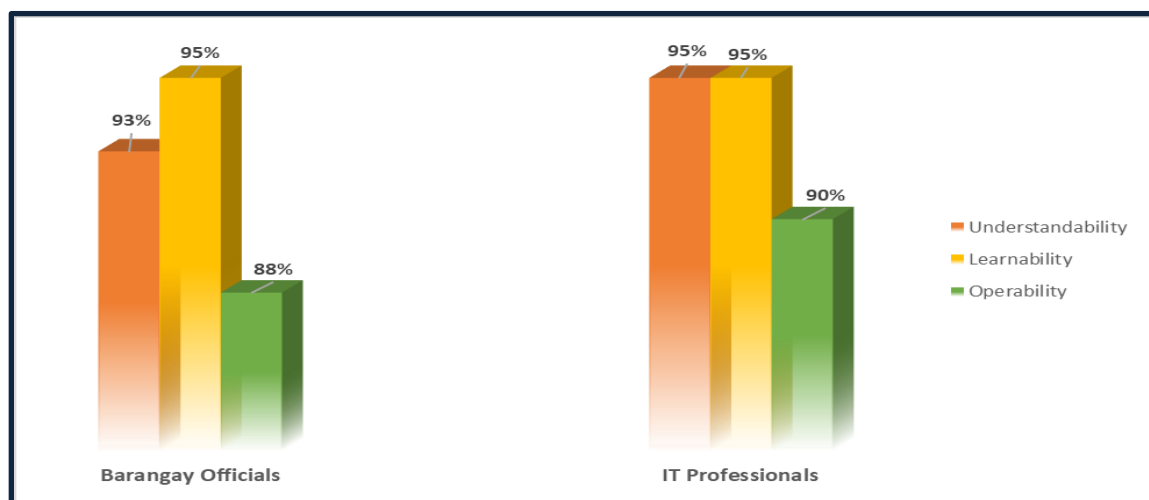

Fig. 4. Result of software evaluation for usability.

The system, with scores ranging from 88% to 95%, demonstrates strong user-centered design, allowing users to grasp its functions and operate it with minimal difficulty. These findings support digital governance research showing that accessible and well-designed digital tools enhance user engagement, streamline administrative work, and reduce resistance to technology adoption (Escobar et al., 2023; Manoharan et al., 2023). The strong usability ratings also align with ASEAN studies, which emphasize that when digital systems empower local users, they significantly improve workflow efficiency and support more responsive and transparent governance (Aminah & Saksono, 2021; Astuti et al., 2024). This study confirmed that the enhanced system meets key usability standards necessary for effective digital transformation in grassroots government settings.
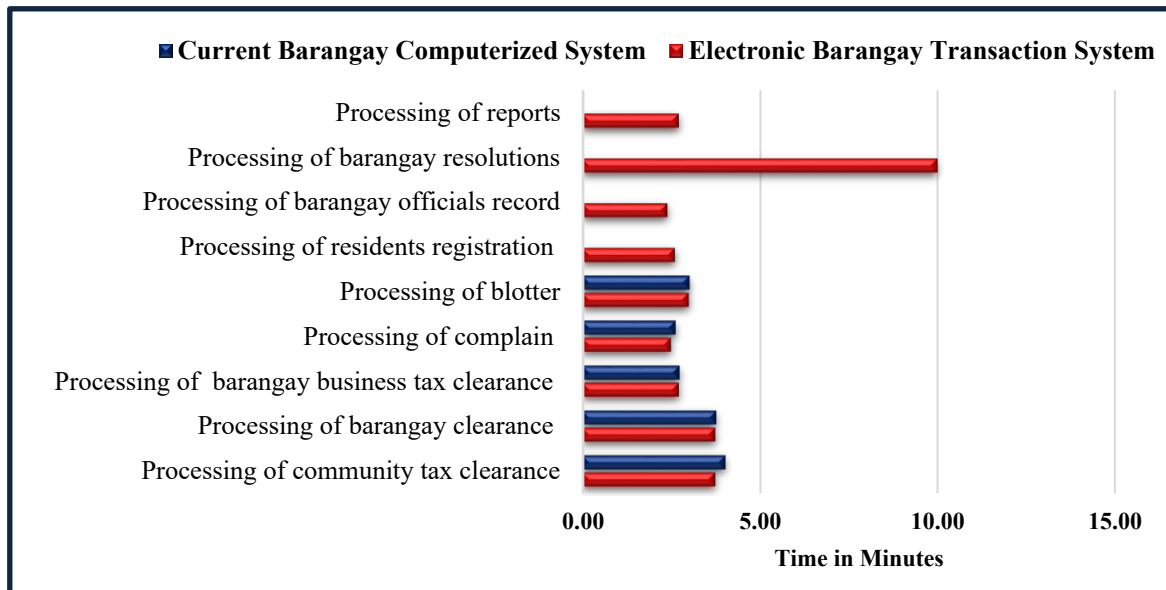
Fig. 5. Result of software evaluation for efficiency.

Figure 5 also shows that the Electronic Barangay Transaction System completes transactions more quickly, especially for complaints, blotter records, business clearances, and barangay resolutions. The study implied that the enhanced system offers superior efficiency, directly contributing to faster, more reliable, and more transparent barangay operations. These improvements reflect the system's streamlined workflow and reduced manual steps, confirming digital governance studies that emphasize how user-centered and automated solutions enhance administrative efficiency and responsiveness (Escobar et al., 2023; Aminah & Saksono, 2021).

The researchers identified several methodological limitations that may have influenced the study's results. First, the evaluation involved only one pilot barangay, limiting the generalizability of the findings to other contexts with different levels of governance capacity. Second, the sampling of respondents consisted primarily of barangay officials and selected IT experts, which may have introduced bias and limited the diversity of user perspectives, including those of barangay citizens. Third, although the rubric was an institutionally standardized tool, the evaluation relied partly on subjective judgments that could vary across evaluators. Finally, the system evaluation occurred over a limited timeframe, which may not have captured long-term adoption issues, such as system sustainability, maintenance challenges, or evolving user needs.

Conclusion and Recommendation

This study successfully met its primary objectives of designing, developing, and evaluating an enhanced Electronic Barangay Transaction (e-BT) System that addresses the operational gaps of the existing barangay computerized platform. With the integration of the Rapid Application Development (RAD) model, the study achieved its purpose of creating a fully functional digital system with expanded capabilities, including automated resident registration, barangay official and resolution management, and socio-demographic

reporting. The evaluation using the ISO/IEC 25010:2011 software quality framework confirmed that the system met the study's second primary objective—demonstrating high levels of functionality, reliability, usability, and efficiency. Both IT professionals and barangay officials provided strong performance scores, validating that the system is not only technically sound but also acceptable and usable for real-world barangay operations.

In fulfilling its purpose of improving barangay record management and administrative processes, the enhanced system significantly reduced processing time, minimized manual inconsistencies, and strengthened data accuracy and reporting. These outcomes demonstrate that the system effectively addresses the identified needs and challenges of barangay-level governance, thereby achieving the study's aim of providing a more efficient and transparent digital solution. Beyond operational improvements, the study contributes to ongoing digital transformation efforts in local government by showcasing the value of applying international software quality standards at the grassroots level. The system's capacity to streamline workflows and support evidence-based decision-making reinforces the role of ICT in empowering communities, building citizen trust, and promoting participatory governance. Ultimately, the results affirm that the enhanced e-BT system advances the goals of Sustainable Development Goal 9-Industry, Innovation, and Infrastructure, and Sustainable Development Goal 16-Peace, Justice, and Strong Institutions, underscoring the global relevance of localized digital governance initiatives.

The e-BT system has potential as a replicable model for other barangay local government units to adopt to improve their administrative processes. Future studies may focus on continuous evaluation and exploring mobile-based features to ensure the e-BT system's long-term relevance and impact while facilitating greater citizen engagement.

Acknowledgment

Disclosure: Use of AI Tools

In compliance with Threshold's guidelines for the ethical use of artificial intelligence (AI) and automated tools in academic research, the authors disclose the use of OpenAI's ChatGPT and Grammarly for enhancing the quality and clarity of the manuscript. They used ChatGPT to improve the clarity, organization, and overall coherence of the text. At the same time, the researchers used Grammarly to refine grammar, spelling, punctuation, and style consistency, and to check for potential plagiarism. Together, these tools ensured the manuscript's Accuracy, originality, and adherence to academic writing standards. The authors confirm that all data analysis, critical interpretations, and conclusions presented in this manuscript were conducted independently by the research team. The authors employed AI tools strictly for editorial assistance. They did not influence the scientific content or ethical considerations of the study. All intellectual contributions from the AI tools are in accordance with the authors' original intentions and have been

reviewed and approved by all co-authors. The use of ChatGPT complies with Threshold's ethical standards and guidelines for transparent reporting of AI involvement in research. The authors remain fully responsible for the integrity and Accuracy of the content presented in this paper.

Literature Cited and References

Aminah, S., & Saksono, H. (2021). Digital transformation of the government: A case study in Indonesia. *Jurnal Komunikasi: Malaysian Journal of Communication*, *37*(2), 272-288.

Astuti, D., Kisworo, B., Shogbesan, Y. O., & Herwina, W. (2024). The effect of local community empowerment on digital transformation in cultural and tourism preservation. *JPPM (Jurnal Pendidikan Dan Pemberdayaan Masyarakat)*, *11*(1), 1-13.

David, A., Yigitcanlar, T., Li, R. Y. M., Corchado, J. M., Cheong, P. H., Mossberger, K., & Mehmood, R. (2023). Understanding local government digital technology adoption strategies: A PRISMA review. *Sustainability, 15*(12), 9645.

Detthamrong, U., Laochankham, S., Emperador-Garnace, X. R., Jitsaeng, K., Chaichuay, V., Chansanam, W., & Li, C. (2025). Thematic shifts in E-governance research: From foundational frameworks to emerging technologies. *Social Sciences & Humanities Open*, *12*, 101888.

Elmatsani, H. M., Widianingsih, I., Nurasa, H., Munajat, M. D. E., & Suwanda, S. (2024). Exploring the evolution of leadership in government: a bibliometric study from e-government era into the digital age. *Cogent Social Sciences*, *10*(1).

Escobar, F., Almeida, W. H., & Varajão, J. (2023). Digital transformation success in the public sector: A systematic literature review of cases, processes, and success factors. Information Polity, 28(1), 61-81.

Lapuz, M. C. M. (2023). The role of local community empowerment in the digital transformation of rural tourism development in the Philippines. *Technology in Society*, *74*, 102308.

Manoharan, A. P., Melitski, J., & Holzer, M. (2023). Digital governance: An assessment of performance and best practices. Public Organization Review, 23(1), 265-283.

Suranto, B., Kovač, N., Haryono, K., Abdul Rahman, S. F., Mohd Shukri, A. F., Suder, M., ... & Žugić, D. (2025). State of digitalization in the Southeast Asia region– bibliometric analysis. *Quality & Quantity*, 1-28.

United Nations. (2024). Philippines Sustainable Coalition Development Framework 2024– 2028 [PDF]. United Nations Philippines. https://philippines.un.org/sites/default/files/2024-08/UN-SCDF-PHL-2024-2028_Publication.pdf

Zhao, B., Cheng, S., Schiff, K. J., & Kim, Y. (2023). Digital transparency and citizen participation: Evidence from the online crowdsourcing platform of the City of Sacramento. *Government Information Quarterly*, *40*(4), 101868.