

E-Ayuda System: A Digital-Based Approach to Transparent and Immediate Disaster Relief Assistance

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Abstract: This study developed and evaluated the E-Ayuda System: A Digital-Based Approach to Transparent and Immediate Disaster Relief Assistance, which was designed to improve the efficiency, transparency, traceability, accountability, and management of disaster relief assistance within Local Government Units (LGUs). The study employed an applied developmental approach guided by the Analysis, Design, and Development phases of the ADDIE Model. Operational concerns in existing manual disaster relief processes were identified, including challenges in beneficiary registration, eligibility validation, documentation, approval, record keeping, monitoring, and fund disbursement. Based on the identified requirements, a functional prototype was developed using Google Forms for beneficiary registration, Google Sheets for centralized database management, and Google Apps Script for workflow automation, beneficiary identification, and status tracking. The system incorporated document uploading, location verification, structured validation and approval, dashboard-based monitoring, audit trails, role-based access, and assisted registration mechanisms. The prototype was evaluated using selected ISO/IEC 25010 software quality criteria. Results showed favorable evaluations for functional suitability ($M = 4.67$), usability ($M = 4.20$), reliability ($M = 4.27$), performance efficiency ($M = 4.40$), and security ($M = 4.60$). Overall, the findings demonstrated that the E-Ayuda System provided a practical and relatively affordable digital solution for strengthening disaster relief administration. However, further real-world pilot testing, broader stakeholder evaluation, and continued enhancement of usability, security, connectivity, and offline mechanisms were recommended before full-scale LGU implementation.

Keywords: Disaster Relief Assistance, Digital Governance, E-Ayuda System, Local Government Units, ISO/IEC 25010.

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I. INTRODUCTION

The Philippines is facing and exposed to multiple disaster threats from tropical cyclones, floods, landslides, earthquakes, volcanic dangers and other natural occurrences. Disaster risk reduction and post-disaster recovery are ongoing national and local governance challenges due to its physical features as well as socio-economic vulnerability and diverse local coping capacities. The Philippines has constantly been listed among countries with very high disaster risk by the WorldRiskReport, emphasizing the relationship between hazard exposure and societal vulnerability (Aguilar, 2025). This vulnerability calls for disaster management systems that are not only able to respond to calamities but are also timely, inclusive, accountable and resilient. In the Philippine context, adaptive social protection has thus been identified as an important instrument for linking disaster risk reduction, climate adaptation and social protection, particularly for households whose livelihoods and assets are very vulnerable to shocks (Dacuycuy & Baje, 2017).

Recent tragedies further illustrate the ongoing need to develop disaster response mechanisms. In 2024, several tropical cyclones hit communities nationwide. These include Tropical Cyclones Kristine and Leon, which required the ongoing monitoring of their effects on affected communities, infrastructure, agriculture, and other sectors at the national level (Laqui, 2024). Large-scale disasters can quickly slash household incomes, destroy productive assets, disrupt employment and commercial activities, and boost urgent spending on food, shelter, medicine, transportation and reconstruction. Thus, providing financial support promptly after a disaster can be a vital way to help people fulfill critical needs and start on the road to recovery. In the Philippines, after Super Typhoon Yolanda, unconditional cash transfers enabled impacted households to maintain food intake, pay for medicines, repair homes, support schooling and recovery of livelihoods (Reyes et al., 2018). More broadly, cash aid has been widely acknowledged as a key component of humanitarian response by providing impacted households with the freedom to address their most pressing concerns (Maghsoudi & Piotrowicz, 2025).

However, the success of disaster relief is not simply a function of the amount of support offered, but also the efficiency of the system through which assistance is found, processed, approved and delivered. Traditional aid techniques may include paper-based application and submission of documentary requirements, repetitive verification, multiple administrative approvals, manual aggregation of beneficiary lists and in-person cash disbursements. The Philippine experience in large-scale social assistance has highlighted the operational limits of such organizations. The use of paper forms, manual processing and physical cash delivery during the implementation of the COVID-19 Social Amelioration Program led to delays and administrative inefficiencies, encouraging subsequent movement toward digital government-to-person payment mechanisms (Acopiado et al., 2022). Similarly, Maghsoudi et al. (2023) demonstrated that the presence of beneficiary identification and payment infrastructure can significantly facilitate help delivery in emergencies.

The Philippines' experience with emergency cash transfers further reinforces the need to bolster the technology infrastructure of disaster relief. The Emergency Cash Transfer mechanism of the Department of Social Welfare and Development was created to extend financial assistance to disadvantaged households affected by catastrophes, and has gradually integrated learning from previous large-scale emergencies (Department of Social Welfare and Development [DSWD], n.d.). The objective of the efforts to connect the beneficiary information and digital identity and electronic payment choices is to allow the verification and payout to be more rapid and reliable (Navarro et al., 2020). Evidence from social security programs in the Philippines also shows that beneficiaries spend less time waiting for assistance with digital payments compared to manual payment systems (Glynn-Broderick et al., 2022). These trends indicate that digitization should be understood not just as the conversion of paper forms into electronic records, but as the redesign of the whole aid system, from registration and verification to approval, distribution, monitoring and reporting.

International evidence similarly suggests the promise of digital technologies in improving humanitarian cash assistance. When adapted to the operational environment, digital currency and voucher systems can improve the speed, scale, traceability and financial transparency of humanitarian operations (Mina et al., 2021). Digital delivery systems can also bring together registration, eligibility determination, beneficiary administration, case processing, payment, monitoring and grievance procedures in a more cohesive service-delivery architecture (World Bank, 2025). In addition, digital government-to-person payments may improve transparency, eliminate fraud, lower delivery costs and make aid more accessible and (Klapper & Singer, 2017). Administrative data can also be used to inform the creation of more systematic ways to beneficiary targeting (however these mechanisms need to be carefully validated to reduce exclusion and inclusion errors (Kusumawati & Kudo, 2019)).

"Timeliness, transparency and accountability are important considerations in disaster assistance. Manual processes can create difficulties in determining the status of an application in the approval process, if multiple claims have been submitted, why an application was accepted or rejected, and whether an authorized payment has really been made to its intended recipient. Some of these restrictions can be overcome by digital systems that generate standardized records, time-stamped transactions, unique claim references, specified user roles and auditable histories of processing. Thus, these modernized social protection systems have focused on beneficiary databases, digital identification, electronic payments, and integrated information management as means for boosting efficiency and institutional accountability (World Bank, 2025). The international experience also shows that antiquated and fragmented administrative systems can constrain governments' ability to respond quickly and accountably in shocks, while digitized records and integrated systems can improve beneficiary management and program oversight (Nazuk et al., 2025).

Transparency is particularly crucial because disaster relief entails distributing limited public resources among individuals and households with urgent needs. Assistance systems should consequently have well-defined eligibility criteria, consistent documentation of decisions and limit needless discretionary intervention in beneficiary processing. The goal is not to eliminate authentic human judgment in crisis management, but to make sure that administrative judgments are based on established criteria and verifiable procedures. In this sense, digital workflow systems can support procedural fairness by standardizing application requirements, capturing verification results, storing transaction histories and allowing authorized workers to identify the status of individual claims (Mina–Aydinan, 2025). These elements are in line with wider plans to improve government financial transactions and public service delivery through digital technologies (Pangandaman, 2023).

Digitalization could potentially minimize some of the operational and security challenges of big scale physical cash distribution. Traditional payout methods may include transferring, storing, counting, disbursing and reconciling large quantities of cash, and may necessitate beneficiaries traveling to specific payout sites and waiting in line. Digital government-to-person payments provide alternative mechanisms that can reduce dependence on physical currency handling and perhaps enhance convenience, efficiency, and security (Klapper & Singer, 2017). According to the Maghsoudi et al. (2023), digital transactions can also enable governments to respond more promptly amid climatic and natural disasters through the quicker provision of government aid. The continuous expansion of digital payments in the Philippines also suggests a more conducive setting for electronic public-service transactions (Arrabaca, 2026).

However, digital disaster support must not be viewed as a technocratic answer. Effectiveness of digital cash assistance is very context-dependent and can be hindered by damaged telecommunications infrastructure, electricity interruptions, limited device ownership, lack of digital proficiency,

financial exclusion, cybersecurity risks, and unequal access to payment channels (Alfiana et al., 2025). Digitalization might thus introduce new types of exclusion if systems expect continuous connectivity or ubiquitous access to technology. Research on cash-based support through digital means shows that it is not the technology itself that determines suitability, but also local infrastructure, institutional capacity, beneficiary characteristics and operational context (Maghsoudi et. al. 2023). Hence, a resilient system for disaster-prone areas should include alternate or aided registration methods in cases where conventional digital access is not feasible.

Beneficiary information processing also has substantial privacy and information security obligations. Systems for disaster aid may collect names, addresses, contact information, household characteristics, identity records, financial information, and proof of disaster-related losses. Government institutions are obliged, under the Republic Act No. 10173 or the Data Privacy Act of 2012, to gather personal information for legitimate purposes, process the information fairly and lawfully, keep the information safe, and prevent access or disclosure without authorization (Republic Act No. 10173, 2012). The handling of personal data by government entities including LGUs is also subject to the requirement of the adoption of adequate organizational, physical and technical measures (Mina, Villaviza, Pascual & Cumbe, 2025). Transparency in disaster assistance should therefore not mean free disclosure of information on beneficiaries but rather transparent procedures, eligibility rules, processing status, accountability mechanisms and auditable transactions with adequate protection of personal data.

The practical requirement for disaster-assistance systems that combine speed, transparency, accountability, accessibility, traceability, privacy protection, and operational continuity within a platform practicable for resource-constrained LGUs continues to exist against this backdrop. The value of emergency cash transfers (Reyes et al., 2018), digital government to person payments (Glynn-Broderick et al., 2022), adaptive social protection (Dacuycuy & Baje, 2017) and digital humanitarian aid has been established in the literature. However, the translation of these concepts into a low-cost, LGU-oriented workflow that incorporates beneficiary registration, validation, approval, payment monitoring and reporting remains an essential topic for applied systems development.

Thus, this study developed the E-Ayuda System: A Digital-Based Approach to Transparent and Immediate Disaster Relief Assistance, a digital platform for disaster assistance that aims to streamline the process and monitoring of financial aid from the registration, verification, approval, disbursement, and reporting of beneficiaries. The prototype utilizes existing digital technologies such as Google Forms, Google Sheets and Google Apps Script to demonstrate the potential for a relatively low-cost digital workflow in the environment of an LGU. The system is designed to provide sequential claim references, keep beneficiary data, track application and payment progress, provide dashboard-based monitoring, and create an auditable record of administrative actions.

The proposed solution acknowledges that calamities can cause disruptions to the electricity, telecommunications, and internet connectivity and does not require continuous digital access. During cases of infrastructure failure, authorized barangay or LGU workers may assist or manually gather data temporarily which would be encoded to the system once connectivity becomes available. The hybrid set-up is meant to ensure continuity of operations without leaving out disaster-hit residents who are unable to access digital services on their own. This approach is consistent with the overarching notion that technology should complement, not replace, inclusive and context-sensitive disaster governance (United Nations Office for Disaster Risk Reduction [UNDRR] & ATscale, 2025).

The study thus contributes to disaster-management practice and digital governance by demonstrating how an accessible technological platform can be developed around the principles of timely assistance, standardized processing, traceability, accountability, data protection, and inclusive service delivery. Rather than approaching digitization as an objective in itself, the E-Ayuda System frames technology as an administrative tool to enhance the integrity and timeliness of disaster relief. In doing so, the study also answers to the continuing demand for practical, scalable, and locally implementable digital solutions that would help LGUs administer disaster aid more efficiently while ensuring transparent procedures and protecting the rights and information of affected populations.

➤ *Objectives of the Study*

The general objective of this study was to design, develop, and evaluate the E-Ayuda System as a digital-based approach to improving the efficiency, transparency, traceability, accountability, and management of disaster relief assistance within Local Government Units (LGUs). Specifically, the study sought to analyze the existing disaster relief assistance processes of LGUs to identify operational problems and system requirements related to beneficiary registration, validation, documentation, approval, monitoring, and disbursement; design the E-Ayuda System based on the identified requirements by incorporating digital beneficiary registration, supporting-document submission, location verification, centralized data management, unique beneficiary identification, validation and approval workflows, monitoring and reporting, security, and accessibility mechanisms; and develop a functional prototype using Google Forms, Google Sheets, and Google Apps Script, consisting of beneficiary registration, database management, and automated workflow functionalities. Furthermore, the study aimed to evaluate the developed E-Ayuda System based on the ISO/IEC 25010 software quality criteria in terms of functional suitability, usability, reliability, performance efficiency, and security; determine its overall acceptability among the selected evaluators; and determine the estimated cost of implementing the proposed system within an LGU setting. These objectives were aligned with the system development, evaluation, and proposed implementation cost presented in the Results and Discussion.

II. METHODOLOGY

This capstone project used an applied developmental approach in the designing and developing of a working prototype of the E-Ayuda System, a digital disaster relief assistance management system that aims to promote transparency, accountability, efficiency, and responsiveness in the delivery of financial assistance related to disaster by Local Government Units (LGUs). The system is developed based on the ADDIE Model which consists of five phases; Analysis, Design, Development, Implementation and Evaluation. However, due to the scope of this project, only the first three phases which are Analysis, Design and Development were carried out as the emphasis of the study is on the production of a functional prototype, not its full-scale operational implementation and evaluation. In the Analysis Phase, operational problems associated with the current manual processes of providing disaster relief assistance were already identified, such as beneficiary registration, validation of eligibility, documentation, approval, record-keeping, and disbursement of funds, and a potential concern about processing delays, administrative workload, transparency, and information management. Relevant information was gathered through observation of existing disaster relief operations, scanning of applicable policies and regulations such as Republic Act No. 10121 or the Philippine Disaster Risk Reduction and Management Act of 2010, and insights from personnel involved in disaster response and assistance administration. The results of this phase were utilized to establish the system needs and how digital technologies could address recognized constraints in existing methods. The Design Phase consisted of conceptualizing the E-Ayuda System system architecture, user workflow, interface, data needs and primary capabilities. The proposed design includes digital beneficiary registration through an online form; uploading of supporting documents such as identification records and photographs of disaster-related damage; location verification through Google Map pinning, where appropriate and legally permissible; automated recording of information in a centralized database; generation of sequential and unique claim reference numbers; structured validation and approval workflows; and dashboard-based monitoring and reporting. The design also included safeguards such as audit logs, role-based management of access, and methods to assist compliance with applicable data privacy standards. In an effort to make it more accessible and to decrease the digital divide, an assisted registration feature was included allowing barangay officials or LGU staff to encode information for beneficiaries without access to a mobile device or computer, internet connection, or lack of sufficient digital literacy skills. Temporary manual or offline data collection is allowed in cases of disruption in technological infrastructure. During the Development Phase, the approved system design and identified functional requirements were converted into a working prototype using accessible and relatively low-cost digital technologies such as Google Forms (for beneficiary data collection), Google Sheets (for the central database and Google Apps Script (for workflow automation, reference-number generation, status tracking and related system functions). The prototype developed showed the proposed end-to-end digital workflow for beneficiary registration,

validation, approval, monitoring, and documentation, thus providing a practical representation of how the E-Ayuda System could contribute to a more efficient, transparent, traceable, and accountable disaster relief assistance process in an LGU setup. Appropriate knowledge and application of data and statistical analysis are important in producing meaningful interpretations of research findings (Mina et al., 2026).

III. RESULTS AND DISCUSSION

This section presents and discusses the results of the development of the E-Ayuda System, highlighting how its features and functionalities address the identified challenges in delivering timely, transparent, efficient, and accountable disaster relief assistance.

➤ *Analysis Phase*

In the Analysis Phase, the researcher identified and examined operational concerns on the present manual processes on the delivery of disaster relief financial aid in the Local Government Units (LGUs). Special focus was on beneficiary registration, eligibility verification, documentation, approval, record keeping, fund disbursement, delays in processing, administrative burden (Mina, Villaviza, Pascual & Cumbe, 2025), transparency and information management. Relevant information was obtained through observation of existing disaster relief procedures, review of relevant policies and regulations including Republic Act No. 10121 or the Philippine Disaster Risk Reduction and Management Act of 2010 and insights from personnel involved in disaster response and assistance administration. The research identified the need for a digital solution that would reduce reliance on manual operations, and increase the speed, transparency, traceability and accountability of help delivery. The identified operational gaps and user requirements were therefore used as a base for the determination of the functional requirements of the E-Ayuda System particularly the digitization of beneficiary registration, validation, approval, monitoring, documentation and disbursement related processes.

➤ *Design Phase*

The requirements found during the analysis were turned into the E-Ayuda System's suggested architecture, workflow, interface, data structure, and functionality during the Design Phase. Digital beneficiary registration via Google Forms; uploading of supporting documentation, such as identification documents and photos of disaster-related damage; location verification via Google Maps pinning, when appropriate and permitted by law; centralized data recording; creation of distinct and sequential beneficiary claim reference numbers; structured validation and approval workflows; and dashboard-based monitoring and reporting were all included in the system's design. The design also included security and accountability features like audit logs, role-based access controls, and data privacy protections. The system incorporated an assisted registration function that enables authorized barangay or LGU staff to encrypt data for beneficiaries without smartphones, internet access, or sufficient digital literacy in order to foster inclusivity. In order

to ensure that the suggested digital solution is still available and responsive in a variety of emergency situations, temporary manual or offline data collecting was also included to guarantee continuity when calamities damage technology infrastructure.

➤ Development Phase

• System Interface and Module Description

To provide a clearer understanding of the E-Ayuda System, screenshots of its modules are included to illustrate its structure and functionality.

• Module 1: Beneficiary Registration (Google Forms)

Fig 1 E-Ayuda Registration Form

In this module, users (Beneficiaries/Assistants) enter their own data and details about disasters and then can upload all necessary documentation, including a valid government-issued ID card, a photo of damage to property, and a

geotagged photo that will be used to collect standardized and complete data.

• Module 2: Database Management (Google Sheets)

Registration	Beneficiary ID	Full Name	Sex	Age	Contact	Municipality	Disaster Event	Damaged House	Valid ID	Damage Category	Duplicate Check
	EA-0001	Morada Tonet Crisanto	Male	18	09494693113	Baler	Typhoon	https://drive.google.com/open?id=1N1	https://drive.google.com/open?id=16f	Totally Damage	OK
	EA-0002	MORADA LYNETT CRUZ	Female	36	09499977784	Baler	SUPER TYPHOON UWAN	https://drive.google.com/open?id=1K7	https://drive.google.com/open?id=1U7	Partially Damage	OK
	EA-0003	CRUZ DWIGHT FELIX FERRERAS	Male	26	09797997101	San Luis	SUPER TYPHOON UWAN	https://drive.google.com/open?id=1sm	https://drive.google.com/open?id=1hU	Totally Damage	OK

Fig 2 E-Ayuda Registration Sheet (Profile)

All submitted data are automatically stored in a centralized database using Google Sheets. This allows real-time data recording, filtering, validation, and monitoring of beneficiary records.

Validation	Beneficiary ID	Full Name	Municipality	Damage Category	Eligibility	Date Validated	Amount Approved	Payout Status	Date Released	Paymaster	Remarks
	EA-0001	Morada Tonet Crisanto	Baler	Totally Damage	Eligible	4/2/2026	10,000.00	Paid	4/2/2026		
	EA-0002	MORADA LYNETT CRUZ	Baler	Partially Damage	Eligible	4/2/2026	5,000.00	Pending			
	EA-0003	CRUZ DWIGHT FELIX FERRERAS	San Luis	Totally Damage	Eligible	4/2/2026	10,000.00	Paid	4/2/2026		

Fig 3 E-Ayuda Validation and Approval Sheet (Payout)

The system generates a unique Beneficiary ID, organizes uploaded files, and updates processing status, such as pending, validated, approved, and paid.

• *Module 3: Automation Workflow and Reset (Google Apps Script)*

```

1 function resetDatabase() {
2
3   var ss = SpreadsheetApp.getActiveSpreadsheet();
4
5   // VALIDATION
6   var valSheet = ss.getSheetByName("Validation, Approval & Payout");
7   if (valSheet) {
8     var lastRow = valSheet.getMaxRows();
9
10    valSheet.getRange(2,5,lastRow,1).clearContent();
11    valSheet.getRange(2,6,lastRow,1).clearContent();
12    valSheet.getRange(2,8,lastRow,1).clearContent();
13    valSheet.getRange(2,9,lastRow,1).clearContent();
14    valSheet.getRange(2,10,lastRow,1).clearContent();
15    valSheet.getRange(2,11,lastRow,1).clearContent();
16  }
17
18  // SUMMARY
19  var summary = ss.getSheetByName("Summary Dashboard");
20  if (summary) summary.getRange("A2:Z").clearContent();
21
22  // PAYOUT
23  var payout = ss.getSheetByName("Payout Sheet");
24  if (payout) payout.getRange("A4:Z").clearContent();
25
26  SpreadsheetApp.getUi().alert("🟢 RESET COMPLETE (ALL SHEETS)");
27 }

```

Fig 4 E-Ayuda Google Apps Script Code and Triggers

Automation processes include generating beneficiary ID numbers, organizing files, updating system status, and database reset.

➤ *Validation Phase*

The data collected during the evaluation of the E-Ayuda System is examined using the ISO 25010 framework. The mean and standard deviation that were calculated are used to interpret the data collected from each respondent.

Table 1 Functional Suitability

No.	Indicator	Mean	SD	Interpretation
1	Provides necessary features	4.60	0.55	Strongly Agree
2	Accurate data recording	4.60	0.55	Strongly Agree
3	Supports monitoring	4.80	0.45	Strongly Agree
	Overall Weighted Mean	4.67	0.41	Strongly Agree

Table 1 shows the respondents' evaluation on the functional suitability of the E-Ayuda System with an overall weighted mean of 4.67 (SD = 0.41) which is interpreted as Strongly Agree. Thus, the system was perceived as having the functionalities needed for the precise and efficient management of disaster relief assistance. The highest score was obtained by the indicator "Supports monitoring" (M = 4.80, SD = 0.45), indicating that the respondents valued the system's capability to monitor beneficiary information and aid processes. The finding is reinforced by Maghsoudi et al. (2023) who discovered that digital technology in disaster cash

assistance can improve speed, quality and financial transparency while strengthening monitoring and tracking. The lowest rated indications were "Provides necessary features" and "Accurate data recording" (both M = 4.60, SD = 0.55) yet both were still under Strongly Agree. The results are still favorable since functional appropriateness implies that the software must have complete and accurate functionalities to fulfill the intended user needs (International Organization for Standardization [ISO] & International Electrotechnical Commission [IEC], 2023).

Table 2 Usability

No.	Indicator	Mean	SD	Interpretation
1	Easy to understand	4.20	0.45	Strongly Agree
2	Easy to use	4.20	0.45	Strongly Agree
3	User-friendly navigation	4.20	0.45	Strongly Agree
	Overall Weighted Mean	4.20	0.45	Strongly Agree

Table 3 presents the respondents' assessment of the usability of the E-Ayuda System, which obtained an overall weighted mean of 4.20 (SD = 0.45), interpreted as Strongly Agree. This indicates that respondents perceived the system as understandable, easy to operate, and user-friendly in navigating its functions. Notably, all three indicators—"Easy

to understand," "Easy to use," and "User-friendly navigation"—obtained the same mean of 4.20 (SD = 0.45); therefore, there was no distinct highest or lowest-rated indicator. Similar ratings point to constant positive evaluations across the numerous dimensions of usability. This result is consistent with ISO/IEC 25010:2023, where

learnability and operability are seen as important properties that enable users to comprehend, operate, and control a system efficiently (ISO & IEC, 2023). Similarly, Mina et al. (2021) showed that e-government platforms in the

Philippines were more usable when they had ordered layouts and logical process flows, but less usable when they had confusing interfaces and poor navigation, which negatively affected user experience.

Table 3 Reliability

No.	Indicator	Mean	SD	Interpretation
1	Consistent performance	4.00	0.00	Agree
2	Accurate processing	4.40	0.55	Strongly Agree
3	Stable operation	4.40	0.55	Strongly Agree
	Overall Weighted Mean	4.27	0.28	Strongly Agree

Table 4 presents the respondents' assessment of the reliability of the E-Ayuda System, which obtained an overall weighted mean of 4.27 (SD = 0.28), interpreted as Strongly Agree. It implies that the system was widely seen as reliable in accomplishing the functions it was designed for – providing disaster relief aid. “Accurate processing” and “Stable operation” were the top rated indicators, both with a mean of 4.40 (SD = 0.55), suggesting trust in the system's capability to accurately process information and maintain operational stability. This is consistent with ISO/IEC

25010:2023 where reliability is defined as the capacity to perform a function without interruption or failure under specified situations (ISO & IEC, 2023). The lowest rated indicator was “Consistent performance” (M = 4.00, SD = 0.00) but it was nevertheless evaluated as Agree. This indicates a space for more system testing and refinement. Dela Peña (2025) also underlined reliability as a significant quality feature of Philippine LGU e-governance systems for effective digital public-service delivery.

Table 4 Performance Efficiency

No.	Indicator	Mean	SD	Interpretation
1	Fast response time	4.40	0.55	Strongly Agree
2	Efficient processing	4.60	0.55	Strongly Agree
3	Smooth operation	4.20	0.45	Strongly Agree
	Overall Weighted Mean	4.40	0.43	Strongly Agree

Table 5 presents the respondents' assessment of the performance efficiency of the E-Ayuda System, which obtained an overall weighted mean of 4.40 (SD = 0.43), interpreted as Strongly Agree. This shows that the system was evaluated to be efficient in responding to users and in handling disaster relief transactions. The highest rated indication was “efficient processing” (M = 4.60, SD = 0.55), which means that the system efficiently enables the processing of beneficiary details and assistance-related transactions. This finding is in line with Maghsoudi et al.

(2023), who demonstrated through cross-case study that digital technology in disaster relief can improve timeliness, speed and operational efficiency. The lowest rated indication was “Smooth operation” (M = 4.20, SD = 0.45) but still falls in the Strongly Agree range. Thus, additional optimization can lead to improvements in the overall operation of the system. According to Kaur et al. (2019), performance efficiency relates to how much a system must satisfy the standards of response-time and throughput and the efficient utilization of resources.

Table 5 Security

No.	Indicator	Mean	SD	Interpretation
1	Controlled access	4.40	0.55	Strongly Agree
2	Data protection	4.60	0.55	Strongly Agree
3	Secure authentication	4.80	0.45	Strongly Agree
	Overall Weighted Mean	4.60	0.43	Strongly Agree

Table 6 presents the respondents' assessment of the security of the E-Ayuda System, which obtained an overall weighted mean of 4.60 (SD = 0.43), interpreted as Strongly Agree. Thus, respondents assessed the system to be able to protect beneficiary information and limit the system functionalities to authorized users. The top-rated indicator was “Secure authentication” (M = 4.80, SD = 0.45), indicating a high level of confidence in the capabilities of the system to check authorized users. This observation is

consistent with Fortinet (n.d.) which considers authenticity, confidentiality, integrity and accountability as important ingredients of software security. The lowest rated indication was ‘Controlled access’ (M = 4.40, SD = 0.55) although this was still in the Strongly Agree range. This means that the access control techniques may yet be improved. Ribeiro et al. (2025) underline the necessity of strong security controls to safeguard sensitive information and ensure the integrity of digital government services.

Table 6 Overall Acceptability

No.	Indicator	Mean	SD	Interpretation
1	Controlled access	4.40	0.55	Strongly Agree
2	Data protection	4.60	0.55	Strongly Agree
3	Secure authentication	4.80	0.45	Strongly Agree
	Overall Weighted Mean	4.60	0.43	Strongly Agree

Table 7 presents the overall acceptability of the E-Ayuda System, which obtained an overall weighted mean of 4.60 (SD = 0.43), interpreted as Strongly Agree. This indicates a high level of acceptance of the system, particularly regarding its security-related features. The highest-rated indicator was “Secure authentication” (M = 4.80, SD = 0.45), suggesting that respondents highly valued mechanisms that verify authorized users and protect access to sensitive beneficiary information. This finding is consistent with Gupta et al. (2024), whose meta-analysis of 68 studies showed that

security and privacy significantly influence trust in e-government systems, which subsequently affects users’ intention to use them. The lowest-rated indicator was “Controlled access” (M = 4.40, SD = 0.55), although it was still interpreted as Strongly Agree. This indicates positive acceptance while suggesting room for strengthening access-management mechanisms. Diaz-Guzmán Verástegui et al. (2025) similarly found that trust, perceived usefulness, and ease of use are important determinants of user acceptance of digital government services.

IV. SUMMARY OF E-AYUDA SYSTEM EVALUATION

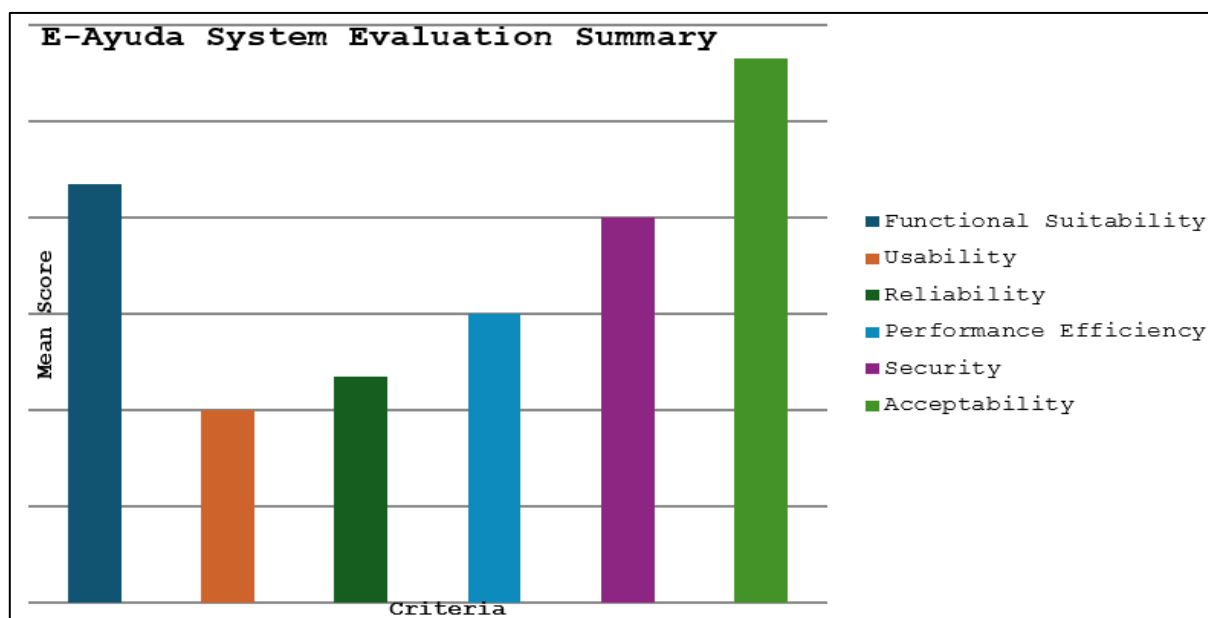


Fig 5 Overall Evaluation Results of the E-Ayuda System Across All ISO 25010 Criteria

The results indicate that all measures are rated "Strongly Agree" at the highest acceptability (4.93) and the lowest usability (4.20). This clearly illustrates that, even though this system is both extremely successful and widely accepted,

enhancements to usability through improved user interface design may further enhance its feasibility.

➤ Proposed Cost of Implementation

Table 7 Cost of Implementation

Item	Estimated Cost
Google Workspace	₱3,000.00 – ₱6,000.00/year
Internet	₱1,500.00 – ₱2,500.00/month
Training	₱50,000.00
Computer	₱50,000.00 – 70,000.00
Total	₱104,500.00 – ₱128,000

The cost-effectiveness of this system (Campos et al., 2025) offers strong feasibility for LGUs, particularly those with very limited financial resources, while enabling them to achieve greater efficiency, transparency, and accountability.

V. CONCLUSIONS

Based on the findings of the study, it was concluded that the E-Ayuda System was effectively conceived and created as a working digital prototype that solved the shortcomings that

were observed in the manual efforts to provide disaster relief aid. Beneficiary registration, centralized data management, validation, monitoring, and automated workflow operations were all made possible by the system through the utilization of digital technologies that were easily available. As a consequence of the evaluation results, which exhibited good assessments across functional appropriateness, usability, reliability, performance efficiency, and security, it can be concluded that the system was generally acceptable to the individuals who administered the evaluation. The system also exhibited potential as a digital solution that is relatively affordable, with the goal of improving transparency, accountability, traceability, and administrative efficiency in the delivery of disaster aid by local government units (LGUs). However, additional testing and implementation in the real world were still required.

VI. RECOMMENDATIONS

The study suggested that the E-Ayuda System should go through additional development and pilot testing in the real world before it is implemented on a large scale in Local Government Units (LGUs). This recommendation was based on the findings of the study. In order to improve usability, system consistency, access controls, and interface design, particular emphasis should be paid to these areas. A sufficient amount of user training, technical assistance, dependable internet connectivity, and alternate offline data-collection procedures should also be given in order to guaranty accessibility in the event of a disaster. Mechanisms for data privacy, security, backup, and recovery should be strengthened in the implementation of future development. In addition, local government units (LGUs) should conduct broader evaluations that involve beneficiaries, disaster-response personnel, and other stakeholders in order to determine the effectiveness of the system under actual disaster situations. These evaluations should be conducted before the adoption of the system.

VII. LIMITATIONS OF THE STUDY

Some limitations of the study should be noted in the interpretation of the results. The evaluation was carried out on a prototype of the E-Ayuda System, using simulated data, and not on a full implementation in a real disaster environment. Consequently, the results illustrate the potential capabilities of the system but may not fully represent its performance in real emergency scenarios. Second, the assessment was done with a limited number of participants who were selected using purposive sampling. The selection of these individuals was based on their relevant expertise and experience, although their perceptions may not be totally representative of the perceptions of users from other LGUs. Third, the system needs a stable internet connection and enough digital infrastructure to be effective, which may be restricted or unstable in rural, geographically isolated and underprivileged communities in the Philippines. Lastly, the users' online literacy and technological competence level may influence their capacity to learn, adopt and effectively use the system. Thus, the adoption and accessibility of the system across different LGU contexts will be facilitated by proper

user training, technical assistance, alternative data gathering modalities, and sustained support to the system.

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