

WEB-BASED DIGITAL DOCUMENT GOVERNANCE SYSTEM FOR OPTIMIZING MULTI-AGENCY COMPLIANCE MONITORING: AN EMPIRICAL STUDY AT TEGAL CITY PPID

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Abstract— Information and documentation management at the Public Information and Documentation Management Office of Tegal City faces operational challenges due to reliance on manual mechanisms for collecting files from 73 Regional Government Agencies. The main obstacles include slow recapitulation processes that can take up to four weeks, high risk of damage or loss of physical archives, and difficulty in monitoring document submission status in real time. This study aims to design and implement a web-based information system that optimizes the workflow of collecting, verifying, and monitoring public document compliance across government agencies within the digital governance infrastructure of Tegal City PPID. The system was developed using the Waterfall model which includes requirement analysis, system and data design, coding, testing, and maintenance. System modeling was carried out using Unified Modeling Language to visualize system functions and data structures. The resulting system integrates workflows between 73 Regional Government Agencies and the PPID through a centralized platform that allows operators to upload documents independently and administrators to conduct verification processes. The system also provides a monitoring dashboard to track document submission compliance in real time. System validation was conducted using Black-box Testing on 11 functional scenarios with a success rate of 100%, and User Acceptance Testing confirming system acceptance based on seven evaluation criteria. The implementation of this system improves efficiency in document management, reduces the risk of data loss, and supports more effective public information services.

Keywords: information system, public information and documentation management office, waterfall, public documentation, web application.

Abstract—Pengelolaan informasi dan dokumentasi pada Pejabat Pengelola Informasi dan Dokumentasi (PPID) Kota Tegal menghadapi tantangan operasional akibat ketergantungan pada mekanisme manual dalam pengumpulan berkas dari 73 Organisasi Perangkat Daerah (OPD). Hambatan utama yang dihadapi meliputi lambatnya proses rekapitulasi yang dapat mencapai empat minggu, tingginya risiko kerusakan atau kehilangan arsip fisik, serta kesulitan dalam memantau status pengiriman dokumen secara real time. Penelitian ini bertujuan untuk merancang dan mengimplementasikan sistem informasi berbasis web yang mengoptimalkan alur kerja pengumpulan, verifikasi, dan pemantauan kepatuhan dokumen publik lintas instansi dalam infrastruktur tata kelola digital PPID Kota Tegal. Metode pengembangan sistem menggunakan model Waterfall yang mencakup tahapan analisis kebutuhan, perancangan sistem dan data, pengkodean, pengujian, serta pemeliharaan. Pemodelan sistem dilakukan menggunakan Unified Modeling Language untuk memvisualisasikan fungsi sistem dan struktur data. Sistem yang dihasilkan mengintegrasikan alur kerja antara 73 OPD dan PPID melalui platform terpusat yang memungkinkan operator mengunggah dokumen secara mandiri dan administrator melakukan proses verifikasi. Sistem juga menyediakan dashboard pemantauan untuk memonitor tingkat kepatuhan pengiriman dokumen secara real time. Validasi sistem dilakukan menggunakan Black-box Testing pada 11 skenario fungsional dengan tingkat keberhasilan 100%, serta User Acceptance Testing yang menunjukkan bahwa sistem dapat diterima

berdasarkan tujuh kriteria evaluasi. Implementasi sistem ini meningkatkan efisiensi pengelolaan dokumen, meminimalkan risiko kehilangan data, serta mendukung pelayanan informasi publik yang lebih efektif.

Kata Kunci: sistem informasi, pejabat pengelola informasi dan dokumentasi, waterfall, dokumentasi publik, aplikasi web.

INTRODUCTION

Public information disclosure is a basic right of the community guaranteed by laws and regulations, as stated in Law Number 14 of 2008 concerning Public Information Disclosure (Pemerintah Indonesia, 2008). In order to fulfill the mandate of the regulation, each local government is obliged to appoint an Information and Documentation Management Officer who is in charge of coordinating the collection, documentation, storage, and service of public information so that it can be accessed by the public in a transparent and accountable manner (Komisi Informasi Pusat, 2021). However, in practice at the regional level, the management of public information and documentation still faces significant operational challenges. A case study on the Tegal City Information and Documentation Management Officer revealed that the entire document management workflow from 73 Regional Apparatus Organizations is still completely dependent on a physical file-based system, resulting in inefficiencies in the recapitulation process, high potential for damage or loss of archives due to unstructured management, as well as obstacles in the process of publication and dissemination of information that require digitization stages manually (Hidayatullah, Reaba, Hasiba, & Teknik, 2024). This condition simultaneously also makes it difficult for the administration to monitor the compliance status of the submission of documents from each regional apparatus organization comprehensively and periodically (Nagrama, Lingating, Calleno, Rato, Catungal, & Encarnacion, 2024).

Departing from the problems that have been identified, this study is intended to answer the fundamental question of how to design and build an integrated web-based information system to transform the document management process at the Tegal City Information and Documentation Management Officer from manual to digital mechanisms, so as to be able to improve the efficiency of document collection and recapitulation from 73 regional apparatus organizations, Minimize the risk of damage to physical archives through electronic database-based storage, while

providing an automatic and real-time document monitoring mechanism. This research aims to produce a system that can support the administrative operations of Information and Documentation Management Officials more effectively, efficiently, and measurably in order to meet the public information service standards set by applicable regulations.

From the point of view of literature review, several previous studies have discussed efforts to digitize archive management and information services in the government environment. Shirley (2022) develop a web-based portal to allow the public to apply for information online to the Communication and Information Service, while Wahyudi, Yusup, & Perdana (2025). successfully built a digital filing system for incoming and outgoing letter documents within the Population Office. On the other hand, Lestari & Saputra (2025) Produce a performance monitoring dashboard sytem for government agencies that shows the relevance of monitoring features in government data management, and Elvina et al. (2023) implement a digital archiving system within the District Attorney's Office. Research by Rizki et al. (2023) and Maylina et al. (2024) It also shows the importance of digitizing archives to prevent damage to physical documents and improve the efficiency of information management. Although these studies have contributed to the field of digital information archiving and services, there is a gap in the study of systems that specifically handle the workflow of collecting, verifying, and monitoring compliance of public documents from a large number of regional.

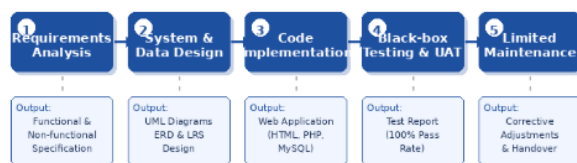
Unlike prior studies that addressed document digitization within single-agency environments, this research introduces a distinctive contribution by developing a centralized multi-agency document governance system capable of simultaneously managing submission workflows, automated verification, and real-time compliance monitoring across 73 Regional Apparatus Organizations under a unified administrative platform. The novelty of this study lies in the integration of role-based access control, automated document validation, and a statistical compliance dashboard into a single cohesive system specifically architected for the institutional structure of regional PPID offices in Indonesia a configuration that has not been systematically addressed in existing literature (Saputra, 2023).

Accordingly, this research specifically aims to design, develop, and empirically validate a web-based document governance information system for the Tegal City PPID that integrates multi-agency document submission workflow, automated administrative verification, role-based access control, and real-time compliance monitoring

dashboard into a unified centralized platform, thereby establishing a measurable and replicable digital governance model for regional PPID institutions across Indonesia.

MATERIALS AND METHODS

This research adopts the Waterfall model as its system development framework, encompassing five sequential phases: requirements analysis, system and data design, code implementation, functional testing, and limited maintenance (Ningsih & Nurfauziah, 2023). The sequential implementation of each Waterfall phase along with its corresponding output in this research is visualized in Figure 1.



Source: (Research Results, 2025)

Figure 1. Waterfall Development Methodology

Figure 1 illustrates the five sequential phases of the Waterfall methodology as applied in this research. The process commences with Requirements Analysis, producing functional and non-functional specifications derived from direct observation and semi-structured interviews at the Tegal City PPID. The subsequent System and Data Design phase generates UML diagrams, Entity Relationship Diagram, and Logical Record Structure as the architectural blueprint of the system. The Code Implementation phase translates the design into a functional web application built upon HTML, PHP, and MySQL technologies. The fourth phase, Black-box Testing and User Acceptance Testing, validates all 11 functional scenarios and 7 acceptance criteria, yielding a 100% pass rate. Finally, the Limited Maintenance phase encompasses corrective adjustments identified during the UAT operational trial, concluding with formal system handover to the Tegal City PPID institution.

It is important to clarify that within the scope of this research, the maintenance phase is conducted in a limited capacity, specifically restricted to post-User Acceptance Testing corrective adjustments identified during the operational trial period involving Administrator and Operator representatives. Extended or long-term maintenance activities beyond this defined scope are acknowledged as a limitation and are recommended for continuation by the host institution following system handover. This

approach was chosen because the development of information systems in the government environment requires comprehensive documentation and an orderly and monitorable workflow at every stage. The primary data sources in this study were obtained through three data collection techniques, namely direct observation of the operational workflow at the Tegal City Information and Documentation Management Officer office to understand the business processes that are running comprehensively, semi-structured interviews with the implementing staff and leaders of the unit to identify managerial barriers and user needs in depth, as well as a literature study that includes regulatory reviews and studies Previous research as a scientific foundation (Saputra, 2023). Secondary data obtained from literature studies include the legal basis of public information disclosure and relevant information system development theories to position research methodologically.

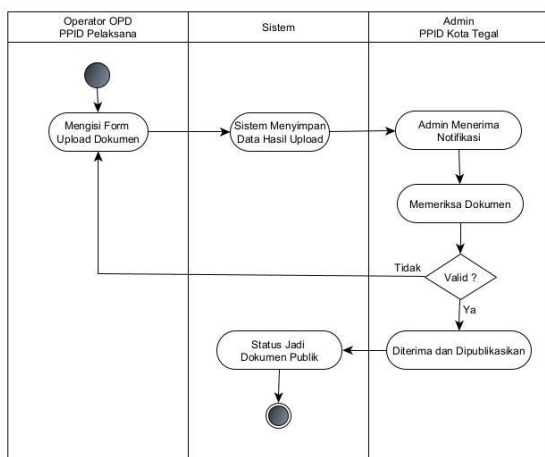
The data that has been collected is then analyzed systematically starting from the stage of running system analysis, where all findings from observations and interviews are integrated to identify functional gaps in the document management process that is still manual-based at the Tegal City Information and Documentation Management Officer serving 73 Regional Apparatus Organizations. The results of the analysis are then translated into the system's functional and non-functional requirements specifications, which include document upload modules, verification and validation mechanisms by administrators, and real-time monitoring dashboard features. The system design was developed using Unified Modeling Language modeling which included usage diagrams, activity diagrams, and sequence diagrams to illustrate the interactions between components, while the database structure was designed through entity relationship diagrams and implemented on MySQL (Afiifah, Azzahra, & Anggoro, 2022). The built system is then tested using a black-box testing method that focuses on verifying the functionality of each key module, and ends with user acceptance testing involving administrator and operator representatives from the real operational environment to ensure the system meets the needs of the end-user as a whole (Wulandari, Saepudin, Kinanti, Sudesi, Saifudin, & Yulianti, 2022).

RESULTS AND DISCUSSION

System Design Results

The results of the first research include modeling and design of information systems built to transform the document management workflow at the Tegal City Information and Documentation

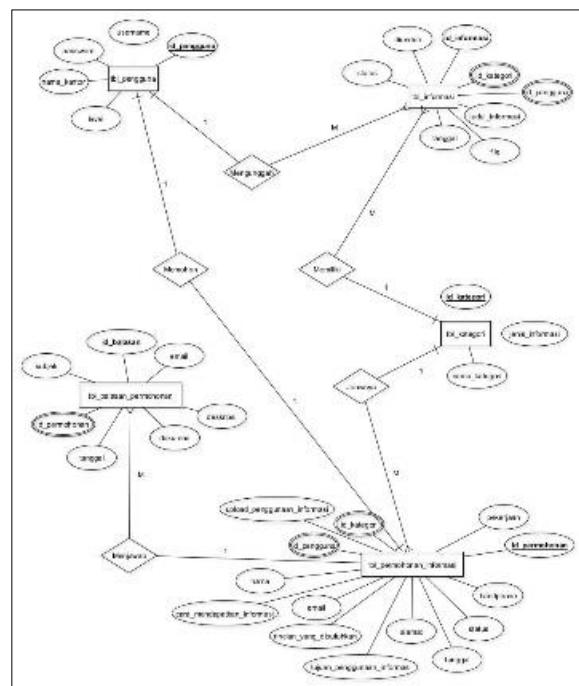
Management Officer from a manual to a digital mechanism. The regulatory framework for public information management in Indonesia is regulated through Law Number 14 of 2008 concerning Public Information Disclosure (Jalil, Hasran, Noor, & Norman, 2023), whose technical implementation is strengthened by Information Commission Regulation Number 1 of 2021 (Dos Santos, Hanifah Permatasari, & Eko Purwanto, 2025), and implemented at the regional level through Tegal Mayor Regulation Number 18 of 2017 (Hanasi, 2025). System modeling is carried out using a standard modeling language that includes usage diagrams, activity diagrams, and sequence diagrams to comprehensively describe the interaction between actors and systems (Ningsih & Nurfauziah, 2023). The information system approach in the context of government functions as a means of supporting administration and public services (Saputra, 2023). The system is designed to accommodate two main user roles, namely the Administrator and the Regional Device Organization Operator, each with customized access rights. The core workflow starts with the Operator uploading the document, then the system stores the data and sends a notification to the Administrator to perform the check. If the document is eligible, its status is updated and entered into the public archive; otherwise the Operator is required to re-upload. The complete document upload and verification workflow, including the conditional branching between document approval and revision request, is systematically illustrated in Figure 2. The diagram delineates the sequential interaction between the Regional Apparatus Organization Operator and the Administrator across five process stages: initiation, upload, system validation, administrative review, and final archiving.



Source: (Research Results, 2025)
 Figure 2. Document Upload and Verification Activity Diagram

Database Design Results

The results of the data modeling design show that the system is built with a database structure consisting of five main entities that are relationally interconnected to avoid redundancy and ensure data integrity (‘Afiifah, Azzahra, & Anggoro, 2022). The user table stores account and agency identity data along with their respective access levels. The category table classifies the types of public information as a reference for the grouping of documents. The information table stores the metadata and files of the uploaded document along with the attributes of the status and number of downloads. The information request table records requests from the public along with supporting data of the applicant, while the request reply table accommodates official responses from related agencies. Relationships between entities are built in a one-to-many pattern, where the user table and category table are connected to the information table and the request table, and the request table is connected to the reply table. The relational structure of the database, comprising five interlinked entities with one-to-many cardinality relationships, is presented in Figure 3. The diagram explicitly illustrates the primary key and foreign key dependencies between the user, category, information, information request, and request reply tables that collectively ensure referential integrity across the system.



Source: (Research Results, 2025)
 Figure 3. Information System Entity Relationship Diagram

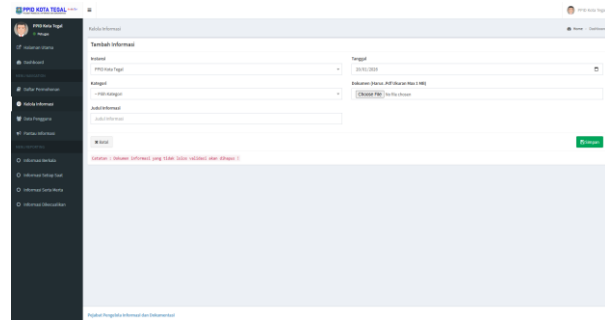
System Implementation Results

The results of the system implementation show that all the key features that have been designed have been successfully translated into a functional web-based application using HTML, PHP, and MySQL technologies (Enterprise, 2023). The monitoring dashboard page designed specifically for Administrators displays a statistical summary of the number of documents divided by four categories of information: periodic, immediate, timely, and excluded. This view allows Administrators to monitor document submission compliance from 73 Regional Device Organizations across the board in one unified view. Figure 4 presents the Administrator monitoring dashboard interface, which aggregates document submission statistics from all 73 Regional Apparatus Organizations into four categorical classifications periodic, immediate, timely, and excluded rendered as a unified real-time visual summary to support administrative decision-making.



Source: (Research Results 2025)
 Figure 4. Administrator Monitoring Dashboard View

The document upload interface for Regional Device Organization Operators is designed with a simple and structured form. The form includes the agency selection column, information category, information title, date, and document file upload column. The system automatically validates the format and size of the uploaded file, and displays a warning message if the document does not meet the specified requirements. This ensures that only valid documents are stored in a centralized digital archive. Figure 5 illustrates the document upload interface provided for Regional Apparatus Organization Operators, featuring structured input fields for agency identification, information categorization, document titling, submission date, and file attachment, complemented by an integrated automatic validation mechanism that enforces format and size compliance prior to submission.



Source: (Research Results 2025)
 Figure 5. Document Upload Page View

Testing Results and Discussion

System functionality testing was conducted using the Black-box Testing method, which evaluates system behavior exclusively from the user interface perspective without examining internal code structures (Wulandari, Saepudin, Kinanti, Sudesi, Saifudin, & Yulianti, 2022).. Testing was implemented across four main modules comprising a total of 11 test scenarios: the access security module (4 scenarios), the document upload module (3 scenarios), the verification and validation module (3 scenarios), and the monitoring dashboard module (1 scenario). All 11 scenarios yielded results consistent with predefined expected outputs, producing a functional test success rate of 100% (11/11 scenarios passed). In terms of process efficiency, the digital system reduced the document recapitulation cycle from an average of four weeks under the manual mechanism to a maximum of one week following system deployment, representing an efficiency improvement of approximately 75% in processing time. Simultaneously, the real-time notification mechanism reduced administrative verification response time from an unstructured multi-day communication process to within the same operational day.

Table 1. Black-box Testing Results

No	Black-box Test Scenarios	Expected Results	Test Results	Conclusion
1	Clear the username and password form and click Login	The system denies access and displays the message "Data must not be empty"	As expected	Valid
2	Entering the wrong username and password	The system denies access and displays the message "Username or Password incorrect"	As expected	Valid
3	Enter the correct username	The system receives access and	As expected	Valid

No	Black-box Test Scenarios	Expected Results	Test Results	Conclusion
	and password as an Operator	directs to the Regional Device Organization dedicated dashboard		
4	Trying to access a dashboard page directly through a web address without logging in	The system rejects and redirects back to the login page	As expected	Valid
5	Upload documents with the appropriate format and size	The document was successfully saved with a status of "Pending" and a success notification appeared	As expected	Valid
6	Upload a document with a prohibited format	The system rejects the file and displays an invalid format warning message	As expected	Valid
7	Clear required fields at upload	The system rejects storage and asks the user to complete the data	As expected	Valid
8	Administrator presses the preview button on the incoming document	The system displays a preview or download the document file	As expected	Valid
9	Administrator presses the receive verification button	The status of the document changes to "Verified" and appears in the public archive	As expected	Valid
10	The administrator presses the revision button and provides a note	The document status changes to "Revision" and the record appears on the relevant Regional Apparatus Organization dashboard	As expected	Valid
11	Opens the dashboard page after a	Statistics and figures for the number	As expected	Valid

No	Black-box Test Scenarios	Expected Results	Test Results	Conclusion
	new Regional Device Organization uploads a document	of documents increase automaticall y		

Source: (Research Results 2025)

Furthermore, user reliability testing is carried out involving representatives of Administrators and Regional Device Organization Operators as end users of the system. This test aims to verify whether the built system is acceptable in a real work environment. The test results showed that all seven acceptance criteria were met with a positive status as detailed in Table 2. The empirical outcomes of this study demonstrate that the implemented system achieved measurable improvements across all three identified operational deficiencies: document recapitulation time was reduced by 75%, real-time compliance monitoring became immediately accessible to administrative leadership, and the risk of physical document loss was effectively eliminated through centralized digital archiving with periodic backup mechanisms. These results substantiate the system's functional validity and its operational contribution to the institutional governance of the Tegal City PPID Lestari & Saputra (2025) regarding the effectiveness of monitoring dashboards in government reporting transparency, and Pujiady, et al. (2025) related to the ability of digital archiving systems to reduce the risk of document loss. A similar approach is also applied by Hapira (2022) in designing a web-based PPID public service application, Elvina et al. (2023) in the digital archive system of the Padang District Attorney's Office, Rizki et al. (2023) in responsive web-based digital archiving at the ATR/BPN Office, and Maylina et al. (2024) who designed a website-based archival information system. Compared to these studies, this study prioritizes the transformation of internal workflows from 73 Regional Apparatus Organizations to a single centralized management unit.

Table 2. User Reliability Test Results

N	Acceptance Scenario	Admission Criteria	Actor Tester	Results
1	Ease of Interface	Is the website's appearance (menus, buttons, forms) easy for ordinary users to understand and navigate?	All Actors	Yes

No	Acceptance Scenario	Admission Criteria	Actor Tester	Results
2	Document Upload Process	Can Regional Device Organization Operators upload documents easily without technical constraints?	Regional Apparatus Organization Operator	Yes
3	Clarity of Information	Can Operators understand the status of their documents clearly?	Regional Apparatus Organization Operator	Yes
4	Verification Efficiency	Do the preview features and verification buttons help Administrators check documents faster than manual methods?	Administrator	Yes
5	Monitoring Dashboard Accuracy	Does the graph on the dashboard change automatically and accurately according to the newly entered data?	Leadership	Yes
6	System Performance	Is the system stable and responsive when accessed over the network?	All Actors	Yes
7	User Satisfaction	Does the system as a whole help speed up document governance work?	All Actors	Yes

Source: (Research Results 2025)

Comparative Analysis of Old and New Systems

The transformation from manual to digital systems has brought significant changes in the document management process at the Tegal City Information and Documentation Management Officer. Prior to the implementation of the information system, the process of recapitulation of documents from 73 Regional Apparatus Organizations took an average of four weeks because it relied on the physical delivery of documents and manual communication by mail or telephone. The Regional Apparatus Organization Operator must send documents in printed form to the Office of the Information and Documentation

Management Officer, then the Administrator manually verifies one by one by recording the results in the register book.

With the implementation of a web-based information system, the document recapitulation time is reduced to a maximum of one week because uploads can be done simultaneously by all Regional Apparatus Organizations. Automated notifications that the system sends to the Administrator allow the verification process to be carried out in real-time. The document preview feature makes it easy for Administrators to check completeness without having to manually open individual files. Revision communication also becomes faster as revision records directly appear in the dashboard of the Operator in question.

The aspects of transparency and accountability have increased significantly. In the manual system, statistical data on document submission is difficult to track because the information is scattered in various register books. The new system provides a monitoring dashboard that displays statistics in real-time with graphical visualization. In terms of security, the digital system provides better assurance with periodic backup mechanisms and audit logs for tracking the history of changes in the status of documents.

Evaluate the suitability of the system to the needs of users

Evaluation of the suitability of the system is carried out to ensure that the implemented features have met the daily operational needs of users in the field. Based on the needs analysis that has been carried out in the initial stage of the research, the system is designed to overcome three main problems, namely the delay in document recapitulation, the difficulty of monitoring the compliance of the submission of 73 Regional Apparatus Organizations, and the lack of transparency in the document verification process.

Functional needs for Regional Device Organization Operators which include account authentication features, document upload modules, status monitoring, and answering information requests have been implemented thoroughly. The document upload module comes with automatic validation that helps the Operator avoid formatting or file size errors. From the Administrator's side, functional needs that include master data management, document verification and validation, and real-time monitoring dashboards have also been well met.

Evaluation of the non-functional aspects of the system shows positive results. The system interface designed with the principle of simplicity in mind makes it easier for users with varying levels of digital literacy to operate the system. The system

has been tested under simultaneous user load conditions and demonstrated good stability without experiencing errors during the test period. Although the system has met most of the needs of users, some operators have proposed a notification feature via a short message application to be able to know the status of documents immediately. The administrator also proposed the addition of a report export feature in Excel or PDF format to facilitate the preparation of periodic reports.

CONCLUSION

This research succeeded in developing a web-based information system for document governance at the Tegal City Information and Documentation Management Officer which integrates 73 Regional Apparatus Organizations in one integrated platform. The implementation of the proposed system using the Waterfall development methodology successfully addresses the core operational deficiencies identified in the Tegal City PPID, reducing the document recapitulation cycle from four weeks to a maximum of one week through the deployment of a simultaneous multi-agency digital upload mechanism. The primary scientific contribution of this research lies in the design and empirical validation of an integrated web-based governance system that unifies document submission workflow, role-based access control, automated administrative verification, and real-time compliance monitoring across 73 Regional Apparatus Organizations within a single centralized platform — a system architecture that has not been previously demonstrated in the context of regional PPID operations in Indonesia. This research thereby establishes a replicable and scalable digital governance model applicable to analogous public information management institutions across Indonesian local government administrations. The results of functional testing showed that all modules were running according to specifications with a one hundred percent success rate. User reliability testing also confirms that the system is able to improve work efficiency and reduce the burden of manual communication. This digital transformation provides significant benefits in the form of accelerating the verification process, increasing transparency through statistical visualization, and minimizing the risk of losing physical archives. This system is an important foundation for improving the quality of public information services within the Tegal City Government.

Notwithstanding the contributions documented herein, this research acknowledges several limitations that warrant systematic attention in future investigations. First, the system has been evaluated exclusively within the

institutional context of the Tegal City PPID, and its generalizability to PPID offices with differing organizational scales or regulatory frameworks has yet to be empirically verified; future research is therefore recommended to conduct multi-site validation across regional PPID institutions of varying administrative capacities. Second, the maintenance phase implemented in this study was limited in scope to post-UAT corrective adjustments; subsequent research should address long-term system sustainability, including security vulnerability assessment, database scalability under increased concurrent user load, and integration feasibility with national e-government platforms. Third, the proposed notification feature via mobile messaging application and the report export functionality in Excel and PDF formats, identified as unmet user needs during the UAT phase, represent concrete development priorities for the next iteration of this system.

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