

Architecture of the Village Budget Reporting Information System Utilizing the CodeIgniter Framework and a Multi-User Role-Based Access Control Approach

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ABSTRACT

Digital transformation in village financial management requires a reporting system with high data integrity to support transparent supervisory functions. In Karangasem Regency, particularly in the pilot locus of Sibetan Village, the management of the Village Revenue and Expenditure Budget (APBDesa) faced challenges with data synchronization, administrative errors, and barriers to conventional audits. This study developed an audit-oriented APBDesa reporting information system architecture that integrates Multi-User Role-Based Access Control (RBAC) and automated logging mechanisms. System requirements were identified and validated through direct observation involving three key stakeholders representing the main reporting roles: the Head of Financial Affairs, the Village Head, and the External Auditor. System development followed four sequential Waterfall phases (requirements, design, implementation, and verification). The system was implemented using the CodeIgniter framework with a Model-View-Controller architecture. Black-box evaluation by five technical testers was organized into seven principal module-level test cases corresponding to authentication, dashboard, revenue management, expenditure management, verification and approval, RBAC, and external-auditor monitoring; all achieved a 100% functional success rate. The system enforced segregation of duties among the Head of Financial Affairs, the Village Head, and the External Auditor while supporting a structured digital audit workflow. These results indicate that embedded role controls and audit stages can strengthen data integrity, traceability, and accountability in APBDesa reporting.

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1. INTRODUCTION

The transformation of village financial governance has necessitated an information system capable of producing fast, accurate, and integrated Village Revenue and Expenditure Budget (APBDesa) reports. The annual increase in village fund allocations requires village governments to manage financial data transparently and accountably to support the monitoring and auditing processes by authorized agencies [1]. Furthermore, manual data management or the use of spreadsheet applications leads to inefficient recording, reporting, and data verification processes, as well as the potential for administrative errors [2].

This study proposes implementing an APBDesa reporting information system architecture for the Sibetan Village Government in Karangasem Regency. The selection of Sibetan Village as the implementation location was based on the requirement for a financial reporting system that integrates the recording, reporting, and information presentation processes in a more structured manner. Village financial data management, which still largely relies on separate spreadsheet applications, can lead to data inconsistencies, record duplication, and slower reporting when needed for monitoring and auditing purposes [3] [4]. Therefore, an information system architecture is needed to integrate the APBDesa reporting process, making data management more effective and consistent, and supporting transparency in accordance with applicable regulations [5]. In addition to data integration, managing user access rights is critical to developing a APBDesa reporting information system. In many reporting systems, all administrative processes are still conducted using a single account or lack a clear division of user authority. This situation allows a single user to have full access to transaction recording, data changes, and report preparation, thus failing to fully comply with the principles of internal control and accountability in financial management [6]. Therefore, an access rights management mechanism is needed that can limit each user according to their duties and responsibilities through a Role-Based Access Control (RBAC) approach, thereby ensuring the security, integrity, and reliability of reporting data [7] [8].

Several previous studies have developed information systems to support village financial management. Research on web-based Village-Owned Enterprise (BUMDes) information systems has successfully increased transparency in data management, but has not yet accommodated reporting that is directly integrated with government audit workflows [9]. Other research developed a village financial administration system using the

Rapid Application Development (RAD) method, which accelerated transaction recording; however, the resulting system remained standalone and did not implement comprehensive user access-right management [10]. Meanwhile, cloud-computing-based research provides easier access to village financial information but does not provide an access-control mechanism that protects data integrity throughout report verification and audit activities [11]. Thus, a research gap remains: most previous solutions address digital recording, administration, transparency, or accessibility separately, but do not combine an integrated audit workflow with granular role segregation across the Head of Financial Affairs, the Village Head, and the External Auditor. This study addresses that gap through an integrated APBDesa reporting architecture that embeds verification, approval, audit monitoring, and role-specific access control within a single workflow.

To address this research gap, this study employs the Waterfall development method, comprising requirements analysis, system design, implementation, and verification [12][13]. Waterfall was preferred over iterative approaches such as Rapid Application Development (RAD) or Agile because the APBDesa reporting process follows relatively fixed administrative workflows, requires role responsibilities and approval sequences to be defined before implementation, and must be documented clearly to support regulatory compliance and auditability. A sequential development process therefore enables each requirement, design decision, implementation artifact, and verification result to be documented and traced systematically before the next stage is completed. The system was implemented using the CodeIgniter framework and its Model-View-Controller (MVC) architecture, which supports organized application development and maintainability [14] [15].

The study lies in the design of the APBDesa reporting information system architecture, which employs the Multi-User Role-Based Access Control (RBAC) approach as the primary mechanism for managing user access rights. This approach divides access rights based on each user's organizational structure and responsibilities, ensuring that each reporting process can be carried out under controlled conditions. In the proposed architecture, the Head of Financial Affairs acts as the operator responsible for recording transactions, managing APBDesa data, and preparing financial reports. The Village Head has the authority to verify, validate, and approve reports before they are designated as official village government reports. Meanwhile, the External Auditor is granted read-only access to conduct inspections and evaluations of reporting data without authority to change information stored in the system. The distribution of access rights applies the principle of least privilege: each user receives only the access rights commensurate with their duties and authorities, thereby maintaining system security, data integrity, reporting accountability, and transparency of the audit process.

2. RESEARCH METHOD

This study uses the Waterfall software development method because APBDesa reporting involves defined administrative procedures, fixed approval workflows, and a strong need for documented traceability between requirements, design, implementation, and verification. Compared with more iterative approaches, the sequential Waterfall structure was considered appropriate for ensuring that access-control rules and reporting workflows were specified before coding and verified against the agreed requirements [16]. The development process covered four main phases: (1) requirements identification and validation, (2) system and data design, (3) system implementation, and (4) verification through black-box testing followed by deployment readiness and corrective maintenance planning. The system development flow is shown in Figure 1. Long-term operational maintenance and large-scale production deployment were outside the evaluation scope of this study.

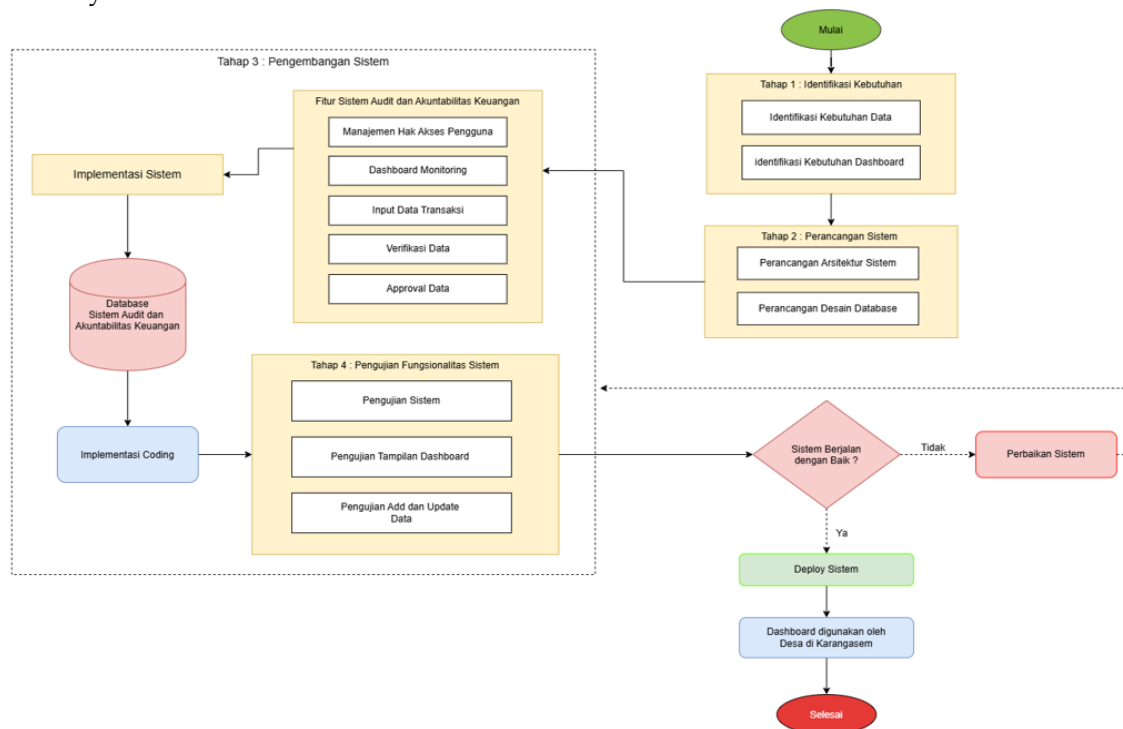


Figure 1. System Development Flowchart

The first stage is requirements identification and validation. Functional and non-functional requirements were identified through direct observation of the APBDesa reporting process involving three key stakeholders: the Head of Financial Affairs, the Village Head, and the External Auditor. The observation focused on the actual workflow for APBDesa data recording, report preparation, verification and approval, audit

monitoring, and the allocation of access rights according to each stakeholder's responsibilities. The observed workflow and role responsibilities were consolidated into the system requirements and used as the baseline for the subsequent design stage.

The second stage is system design. The architecture was designed using the CodeIgniter framework and the Model-View-Controller (MVC) pattern [17]. The use case diagram defines interactions among the three principal roles: the Head of Financial Affairs manages APBDesa data and prepares reports; the Village Head verifies, returns, or approves submitted reports; and the External Auditor reviews approved information and records audit notes without modifying transactional data. The activity diagrams describe the sequence from data entry, submission, verification or revision, approval, and audit monitoring. The Entity-Relationship Diagram (ERD) organizes the main data entities for users and roles, APBDesa revenue and expenditure records, verification status, supporting documents, and audit records, while the user-interface design maps these functions to role-specific pages. The Multi-User Role-Based Access Control (RBAC) design applies least-privilege rules so that each role can access only functions within its authority.

The third stage is system implementation. The design artifacts were translated into PHP code using the CodeIgniter framework and a MySQL database. Implementation focused on authentication, APBDesa data management, report preparation, verification and approval, audit monitoring, and RBAC enforcement. The system has three user groups: the Head of Financial Affairs, the Village Head, and the External Auditor. The Head of Financial Affairs manages APBDesa data and prepares financial reports; the Village Head verifies and approves reports; and the External Auditor has read-only access to inspect approved reporting data and record audit observations without changing transaction data.

The fourth stage is verification. Black-box testing was used to evaluate each function against the established requirement specification. Testing was organized into seven consolidated module-level test sets: User Login and Authentication, System Dashboard, APBDesa Revenue Data Management, APBDesa Expenditure Data Management, Village Head Verification and Approval, Multi-User RBAC Access Control, and External Auditor Audit and Monitoring. Each module-level test set included scenarios representing the relevant functional path and, where applicable, access-control restrictions and workflow transitions. The scenarios covered valid and invalid authentication, authorized and unauthorized access attempts, APBDesa data operations, report submission, return-for-revision and approval paths, auditor read-only access, and completion of the reporting workflow. After successful verification, the application was considered ready for controlled implementation in the Sibatana Village Government environment. Corrective adjustments identified during verification were treated as the initial maintenance activity, while long-term operational maintenance was outside the scope of this study.

3. RESULTS AND DISCUSSION

3.1. System Architecture Design Results

The main result of this research is the design and implementation of a web-based APBDesa Reporting Information System architecture using the CodeIgniter framework with a Multi-User Role-Based Access Control (RBAC) approach. This system architecture is designed to support the integrated management process for APBDesa reporting, from data recording by the Head of Financial Affairs and verification by the Village Head to the presentation of reports to the External Auditor (Inspectorate). The system architecture applies the Model-View-Controller (MVC) pattern provided by the CodeIgniter framework. Figure 2 shows the architecture of the APBDesa reporting information system for managing revenue and financing at the Sibetan Village Government Office.

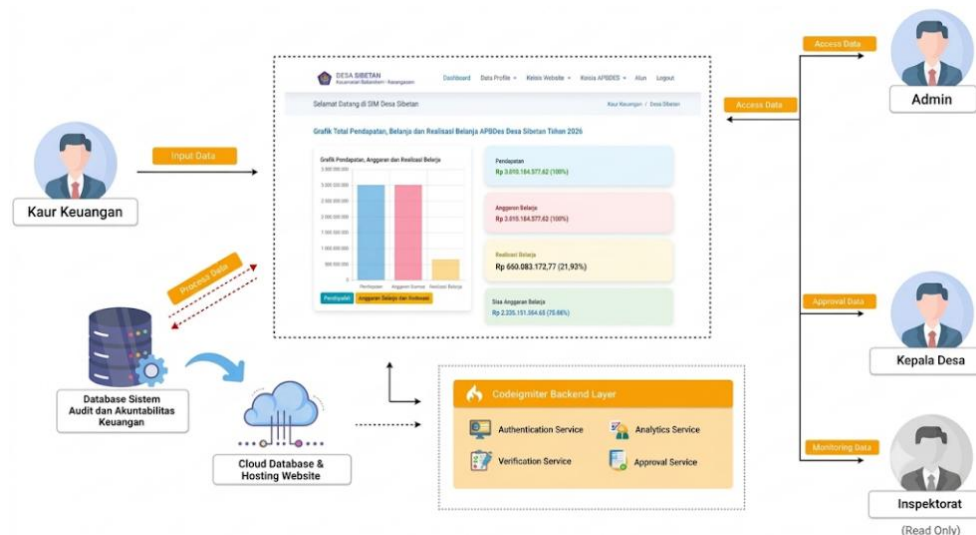


Figure 2. Village Budget Reporting System Architecture

3.2. System Implementation

The main page accessed by the Head of Financial Affairs after authentication is the Main Dashboard. As shown in Figure 3, this feature displays a real-time graphical visualization of APBDesa realization. This page was developed to provide an executive summary of total village revenue, total expenditure, and remaining funding, presented through interactive graphics.

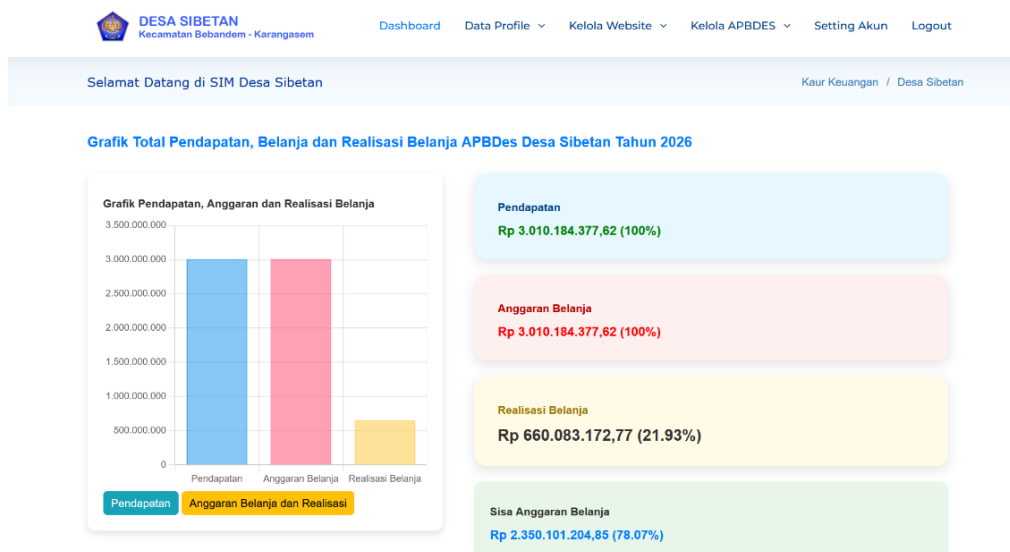


Figure 3. Head of Financial Affairs Dashboard Page

Next, the Head of Financial Affairs uses the APBDesa data management page to record and manage village revenue data. The Village Expenditure Management feature is used to record and manage APBDesa expenditure data, as shown in Figure 4.

Figure 4. Village Budget Expenditure Data Management Page

Once the Head of Financial Affairs completes entering the expenditure data, it is automatically transferred to the Village Head's work page to begin the digital verification process. During this verification stage, the Village Head reviews the budget data submitted by the Head of Financial Affairs to ensure consistency with the village work plan. Based on the review, the Village Head can approve the submission when the data are correct or return it to the Head of Financial Affairs with evaluation notes for correction and resubmission. Figure 5 shows the verification screen on the Village Head's page.

Lembar Verifikasi & Validasi Kepala Desa

Tahun Anggaran
2026

Sumber Dana APBDes
Anggaran Dana Desa (ADD)

Nama Kegiatan Belanja
1.1.1. Penyediaan Penghasilan Tetap Dan Tunjangan Kepala Desa/Perbekel

Pagu Target Anggaran
Rp 69.627.600,00

Total Realisasi Diajukan
Rp 69.000.000,00 (99.10%)

Disposisi Catatan Kepala Desa

Catatan ini wajib diisi apabila Anda memutuskan untuk **Tolak / Minta Revisi** dokumen belanja dari kaur.

Tulis instruksi evaluasi atau alasan penolakan anggaran di sini...

Sahkan & Setujui
Tolak / Minta Revisi
Tutup

Lampiran Rincian Transaksi Realisasi Belanja

No	Tanggal Penyaluran	Uraian Deskripsi Nota / Keterangan Transaksi	Jumlah Realisasi (Rp)
1	15-04-2026	Penyaluran Siltap Triwulan I TA 2026	Rp 34.500.000,00
2	10-07-2026	Penyaluran Siltap Triwulan II TA 2026	Rp 34.500.000,00
Total Akumulasi Transaksi Diajukan			Rp 69.000.000,00

Figure 5. Verification Page by Village Head

After verification and approval by the Village Head, the External Auditor, with read-only access, conducts the monitoring and audit phase. As shown in Figure 6, the auditor can review budget realization, examine supporting documents, and provide notes and recommendations based on the audit results without altering the stored transaction data. Once the audit process is complete, the audit results are stored in the system as documentation supporting accountability, audit trails, and transparency in APBDesa management. The system then updates the transaction status to indicate completion of the reporting workflow. This result demonstrates that the Multi-User Role-Based Access Control (RBAC) mechanism manages the workflow from data input and verification to audit in a structured manner while maintaining segregation of duties.

Daftar Belanja APBDes Tahun 2026							
No	Nama Bidang	Sub Bidang	Uraian Kegiatan	Anggaran (Rp.)	Realisasi (Rp.)	Sumber Dana	Aksi
1	BIDANG PENYELENGGARAAN PEMERINTAHAN DESA - Total Anggaran: Rp. 1.659.531.427,73						
		1.1.	Penyelenggaraan Belanja siltap,Tunjangan dan Operasional Pemerintah Desa - Total Anggaran: Rp. 1.283.667.151,73				
		1.1.1.	Penyediaan Penghasilan Tetap Dan Tunjangan Kepala Desa/Perbekel	Rp. 69.627.600,00 (100%)	Rp. 69.000.000,00 (99.10%)	ADD	Lihat Dokumen
			Kades: Terverifikasi Auditor: Disetujui				

Figure 6. Verified and Approved Status Page

3.3. System Test Results

Functionality testing was conducted using the Black-Box Testing method for all main modules of the APBDesa Reporting Information System. The evaluation was organized into seven consolidated module-level test sets corresponding to User Login and Authentication, System Dashboard, APBDesa Revenue Data Management, APBDesa Expenditure Data Management, Village Head Verification and Approval, Multi-User RBAC Access Control, and External Auditor Audit and Monitoring. Each test set comprised scenarios designed to exercise the relevant functions, role restrictions, and workflow transitions. This structure ensured coverage of valid and invalid authentication, role-authorized and unauthorized access, APBDesa data management, report submission and revision, verification and approval, auditor read-only access, and workflow completion.

Table 1. Black-Box Testing Results

No	Tested Module	Success Rate
1	User Login and Authentication	100%
2	System Dashboard	100%
3	APBDesa Revenue Data Management	100%
4	APBDesa Expenditure Data Management	100%
5	Village Head Verification and Approval	100%
6	Multi-User RBAC Access Control	100%
7	External Auditor Audit and Monitoring	100%

As shown in Table 1, all seven module-level test sets achieved a 100% success rate. The authentication test set confirmed valid and invalid login handling; the APBDesa data-management test sets confirmed the required recording and management functions; the verification test set covered submission, return-for-revision, and approval paths; the RBAC test set verified role-based restrictions, including unauthorized-access attempts; and the External Auditor test set confirmed read-only monitoring and audit access. These results indicate that the tested functions and access-control rules operated according to the established specifications in the Sibatana Village implementation environment.

4. CONCLUSION

This study successfully designed and implemented a web-based Village Revenue and Expenditure Budget (APBDesa) Reporting Information System using the CodeIgniter framework with a Multi-User Role-Based Access Control (RBAC) approach. System requirements were identified and validated through direct observation involving three key stakeholders: the Head of Financial Affairs, the Village Head, and the External Auditor. The proposed architecture directly addresses the problems identified in manual and spreadsheet-based workflows by centralizing APBDesa data, reducing the risk of inconsistent or duplicated records, and preventing unauthorized unilateral modification through explicit segregation of duties among these three roles. Through the User, Frontend, Backend, and Data Storage layers, the system supports a controlled workflow from recording and report preparation to verification, approval, and audit monitoring. Black-box testing of seven module-level test sets showed a 100% functional success rate, confirming that the tested functions and access rules operated according to the specified requirements. However, the evaluation was limited to the Sibetan Village case and focused on functional black-box testing; multi-village load testing, long-term operational evaluation, and broader user-based usability assessment were not conducted. Future work should therefore evaluate scalability across multiple villages, integrate the application with national or regional village-finance platforms where interoperability is permitted, provide secure mobile access, support legally compliant digital signatures, and develop automated checks that flag APBDesa entries or workflow actions that do not conform to applicable regulatory rules.

REFERENCES

- [1] M. Lavenia and M. T. Hidayat, "Analisis Transfaransi dan Akuntabilitas Pengelolaan Anggaran Pendapatan Belanja Desa (APBDes) di Desa Sirapan Kecamatan Madium Kabupaten Madium," vol. 10, no. 204, pp. 2217–2227, 2025.
- [2] A. Haris, "Transformasi Digital Pengelolaan Anggaran Dana Desa ; Studi Tentang E- Budgeting , Transparansi dan Partisipasi Masyarakat Pendahuluan," vol. 5, no. 1, pp. 28–37, 2025.
- [3] Anisa, A. Handayani, and K. Faozi, "Digitalisasi Pengelolaan Keuangan Desa : Analisis Implementasi Aplikasi Keuangan pada BUMDes Bebedahan Berkah," *J. Akuntansi, Ekon. dan Manaj. Bisnis*, 2025.
- [4] S. Kadoka, J. Wolu, and Y. Rada, "Development of a Financial Management Information System for Village Income and Expenditure Budgets Based on Object Oriented Analysis and Design Pengembangan Sistem Informasi Pengelolaan Keuangan Anggaran Pendapatan dan Belanja Desa Berbasis Object Orient," *Indones. J. Mach. Learn. Comput. Sci.*, vol. 4, no. April, pp. 443–451, 2024.
- [5] S. Purwanti and B. Architecture, "Perancangan Arsitektur Enterprise Pendahuluan Kajian Teori," vol. 13, no. 01, pp. 81–91, 2026.
- [6] M. Efrina, "Prosedur Sistem Pengendalian Intern Atas Nota Kredit Divisi Umum Pada PT Bank Pembangunan Daerah Jambi Kantor Pusat," *J. Media Akad.*, vol. 4, no. 6, 2026.

- [7] A. K. Nasich, S. A. Wicaksono, and M. C. Saputra, "Implementasi Role Based Access Control (RBAC) dalam Sistem Informasi Manajemen Pelanggan dan Pembayaran Air Berbasis Web (studi pada PT Tirta Wangi Sejahtera)," *J. Pengemb. Teknol. Inf. dan Ilmu Komput.*, vol. 9, no. 9, pp. 1–9, 2025.
- [8] E. R. Susanto *et al.*, "Analisis Implementasi Sistem Keamanan Basis Data Berbasis Role-Based Access Control (RBAC) pada Aplikasi Enterprise Resource Planning," *J. Sains Teknol. dan Sist. Inf.*, vol. 5, no. 1, pp. 105–116, 2025, doi: 10.54259/satesi.v5i1.3997.
- [9] E. N. and Yanti, "Sistem Informasi Akuntansi Berbasis WEB sebagai Transparansi dan Sinkronisasi dalam Pengelolaan BUMDES Kabupaten Karawang," *J. Akunt. Akuisisi*, vol. 18, no. 1, pp. 74–85, 2022.
- [10] B. O. Perdiyana and R. Alit, "Penerapan Metode Rapid Application Development (RAD) Pada Aplikasi Administrasi Desa Tunjungmekar Berbasis," vol. 07, pp. 382–388, 2025.
- [11] D. Pratmanto, S. Aji, I. Tazali, M. Hasani, and Y. P. L., "Pengembangan Sistem Informasi Anggaran Desa Berbasis Cloud untuk Meningkatkan Transparansi dan Partisipasi Masyarakat dalam Pengelolaan Keuangan Desa," *Indones. J. Softw. Eng.*, vol. 10, no. 2, pp. 123–130, 2024.
- [12] Y. S. Rahayu, Y. Saputra, and D. Irawan, "Implementasi Metode Waterfall Pada Pengembangan Sistem Informasi Mobile E-Disarpus," *J. Sist. Inf.*, vol. 6, no. 2, pp. 523–534, 2024.
- [13] L. F. Ulya, Z. Ruscitasari, and J. J. Ekonomi, "Digitalisasi Keuangan Desa dan Akuntabilitas : Menilai Dampak Implementasi Siskeudes di Desa Dawung Kecamatan Tegalrejo Kabupaten Magelang Abstrak," *J. Ekon. Manajemen, dan Akunt.*, vol. 11, no. 5, pp. 3464–3477, 2025.
- [14] A. Sansprayada, R. A. Aziz, K. Mariskhana, and I. D. Sintawati, "Implementasi Internal System Menggunakan Framework CodeIgniter (CI) Studi Kasus PT Ampera Abadi," *J. Minfo Polgan*, vol. 14, pp. 2295–2302, 2025.
- [15] I. K. Naryasa, G. Ngurah, M. Nata, and J. Santoso, "Sistem Informasi Manajemen Desa Berbasis Web Menggunakan Framework Codeigniter4," *Pros. Semin. Has. Penelit. Inform. dan Komput.*, vol. 1, no. 2, pp. 754–759, 2024.
- [16] Y. Anis, A. B. Mukti, and A. N. Rosyid, "Penerapan Model Waterfall Dalam Pengembangan Sistem Informasi Aset Destinasi Wisata Berbasis Website," *Kaji. Ilm. Inform. dan Komput. ISSN 2723-3898 (Media Online) Vol 4, No 2, Oktober 2023, Hal 1134-1142 DOI 10.30865/klik.v4i2.1287*, vol. 4, no. 2, pp. 1134–1142, 2023, doi: 10.30865/klik.v4i2.1287.
- [17] dan F. Maria Sri Wulandari, Rahayu Noveandini, "Penerapan Model View Controller Berbasis Framework Codeigniter Pada Sistem Penjualan (Studi Kasus : Toko Jaya Motor)," *J. Ilm. KOMPUTASI, Vol. 23 No 2, Juni 2024, p-ISSN 1412-9434/e-ISSN 2549-7227*, vol. 21, no. 4, pp. 319–330, 2024.