

Digital Platforms for Integrated Rural Transformation in the TEKAD Program

Leroy Samy Uguy^{1*} , Esther Kembauw² , Maulida Nurfajrianti³ , Richard Evans⁴ 

¹Faculty of Economics and Business, Universitas Pelita Harapan, Indonesia

²Faculty of Agriculture, University Pattimura, Indonesia

³Ministry of Village and Development of Disadvantaged Regions, Indonesia

⁴Department of Economics and Business, Adi-Journal Incorporation, USA

¹leroy.uguy@uph.edu, ²ekembauw@yahoo.co.id, ³maulidanurfajrianti@gmail.com

⁴vans.richard@adi-journal.org

*Corresponding Author

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ABSTRACT

Digitalization has become one of the foundational elements for the modernization of subsistence-based rural economies. **The present study** examines the implementation and performance of the Management Information System (MIS) and the Eastern Indonesia Gateway (EIG) in the *Transformasi Ekonomi Kampung Terpadu* (TEKAD) program. The study contributes by offering an integrated evaluative perspective that links digital governance, market visibility, fiscal latency, asynchronous processing, and visual pedagogy in rural transformation. **Based on the 2025 Progress Report** and 2021 Baseline Surveys over nine provinces in Eastern Indonesia, we describe how digital platforms enable evidence-based decision-making and market linkage. **Based on statistical findings**, the program has reached 101,920 households, representing 61.6% of the target beneficiaries. Despite this progress, several barriers remain, including a low budget absorption rate of 10.43%, which is largely associated with bureaucratic fiscal delays, limited literacy in remote districts such as Pegunungan Arfak, infrastructure gaps, and discontinuity in field-level facilitation, indicating that rural digitalization is constrained not only by technological limitations but also by fiscal latency and bureaucratic challenges nevertheless, **the study highlights** that rural digital platforms can support sustainable management, risk governance, financial transparency, and future fintech or blockchain-enabled accountability in village economic transformation, particularly when supported by asynchronous processing mechanisms that allow data to be stored locally and synchronized when connectivity becomes available, as well as visual teaching methods such as infographics, screen-based tutorials, and simplified digital training materials for village cadres.

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1. INTRODUCTION

Eastern Indonesia, including Papua, West Papua, Maluku, North Maluku, and Nusa Tenggara Timur, continues to face major challenges in shifting from subsistence-based economies to more integrated market-

oriented economies. These challenges are strongly influenced by geographic isolation, limited infrastructure, and uneven human capital development [1, 2]. The TEKAD Programme, co-led by the Government of Indonesia under the IFAD banner, seeks to overcome this challenge with three interconnected aspects: empowerment, collaboration, and policy innovation. At the core of this transformation is the use of digital platforms (such as the MIS and EIG) to deliver a "directional thrust" to village-run development. In simple terms, the MIS can be understood as a digital monitoring system that helps collect, organize, and evaluate village development data, while the Eastern Indonesia Gateway (EIG) functions as a digital window that presents village products, local innovations, and rural economic potential to wider markets and stakeholders. By explaining these platforms in practical terms, the study aims to make the discussion more accessible not only to digital transformation specialists, but also to policymakers, village facilitators, and development practitioners. This article examines these platforms as catalysts of structural transformation, but against systemic bureaucratic and physical challenges [3, 4].

The novelty of this study lies not in proposing a new digital application, but in developing an integrated evaluative perspective on how rural digital platforms function under conditions of geographic isolation, fiscal delay, limited literacy, and fragmented institutional capacity. Unlike previous studies that mainly view digitalization as a tool for administrative modernization, this study positions MIS and EIG as an integrated mechanism for rural transformation. This mechanism connects evidence-based planning, beneficiary monitoring, market visibility, and adaptive implementation strategies. The study also introduces the concepts of fiscal latency, asynchronous processing, and visual pedagogy as practical lenses for understanding why digital rural transformation in Eastern Indonesia requires more than platform availability. Therefore, the originality of this paper is reflected in its contextual integration of digital governance, ICT4D, Community-Driven Development (CDD), and adaptive rural management within the TEKAD Program [5].

The SDGs framework further strengthens the relevance of Environmental, Social, and Governance (ESG) and Gender Equality and Social Inclusion (GESI) in the TEKAD digital transformation model, particularly through SDG 8 Decent Work and Economic Growth, SDG 9 Industry Innovation and Infrastructure, and SDG 10 Reduced Inequalities. MIS enables the program to monitor whether rural development benefits are distributed inclusively, while EIG helps connect village products with broader markets [6, 7]. This supports SDG 8 by encouraging local economic productivity and market access, SDG 9 by promoting digital innovation and rural data infrastructure, and SDG 10 by reducing inequality through inclusive participation and beneficiary monitoring. Therefore, the SDGs provide a broader development framework for understanding the contribution of MIS and EIG beyond technical efficiency.

2. LITERATURE REVIEW

2.1. Endogenous Structural Transformation (EST)

According to the EST theory, economic development can be viewed as the movement of resources from low-productivity activities into high-productivity activities. Economic structures have three properties: structurality, duration, and transformality [8]. In the field of Eastern Indonesia, transformation refers to the process of transition by which the "social planner" (village leaders) has changed the productive functions and adopted clean, modern technologies to avoid carbon-intensive stages. Digitalization is a functional variable that divorces economic structures from numerical inputs, enabling a decoupled governance-performance analysis.

2.2. Digital Governance and CDD

This CDD model shares decision-making power and resources with the group end-users. But its success depends on three components: empowerment, human agency, and public deliberation. But CDD is susceptible to "elite capture". By providing an open MIS that is responsible for the distribution of Village Funds (Dana Desa), we reduce our risk of this. Digital governance in TEKAD extends the use of evidence-based methods in which information from the Village Information System (VIS) is utilized as a starting point for promoting inclusive economic policies and programs [9, 10].

2.3. Digital Platforms within Information and Communication Technology for Development (ICT4D)

Digital platforms can be understood as social technologies that strengthen community mechanisms through data, coordination, and market visibility. In the TEKAD Program, the EIG functions as a digital branding platform that promotes village products, local innovation, and rural economic potential to broader

stakeholders and investors. This role aligns with green developmental statecraft, which emphasizes strategic investment and institutional support for sustainable economic transformation [11].

Recent studies highlight that rural digital transformation is not limited to online platform adoption, but also involves digital public infrastructure, data governance, inclusive digital skills, and resilient service delivery. In this context, MIS and EIG are relevant because they combine internal monitoring with external market visibility. MIS supports data-based planning, beneficiary monitoring, and accountability, while EIG strengthens product promotion, market access, and rural economic resilience. Therefore, digital transformation in rural areas requires not only technical systems, but also institutional readiness, digital literacy, and inclusive governance [12, 13].

2.4. ESG and GESI

Digital transformation in the 21st century should align with ESG principles. In the TEKAD Program, this is reflected through Social, Environmental, and Climate Assessment Procedures (SECAP), which support the monitoring of women beneficiaries, marginalized groups, village fund allocation, productive activities, and environmental compliance. MIS and EIG function as digital instruments for sustainable management by tracking program performance, improving transparency, and displaying village products, commodity potential, and local innovation narratives [14, 15].

These functions are closely related to risk management because rural transformation programs are vulnerable to fund misallocation, data inconsistency, elite capture, weak market access, and unequal participation [16]. Therefore, integrating ESG/GESI indicators into MIS and EIG strengthens TEKAD as a sustainable rural management model by improving accountability, inclusion, and economic resilience. Based on the reviewed literature, this study positions digital transformation as both a governance mechanism and a rural development instrument. CDD emphasizes community participation and empowerment, ICT4D positions MIS and EIG as digital infrastructures for data governance and market connectivity, while ESG/GESI contributes sustainability, accountability, and inclusion dimensions. Figure 1 illustrates the conceptual relationship between digital governance, MIS, EIG, rural transformation outcomes, and SDGs alignment [17]. The framework highlights that MIS functions as an internal governance mechanism for monitoring and evidence-based decision-making, whereas EIG serves as an external platform for market visibility and stakeholder engagement. Together, these digital platforms support inclusive rural transformation by connecting data-driven governance, community participation, economic development, and sustainable management practices.

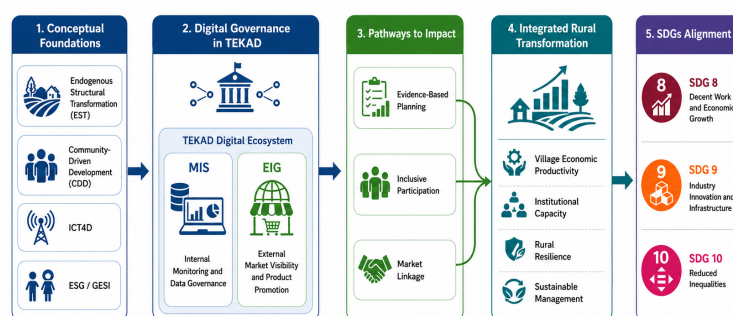


Figure 1. Conceptual Framework of Digital Rural Transformation in the TEKAD Program

As shown in Figure 1, digital governance, MIS, and the EIG support integrated rural transformation. MIS functions as an internal monitoring and data governance system, while EIG serves as an external platform for market visibility and village product promotion. Together, these platforms support evidence-based planning, inclusive participation, rural economic productivity, and alignment with SDG 8, SDG 9, and SDG 10.

3. RESEARCH METHODOLOGY

Following the conceptual foundation established in the literature review, the methodology was structured to examine the performance of MIS and EIG through indicators related to digital governance, community

participation, village economic transformation, inclusion, and implementation risk [18].

3.1. Sample and Data Collection

The study used stratified random sampling in total (pre-splitting) and within 5 provinces [19]. The sample size was calculated using Slovin's Formula and Power Analysis to secure conclusions that are 95% correct. Sample Size: 1,110 targeted villages and 149,850 households. Instruments: 12 structured modules (A-L) that recorded everything from asset ownership to village fund participation.

3.2. Technical Mechanism and System Integration

The TEKAD digital ecosystem operates through a multi-layered data flow. The process connects village-level data collection, district-level verification, centralized MIS monitoring, and public dissemination through EIG [20]. At the village level, facilitators and village cadres collect data related to beneficiaries, household conditions, village economic activities, participation in village meetings, productive assets, and Village Development Index indicators. These data are entered into the MIS through structured digital modules, allowing the system to standardize information across different provinces and districts [20, 21].

To clarify the technical mechanism of the TEKAD digital ecosystem, Figure 2 illustrates the flow of data from village-level collection, MIS-based standardization, district verification, centralized monitoring, asynchronous synchronization, and public-facing dissemination through the EIG.

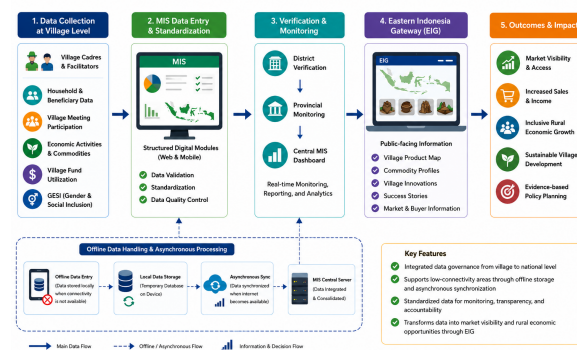


Figure 2. Technical Architecture of MIS and Eastern Indonesia Gateway Integration

As shown in Figure 2, village cadres and facilitators collect data and enter it into MIS for validation, monitoring, and reporting. In low-connectivity areas, data can be stored offline and synchronized later [22]. After verification, selected data are shared through EIG as product maps, commodity profiles, innovation stories, and digital branding materials, positioning MIS as the internal data governance system and EIG as the external platform for market linkage [23, 24].

3.3. Statistical analysis and results

3.3.1. MIS Outreach and Participation

The digital monitoring system reported as of November 30, 2025, the following progress Table 1 presents the key performance indicators used to evaluate the outreach and participation achievements of TEKAD digital platforms in 2025 [20]. The indicators include the number of households reached, the proportion of female beneficiaries, indigenous people reached, and participation in village meetings. These indicators are important because they show whether the MIS-supported monitoring system is able to capture not only administrative progress, but also inclusion, community engagement, and beneficiary coverage across rural areas in Eastern Indonesia.

Table 1. TEKAD Digital Platforms KPI Achievements for 2025

Indicator	End Target	Completion 2025	% of Target
Households Reached	165,370	101,920	61.6%
Female Beneficiaries	50%	44.4%	88.8%
Indigenous People Reached	-	154,975	N/A
Participation at Village Meetings	90,800	135,700	149.4%

The results in Table 1 show that TEKAD had reached 101,920 households, representing 61.6% of the total target of 165,370 households. This achievement indicates substantial progress in beneficiary coverage, although the program had not yet reached full implementation capacity [25, 26]. The female beneficiary achievement reached 44.4%, equivalent to 88.8% of the 50% target, suggesting that gender inclusion has been relatively well supported while still requiring further improvement. The participation of 135,700 people in village meetings exceeded the target of 90,800, reaching 149.4%, which reflects strong community engagement in local planning and decision-making processes [27]. Meanwhile, the record of 154,975 indigenous people reached demonstrates the contribution of TEKAD in supporting inclusive rural transformation across culturally diverse regions of Eastern Indonesia.

These indicators demonstrate that MIS-supported monitoring contributes beyond administrative reporting by enabling systematic tracking of beneficiary coverage, participation, and inclusion outcomes. The empirical findings provide evidence of both progress and remaining implementation gaps. The achievement of 101,920 reached households shows that MIS has improved the ability of TEKAD to document beneficiaries and support evidence-based program monitoring.

The high participation rate in village meetings further confirms strong community involvement in local development processes [28, 29]. However, the 10.43% budget absorption rate represents a major implementation constraint that affects field activities, facilitator support, and continuous utilization of digital platforms. These findings indicate that the success of rural digital transformation should not be assessed only through outreach achievements but also through institutional capacity, fiscal readiness, and the ability of local actors to sustain digital practices [30, 31].

Furthermore, digital capacity development remains an important factor in sustaining MIS implementation. Approximately 78% of district facilitators and 75% of village cadres in 14 districts had participated in digital data-entry training [32]. This training support strengthens the ability of local actors to utilize MIS for data management, monitoring, and reporting. Therefore, the effectiveness of TEKAD digital transformation depends not only on platform availability but also on continuous capacity building, institutional support, and local readiness to adopt digital governance mechanisms.

3.3.2. Impact on Village Independence (IDM)

Table 2 presents the progress of Village Development Index status among Stage I villages from 2020 to 2025 [33, 34]. The IDM classification is used to assess whether villages are categorized as underdeveloped, developing, or advanced. This table is important because it provides empirical evidence of how village conditions changed during the TEKAD implementation period and helps evaluate whether digital planning, monitoring, and rural economic facilitation contributed to village independence.

Table 2. IDM Status Progress of Stage I Villages (N=499)

Status	2020 (%)	2025 (%)
Advanced Maju	0.80%	7.01%
Developing Berkembang	15.43%	43.29%
Underdeveloped Tertinggal	59.72%	28.66%

The data in Table 2 indicate a positive shift in village development status during the TEKAD implementation period. The proportion of advanced villages increased from 0.80% in 2020 to 7.01% in 2025, while developing villages increased from 15.43% to 43.29%. Meanwhile, the proportion of underdeveloped villages decreased from 59.72% to 28.66%. These changes provide empirical evidence that TEKAD contributed to measurable improvements in village independence through integrated planning, monitoring, and economic facilitation mechanisms.

The MIS played an important role in supporting this transformation by enabling systematic data collection, progress monitoring, and evidence-based decision-making at the village level. Through structured information management, program managers and facilitators could identify village conditions, monitor development progress, and determine areas requiring additional intervention. Therefore, MIS functioned not only as an administrative reporting system but also as a governance mechanism that strengthened adaptive management and coordination among rural stakeholders.

However, the remaining proportion of underdeveloped villages indicates that rural transformation remains uneven and continues to face non-technical challenges. Factors such as fiscal stability, institutional capacity, digital literacy, infrastructure limitations, and market access influence the effectiveness of digital

transformation initiatives. Therefore, the Table should be interpreted not only as evidence of progress but also as an indication of the continuing development gap in rural Eastern Indonesia. In addition, the proportion of Village Fund allocated to productive economic activities increased from 17.9% in 2021 to 27.37% in 2024, approaching the conceptual target of 30%, which further reflects the gradual strengthening of village economic capacity.

3.3.3. Key Features of the EIG Digital Platform

The EIG portal serves as a key platform for digital branding and innovation sharing. The main features include:

- Village Product Map: GIS-based visualization of village products and economic potential.
- Inspiration Stories: Documentation of successful rural economic models, such as the Ngada candlenut export to Saudi Arabia.
- Asynchronous Mobile Sync: A mechanism that allows data to be stored locally in low-connectivity areas and synchronized when network access becomes available [35, 36].

From a technical perspective, the integration of MIS and EIG follows a functional separation between back-end monitoring and front-end dissemination [37]. MIS functions as an internal governance platform that collects, validates, and manages structured operational data, including beneficiary records, training participation, village economic activities, fund utilization, and IDM-related indicators. These data undergo completeness, consistency, and duplication checks before being verified for further processing.

After validation, selected non-sensitive information is transformed into EIG content, including GIS-based product visualization, commodity profiles, innovation stories, and digital branding materials [38, 39]. Unlike MIS, which focuses on internal monitoring, accountability, and evidence-based planning, EIG functions as an external platform to increase market visibility and connect village products with broader stakeholders.

In low-connectivity areas, the system supports offline–online synchronization, allowing village cadres and facilitators to store data locally and synchronize records when internet connectivity becomes available. This mechanism ensures continuous data collection despite infrastructure limitations. Through this integration, MIS and EIG combine administrative data governance, spatial visualization, digital communication, and market-oriented dissemination within a single rural transformation architecture [40].

4. RESULTS AND DISCUSSION

The findings indicate that the contribution of TEKAD digitalization should be understood beyond the operational use of MIS and EIG. The originality of this study lies in showing how these platforms connect digital readiness, institutional capacity, fiscal conditions, and community learning processes. MIS functions not only as a reporting system but also as a diagnostic tool to identify gaps in assistance, managerial capacity, and village economic readiness. Meanwhile, EIG extends digital platforms toward market positioning by increasing the visibility of village products and innovation stories. This demonstrates that rural digital transformation requires alignment between technology, governance capacity, digital literacy, and adaptive implementation [41].

From a risk management perspective, MIS supports the identification of operational, fiscal, and institutional challenges, including delayed budget absorption, uneven participation, and limited facilitator capacity. EIG complements this function by reducing market-access risks through improved product visibility and stakeholder connectivity [42]. Therefore, MIS and EIG serve not only as administrative platforms but also as strategic instruments for sustainable rural management by strengthening transparency, evidence-based decisions, and adaptive governance.

In practical terms, TEKAD digitalization enables villages to collect reliable data, improve decision-making, promote local products, and identify implementation challenges earlier. The integration of MIS and EIG supports both administrative efficiency and inclusive rural economic empowerment.

4.1. The “Nameplate” Challenge, Professional Capacity

But in spite of this online existence, a closer analysis reveals many Village-Owned Enterprises (BUM Desa) are “nameplates” (*papan nama*), bereft of professional management capacity. Indeed, MIS shows an

incongruence between the physical aid (machines) and local expertise, which implies that digitization is not able to replace the institutionalization of local cadres [43].

4.2. Bureaucratic Fiscal Latency

One of the key observations is the effect of "fiscal latency" on digital implementation. Delays in the Budget Execution Document (DIPA) in 2025 had resulted in limited field activities in the first two quarters. Budget absorption was 10.43% as of October 31, 2025. This delay constrained the operational capacity for field implementation, which culminated in the termination of all facilitator contracts by late 2024 and the consequent erosion of institutional memory [44]. Fiscal latency is one of the most critical practical barriers to rural digitalization, as it directly affects the continuity of field activities, facilitator engagement, data collection cycles, and platform utilization. In the TEKAD context, delayed budget execution did not only reduce financial absorption but also disrupted the operational rhythm of MIS and EIG implementation. When funds are delayed, village facilitators cannot conduct regular mentoring, digital data entry training is postponed, verification activities become inconsistent, and village-level economic assistance loses momentum [45].

As a result, digital platforms may remain available at the system level but become underutilized at the community level. This condition shows that the success of rural digital transformation depends not only on technological readiness, but also on the synchronization between fiscal procedures, bureaucratic approval mechanisms, and local implementation schedules. Bureaucratic challenges also emerge from the multi-level governance structure of rural development programs [46]. TEKAD requires coordination among national ministries, provincial actors, district governments, village institutions, facilitators, and community groups [47]. Each level has different administrative procedures, reporting requirements, approval timelines, and implementation priorities. When these processes are not synchronized, digital transformation faces delays in procurement, training, monitoring, and technical assistance. This creates a gap between digital planning and field execution. Therefore, bureaucratic simplification, clearer coordination protocols, and predictable fiscal calendars are necessary to ensure that MIS and EIG can function as active tools for rural transformation rather than merely as reporting platforms [48].

4.3. Bridging the Literacy Divide

But it brings with it the serious challenge that digitalization is harsh in areas like Pegunungan Arfak, which is characterized by only a 25 % literacy rate and 41.6 % of its inhabitants never went to school [49, 50]. This indicates a lack of digital infrastructure and education systems' accessibility in certain areas. In view of this, the program shifted from academic modules into "visual pedagogy". The strategy includes:

- 10,000 Pocketbooks – Visual, easy-access supporting materials for village cadres.
- Visual Training Resources: Screen tutorials and infographics that can be used by small groups in tablets to overcome traditional literacy barriers.

5. MANAGERIAL IMPLICATIONS

5.1. Adaptive Efficiency

In short, village firms must implement adaptive efficiency – to be adaptive in that they do not simply produce a series of stable rules to which they can adapt in response to market crashes. Digital systems need to emphasize value-chain management over data management and administration, simply as documentation in a digital form. From a managerial perspective, the findings provide practical guidance for program managers, village enterprise leaders, facilitators, and local government actors in improving decision-making and operational strategies. First, MIS data should be used as an early-warning tool to identify implementation problems such as low budget absorption, weak beneficiary participation, delayed training, and gaps between physical assistance and local managerial capacity. By using MIS dashboards regularly, managers can prioritize villages that require additional mentoring, adjust facilitator assignments, and design targeted capacity-building programs for village cadres and BUM Desa managers. This allows digital monitoring to function not only as a reporting mechanism, but also as a basis for corrective action.

Second, the EIG can support managerial decisions related to market development and rural value-chain strategies. Managers can use EIG data to identify village products with strong market potential, improve digital branding, connect producers with buyers, and strengthen product storytelling through commodity profiles and innovation narratives. For BUM Desa managers, this means that digital platforms should be used to

support product selection, inventory planning, quality improvement, and customer outreach. Therefore, the managerial contribution of this study lies in showing how MIS and EIG can help rural managers shift from reactive administration to proactive, data-driven, and market-oriented decision-making.

5.2. Policy Synergy

National ministries (Villages, Finance and Bappenas) need to work together on policy synergy to align DIPA approval/decision-making cycles with planning windows in villages (RKPDs). Without stable fiscal flow, the "pasang surut" (ebb and flow) of development can only gradually weaken institutional memory. From a policy perspective, addressing fiscal latency requires better alignment between national budget approval cycles and village-level planning cycles. The implementation of MIS and EIG should be supported by a predictable financing schedule so that facilitator contracts, digital training, field verification, and village mentoring can continue without interruption. In addition, bureaucratic procedures related to fund disbursement, reporting, and inter-agency coordination should be simplified through integrated digital workflows. This would allow TEKAD to reduce administrative delays, maintain institutional memory, and ensure that digital platforms are consistently used by local actors. Strengthening fiscal and bureaucratic coordination is therefore essential for transforming MIS and EIG from project-based tools into sustainable rural governance infrastructure.

5.3. Sustainable Digital Finance and Risk Governance Implications

The integration of MIS and EIG also provides implications for sustainable digital finance and rural risk governance. In the context of fintech, verified MIS data can be used as a basis for assessing village economic readiness, productive activity performance, and potential access to inclusive financing. This is important because many rural enterprises and BUM Desa still face difficulties in obtaining financial access due to limited formal records and weak business documentation. By improving the availability of verified digital records, MIS can support more transparent financing decisions and reduce information asymmetry between rural producers, financial institutions, and government agencies.

In addition, blockchain technology can be considered as a future enhancement for TEKAD's digital governance architecture. Blockchain-based audit trails may help secure records of Village Fund allocation, beneficiary verification, product transactions, and ESG/GESI compliance. Although blockchain implementation is not the main focus of the current study, its potential relevance lies in strengthening traceability, accountability, and trust in rural transformation programs. Therefore, the TEKAD digital ecosystem can be further developed as a sustainable management platform that combines MIS-based monitoring, EIG-based market visibility, fintech-enabled inclusion, and blockchain-supported risk governance.

6. CONCLUSION

The TEKAD Program demonstrates that the integration of MIS and the EIG can help bridge geographic gaps by improving transparency, data-based planning, and market visibility for rural communities. The findings show that these digital platforms support village economic transformation, beneficiary monitoring, risk identification, and inclusive market access. The improvement of Village Development Index status from underdeveloped to developing and advanced villages indicates positive progress, although the transformation remains constrained by fiscal latency, bureaucratic delays, limited digital literacy, and discontinuity in field-level facilitation.

These findings indicate that sustainable rural digitalization requires more than technological infrastructure. Stable fiscal coordination, strong institutional capacity, continuous facilitator support, inclusive digital literacy, and reliable data governance remain essential to ensure the effective implementation of digital platforms. Therefore, digital transformation should be supported by both technological readiness and adaptive governance mechanisms.

From a managerial perspective, MIS and EIG provide practical value by enabling program managers, village facilitators, and BUM Desa leaders to identify implementation risks, prioritize mentoring, strengthen local capacity, and develop market-oriented strategies for rural products. The study also confirms the contribution of the TEKAD digital transformation model to SDG 8 (Decent Work and Economic Growth), SDG 9 (Industry, Innovation and Infrastructure), and SDG 10 (Reduced Inequalities), highlighting rural digital platforms as strategic instruments for inclusive governance, sustainable management, and long-term rural economic resilience.

7. DECLARATIONS

7.1. About Authors

Leroy Samy Uguy (LU)  <https://orcid.org/0009-0009-9039-5731>

Esther Kembauw (EK)  <https://orcid.org/0000-0003-1340-7398>

Maulida Nurfajrianti (MN)  <https://orcid.org/0009-0004-3455-2767>

Richard Evans (RE)  <https://orcid.org/0009-0007-7280-8323>

7.2. Author Contributions

Conceptualization: LU and EK; Methodology: LU; Software: EK and MN; Validation: LU and MN; Formal Analysis: EK and MN; Investigation: LU; Resources: EK; Data Curation: MN; Writing Original Draft Preparation: LU and RE; Writing Review and Editing: MN and RE; Visualization: LU. All authors, LU, EK, MN, and RE, have read and agreed to the published version of the manuscript.

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