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A Digital Innovation Diffusion Maturity Model for Smart Village Governance

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Abstract

This study develops a digital innovation diffusion maturity model for smart village governance by examining the extent to which technological innovations in village fund management have diffused beyond administrative use to reach residents as end-users. The research addresses a critical gap in existing studies that primarily focus on administrative performance rather than community-level diffusion. A qualitative descriptive approach was employed, using in-depth interviews, direct observation, and document analysis involving key village stakeholders. The study proposes a three-tier maturity model consisting of technical-administrative maturity, public transparency maturity, and citizen participation maturity. Empirical findings reveal that Kalempang Village has achieved the first tier, where the village financial system operates effectively and meets administrative standards. However, the diffusion process has not progressed to the second and third tiers due to several structural barriers. These include limited digital literacy among village officials, unequal network infrastructure, and the absence of a public-facing information platform. As a result, residents are unable to access, verify, or participate in village financial governance processes. The study contributes a structured and diagnostic framework that enables systematic assessment of village digital maturity. This model provides practical value for policymakers and practitioners by offering a basis for designing more targeted, inclusive, and measurable smart governance interventions at the village level.

Keywords:
Citizen participation; digital governance; public transparency; rural governance; village finance system.

Introduction

The digital transformation of village governance in Indonesia has entered a new phase, marked by the widespread adoption of financial management applications such as Siskeudes across thousands of villages nationwide (Anthopoulos, 2022; Muhtar, 2023; Yuhefizar et al., 2024). These applications have demonstrably contributed to improved accountability and transparency in village financial

management (BPKP), 2015; Ariyanto et al., 2022). Bolívar, 2018 identifies four dimensions of smart governance that must operate in tandem: information transparency, bureaucratic efficiency, digital-based participation, and verified accountability. These dimensions cannot be achieved merely by adopting applications; they require that technological innovations, once adopted, genuinely permeate all levels of government and society (Bolívar, 2018; Lember et al., 2023; Vial, 2022). However, a critical question that is rarely asked is whether this innovation has truly diffused, in the sense defined by (Rogers, 2003), to all members of the village social system, including ordinary residents as the primary beneficiaries.

This is precisely where Rogers' (2003) Theory of Innovation Diffusion becomes critical: diffusion is not simply adoption, but a process through which innovations are communicated through specific channels, over a defined period of time, among members of a social system. Rogers identifies five attributes that determine the rate of diffusion relative advantage, compatibility, complexity, trialability, and observability-as well as the stages of the innovation-decision process that each member of a social system must traverse: knowledge, persuasion, decision, implementation, and confirmation (Nareswari & Hafidz, 2025). This framework offers a considerably sharper lens for assessing whether a village is genuinely progressing toward smart governance, or merely operating technology to serve internal administrative ends. Rahmat et al. (2025) empirically documented these dynamics in Kalempang Village, Sidenreng Rappang Regency, finding that information technology functions effectively for vertical administrative purposes but has yet to reach residents as the ultimate beneficiaries. This finding raises a more fundamental follow-up question: not merely why residents are not being served, but at what level of digital maturity does the village stand, and what instruments are needed to diagnose it?

Previous studies on technology and village funds have generally operated within an administrative performance evaluation framework, examining whether reporting is faster, whether data is more accurate, and whether systems operate in accordance with regulations (Aswad & Siskawati, E., Jr, S. R Meuthia, 2023; Octavia et al., 2023; Rahmat et al., 2025; Razak et al., 2024). While this framework is important, it inherently focuses on early adopters namely village

officials and district governments and overlooks the majority of members of the village social system: the residents themselves. Among existing studies, Rahmat et al. (2025) is the most closely aligned with the present research in terms of empirical context; however, it employs Biddle-Thomas Role Theory as its analytical lens, yielding a description of role expectation gaps rather than a generalizable, tiered diagnostic model. To date, no study has explicitly proposed a model of digital diffusion maturity for villages an instrument that would enable systematic assessment of where a village stands on its journey toward smart governance. It is this conceptual gap that constitutes the primary area of contribution of the present research.

This study pursues two interrelated objectives. First, to develop a three-tier model of village digital diffusion maturity as a new conceptual framework that integrates Bolívar's (2018) smart governance dimensions with Rogers' (2003) Theory of Innovation Diffusion. Second, to test and illustrate this model through empirical analysis in Kalempang Village, Sidenreng Rappang Regency-a village where Siskeudes is operational, hardware is available, and internet access is already in place, making it an ideal site for assessing digital maturity beyond the question of mere technology adoption-with a focus on the extent to which technological innovations in village governance have diffused from the administrative sphere into the public sphere.

Literature Review

Diffusion of Innovation Theory

The Diffusion of Innovation Theory proposed by Everett M. Rogers (2003) explains that the process of spreading innovation within a social system is influenced by five main attributes, namely relative advantage, compatibility, complexity, trialability, and observability. Furthermore, the process of innovation adoption takes place through five sequential stages, namely knowledge, persuasion, decision, implementation, and confirmation. In the context of digital villages, this theory serves as an analytical framework for assessing the extent to which technological innovation is not only adopted administratively, but also internalized in the social practices of the community (Susilowati, A. P. E., 2025). However, a critical limitation of Rogers' framework, when applied in isolation, is that it does not specify *which tier* of a social system has been reached by the innovation. It can confirm that diffusion has occurred, but it does not offer a diagnostic instrument to assess whether diffusion has penetrated beyond early adopters such as village officials to reach the wider community. This limitation becomes particularly salient in the context of village governance, where the

social system is stratified between administrative actors and ordinary residents.

Smart Governance and Smart Village Governance

The concept of Smart Village Governance emphasizes the importance of integrating four main dimensions, namely information transparency, bureaucratic efficiency, digital participation, and accountability (Herpamudji et al., 2025). According to Manuel Pedro Rodríguez Bolívar (2018), these four dimensions must operate simultaneously and mutually reinforce one another. Digital transformation in village governance is not only oriented toward the digitalization of administrative processes, but also demands a shift in the relationship between village government and the community toward a more participatory and collaborative pattern. This is further reinforced by Constantinos (Anthopoulos, 2022; Muhtar, 2023), who emphasize the importance of community empowerment as a core element in smart village governance (Susilowati, A. P. E., 2025). Critically, however, Bolívar's framework defines *what* smart governance should look like as an end state, but does not specify *how* a village progresses toward it, nor does it offer a means of measuring intermediate stages of maturity. This is precisely the gap that Rogers' diffusion stages can address: when integrated with Bolívar's four dimensions, they provide a dynamic, process-oriented lens through which the trajectory of a village's governance transformation can be systematically traced.

Technology Adoption in Government (TAM and UTAUT)

Technology acceptance models such as the Technology Acceptance Model (TAM) developed by Fred D. Davis (1989) assert that perceived ease of use and perceived usefulness are the primary determinants in technology adoption (Julia, 2025). This model was subsequently developed into the Unified Theory of Acceptance and Use of Technology (UTAUT) by Viswanath Venkatesh et al. (2003), which added the variables of facilitating conditions, social influence, and performance expectancy. In the context of village governance, infrastructure factors and perceptions of benefit have proven to be the dominant determinants in driving technology acceptance among village officials (Rawambaku et al., 2024). Nevertheless, both TAM and UTAUT share a fundamental limitation that is particularly consequential for the present study: they treat adoption as an individual-level outcome, measured at the point of acceptance, and therefore do not capture the *collective* or *systemic* dimension of diffusion across a social system. In other words, TAM and UTAUT can explain why a village official adopts Siskeudes, but they cannot explain whether the benefits of that adoption have meaningfully reached village residents. This distinction reinforces the relevance of Rogers' (2003) diffusion framework as the more appropriate

theoretical lens for assessing village-level digital maturity.

Siskeudes and Village Financial Accountability: An Empirical Review

The Village Financial System (Siskeudes) is an instrument developed by the Financial and Development Supervisory Agency (BPKP) to improve accountability and transparency in village financial management. Various empirical studies indicate that the implementation of Siskeudes contributes to improvements in administrative order and village financial accountability (Susano & Rachmawati, 2024). However, a number of studies also reveal that public transparency has not yet been fully optimized, attributed to limited human resource capacity and the absence of inclusive information access mechanisms for the community. Accordingly, Siskeudes still requires strengthening in the aspects of information disclosure and public participation. Most critically, the existing body of empirical research on Siskeudes has been conducted almost exclusively within an administrative performance evaluation framework assessing speed of reporting, data accuracy, and regulatory compliance which by design focuses on village officials as the primary unit of analysis and excludes residents as the ultimate beneficiaries of village financial governance. Rahmat et al. (2025) represent a partial exception, documenting empirically that technology functions effectively for vertical administrative purposes in Kalempang Village but has yet to reach residents; however, their analysis employs Biddle-Thomas Role Theory, which yields a description of role expectation gaps rather than a generalizable diagnostic model applicable across villages.

Taken together, the literature reveals a consistent and consequential gap: existing theoretical frameworks and empirical studies are well-equipped to explain technology adoption at the administrative level, but none offers a systematic, tiered model for diagnosing the extent to which digital innovation has diffused across the full social system of a village from officials to residents. Rogers' (2003) framework provides the process stages; Bolívar's (2018) dimensions provide the normative benchmarks of smart governance; and the empirical evidence from Siskeudes implementation confirms that the gap between administrative adoption and community-level diffusion is real and measurable. What is missing is an integrative instrument a village digital diffusion maturity model that combines these theoretical and empirical insights into a coherent diagnostic framework. It is this gap that the present study seeks to address by proposing a three-tier maturity model and testing it empirically in Kalempang Village, Sidenreng Rappang Regency.

Method

This study employs a qualitative descriptive design, as the research questions prioritize understanding of context and process over numerical measurement (Sugiyono, 2020). Two categories of data

were used: primary data obtained through in-depth interviews and direct observation, and secondary data drawn from village financial reports, government regulations, and administrative records. Informants were selected through purposive sampling based on role relevance, comprising four key stakeholders: the village head, village officials, the chairperson of the Village Consultative Body (BPD), and a community member. Direct observation was carried out on information system usage and digital infrastructure conditions at the village office, while document analysis was performed on financial reports and supporting administrative records.

Data analysis followed the interactive model of Miles and Huberman, encompassing data reduction, data display, and conclusion drawing (Abdussamad, 2021). Six analytical aspects were examined: the management system, reporting mechanisms, hardware conditions, community access to information and dialogue, software availability, and communication network quality. Findings were interpreted against the three-tier maturity model: Tier One covers technical-administrative maturity, Tier Two covers public transparency maturity, and Tier Three covers citizen participation maturity. Data validity was ensured through methodological triangulation- comparing findings from interviews, observation, and documents and source triangulation by cross-referencing perspectives across informants in structurally different positions. Findings are presented through descriptive narrative and a structured maturity positioning diagram that maps the six analytical aspects against each tier, serving as a transferable diagnostic instrument applicable to other villages.

Result

This section presents empirical findings from Kalempang Village, Sidenreng Rappang Regency, organized across six analytical aspects examined through in-depth interviews, direct observation, and document analysis. Findings are mapped against the three-tier model of digital diffusion maturity: Tier One (technical-administrative maturity), Tier Two (public transparency maturity), and Tier Three (citizen participation maturity).

Financial Management System

Village fund management in Kalempang Village follows procedures established by the local government, encompassing financial record-keeping, reporting, and accountability mechanisms. Village officials affirmed that the current system meets applicable criteria, with financial records and reports deemed accurate and transparent in accordance with district standards. Coordination with the Village Consultative Body (BPD) as an internal oversight partner is in place, though it does not consistently operate with full effectiveness.

Reporting Mechanisms

The introduction of Siskeudes has fully replaced the previous manual reporting process. Village officials confirmed that

reporting now proceeds smoothly through the application and is considered compliant with established procedures. Reports are submitted successfully to the district government via Siskeudes. However, no mechanism exists that would allow residents to independently access, download, or review budget realization reports. The system functions exclusively as an upward-facing administrative reporting tool.

Hardware Conditions

The Kalempang Village Office is equipped with computers, laptops, and printers sufficient for daily operational needs. Observation confirmed that these devices are used primarily for data entry into Siskeudes and document printing for official purposes. Village officials acknowledged that limited technical capacity among human resources has prevented the available hardware from being utilized to its full potential. Instances of hardware malfunction during reporting deadlines were noted as recurring operational disruptions.

Community Access to Information and Dialogue

Community access to information about village fund management is limited and mediated exclusively through periodic village deliberation forums. There are no digital, asynchronous, or on-demand information channels available to residents. Residents' ability to independently access financial information is constrained, and the deliberation forum held periodically is the sole available channel. Community members who are unable to attend, including the elderly, residents in remote hamlets, and those occupied with daily labor, have no alternative means of engagement. No digital record of deliberation proceedings is available for subsequent retrieval.

Software Availability

The only software in active use is Siskeudes, which is designed exclusively for internal financial reporting to the district government. The village possesses an official website that remains inactive and has not been utilized as a medium for public information dissemination. No alternative public-facing digital platform is in operation. As a result, resident access to information on village fund utilization is contingent upon direct interaction with village officials.

Communication Network Facilities

Internet access has reached Kalempang Village, but its reliability is uneven. Observation and interviews confirmed that the connection is frequently unstable, and several hamlets experience persistently weak or absent signals. This infrastructure disparity affects Siskeudes synchronization and has the structural effect of excluding residents in affected hamlets from any digital information ecosystem, regardless of any platform that might be made available.

The consolidated findings confirm that Kalempang Village is firmly established in Tier One: technological innovation has achieved solid technical-administrative maturity. However, three systemic barriers

prevent advancement to Tier Two and Tier Three. First, a capacity barrier, where digital literacy among village officials does not yet fully meet system demands. Second, a design barrier, where no software or platform is configured to reach residents. Third, an infrastructure barrier, where network disparities physically exclude certain residents from the village's digital ecosystem. Of Bolívar's (2018) four smart governance dimensions, only bureaucratic efficiency and vertical accountability are partially met; public information transparency and community digital participation have not been achieved. Table 1 below presents the full maturity positioning across all six aspects.

Table 1. Digital Diffusion Maturity Positioning of Kalempang Village

Analytical Aspect	Tier 1: Technical–Administrative Readiness	Tier 2: Public Transparency	Tier 3: Citizen Participation
Financial Management System	**Achieved.** Siskeudes is operational, and financial reports are prepared accurately according to district government standards.	**Not achieved.** There is no public access mechanism that allows residents to verify village financial reports.	**Not achieved.** There is no participatory oversight channel that enables residents to monitor village fund management.
Reporting Mechanisms	**Achieved.** Financial and administrative reports are successfully submitted to the district government.	**Not achieved.** Residents do not have access to download, review, or verify official village reports.	**Not achieved.** Residents cannot confirm the outputs, benefits, or accountability effects of the reporting system.
Hardware Conditions	**Partially achieved.** Adequate hardware is available at the village office, but its use remains limited due to human resource capacity constraints.	**Not achieved.** Available hardware is not yet used to disseminate public information to residents.	**Not achieved.** There is no hardware-supported mechanism for digital public engagement.
Community Access to Information and Dialogue	**Not applicable.** This aspect is mainly related to public-facing governance rather than internal administrative processes.	**Not achieved.** Public communication still relies on periodic deliberation forums, with no asynchronous or digital information channel.	**Not achieved.** Residents remain at the knowledge stage and are not yet structurally involved in persuasion, consultation, or decision-making processes.
Software Availability	**Achieved.** Siskeudes is	**Not achieved.** The village	**Not achieved.** There is no

	operational for internal financial reporting and administrative purposes.	website is inactive, and there is no public-facing digital platform for transparency.	digital space that enables community engagement, feedback, or participatory interaction.
Communication Network Facilities	**Partially achieved.** Internet access is available at the village office, but connectivity remains unstable in several hamlets.	**Not achieved.** Network instability disrupts real-time information dissemination and limits transparency.	**Not achieved.** Hamlet-level blank spots structurally exclude some residents from the village digital ecosystem.
Overall Maturity Position	**Established.** Technical-administrative digitalization has been implemented mainly for internal government functions.	**In transition, but not yet achieved.** Digital tools have not yet supported open public transparency.	**Not reached.** Digital diffusion has not yet advanced toward meaningful citizen participation.

Source: obtained from primary data

Discussion

The empirical findings from Kalempang Village, when analyzed through the integrated lens of Rogers' (2003) Diffusion of Innovation Theory and Bolívar's (2018) smart governance dimensions, reveal a governance condition that is more analytically nuanced than a simple binary of "digital" or "not digital." The village has successfully traversed the first threshold of digital transformation administrative adoption but the diffusion chain has stalled before reaching the broader social system. This discussion situates these findings within three interrelated arguments.

The Relative Advantage Trap: When Efficiency Serves Only Its Adopters

The most immediate finding is that Siskeudes has delivered demonstrable relative advantage, but exclusively to its direct users: village officials and district oversight bodies. Reporting that was previously manual is now faster, more accurate, and more compliant. This aligns with Rogers' (2003) observation that perceived relative advantage is the strongest predictor of adoption among early adopters. However, Rogers also cautions that an innovation's diffusion potential across a social system depends on whether members beyond the initial adopter group can perceive its benefits.

In Kalempang Village, residents the intended ultimate beneficiaries of village financial governance have no channel through which to perceive the relative advantage of Siskeudes. They cannot access reports, verify expenditures, or observe improvements in accountability. In Bolívar's (2018) terms, the dimension of information transparency, which requires information to be publicly verifiable, has not been activated.

The implication for smart governance theory is significant: administrative efficiency that is not coupled with public transparency does not constitute smart governance; it constitutes smart administration. These are categorically different achievements.

The Design Barrier as a Structural Problem, Not a Behavioral One

A second theoretical contribution of these findings concerns the location of the diffusion failure. It would be tempting to attribute the stall to low digital literacy among residents, or to cultural disengagement from governance processes. However, the evidence points to a more fundamental structural problem: the diffusion system is not designed to reach residents in the first place.

Siskeudes was built as a vertical reporting tool from village to district not as a horizontal transparency platform. The village website, which could serve as a public-facing interface, remains inactive. No change agents, as defined by Rogers (2003), are actively working to extend the benefits of Siskeudes into the public sphere. This finding resonates with the broader critique of e-government implementations that conflate digitizing internal processes with achieving genuine digital governance (Anthopoulos, 2022; Vial, 2022). The absence of a public platform is not an oversight; it is a design choice, even if an implicit one. Addressing it requires intentional redesign of the information architecture of village governance, not merely remedial digital literacy training.

This distinction carries practical implications. If the problem is framed as a capacity problem, the solution is training. If it is framed as a design problem, the solution requires platform development, policy change, and sustained institutional commitment to public information channels. The findings of this study support the latter framing.

The Infrastructure Disparity as a Rights Dimension

The third dimension of the discussion concerns network infrastructure. The finding that several hamlets in Kalempang Village remain within blank spot zones is not merely a technical inconvenience it constitutes a structural barrier to residents' right to information. Rogers (2003) identifies communication channel quality as a fundamental determinant of diffusion scope: without adequate channels, innovations cannot spread beyond early adopters regardless of their inherent attributes.

This structural exclusion adds a distributional justice dimension to the smart governance analysis. Even if the village were to activate its website and establish a public information platform, residents in hamlets without reliable internet access would remain outside the digital ecosystem. Bolívar's (2018) fourth dimension verified accountability requires that accountability mechanisms be accessible to all citizens, not only those with connectivity advantages. The infrastructure disparity thus creates a sub-population of residents who are structurally

precluded from participating in digital governance, independent of their willingness or capacity to do so.

Toward a Generalizable Diagnostic Model

Taken together, these findings validate the three-tier maturity model as a theoretically coherent and empirically applicable diagnostic instrument. The model's core contribution is its insistence on distinguishing between tiers: achieving Tier One (administrative adoption) does not automatically generate progress in Tier Two (public transparency) or Tier Three (citizen participation). Each tier requires distinct enabling conditions design choices, institutional commitments, and infrastructure investments that must be deliberately cultivated.

The case of Kalempang Village illustrates that a village can be technically compliant, operationally functional, and administratively efficient while simultaneously being opaque to its own residents. This condition is not unique to Kalempang; it is likely representative of a large segment of Indonesian villages that have adopted Siskeudes and similar systems within an administrative performance framework without systematically addressing community-level diffusion. The maturity model proposed here offers a transferable instrument for diagnosing this condition across villages, enabling more precise policy targeting and intervention design.

The Role of Intention and Institutional Design

Finally, it is important to affirm what the findings do not show: they do not reveal malicious intent or deliberate exclusion of residents. The village head understands the importance of transparency; village officials work within the constraints of their resources and technical capacity; residents express a genuine desire to understand how their village's finances are managed. The barrier is systemic, not motivational.

Rogers (2003) reminds us that change agents bear a responsibility to ensure that innovations benefit all members of a social system, not merely its early adopters. In the context of Indonesian village governance, this responsibility extends beyond individual villages to include the designers of Siskeudes, the regulators who set accountability standards, and the district governments that supervise implementation. Smart governance cannot be achieved at the village level alone if the tools, policies, and infrastructure provided to villages are designed only for administrative compliance. A genuine commitment to smart village governance requires that the full diffusion chain from officials to residents be treated as the measure of success, not merely the adoption rate at the administrative tier.

Conclusion

This study provides two main contributions in advancing the understanding of smart village governance. First, it proposes a three-layer model of village digital diffusion maturity consisting of technical-

administrative maturity, public transparency maturity, and citizen participation maturity. This model offers a diagnostic framework to assess the position of a village within the digital transformation process, complementing previous studies that primarily explain the causes of governance gaps. Second, the empirical findings demonstrate that achieving technical-administrative success does not automatically lead to higher levels of transparency and participation. In the case examined, digital innovation remains confined to administrative functions and has not yet reached the broader community.

The findings highlight three key structural barriers: limited human resource capacity, the absence of a public information platform, and unequal network infrastructure. These barriers indicate that digital transformation requires not only technology adoption but also institutional design, capacity development, and infrastructure support.

Based on these findings, several recommendations are proposed. Local governments should implement continuous technical assistance programs to strengthen digital competencies among village officials. Village administrations need to develop accessible public information platforms, such as social media and official websites, to improve transparency. In addition, infrastructure development must be prioritized to ensure equitable access to digital services across all hamlets. Future research should apply this model in different village contexts and develop standardized indicators for each maturity level to enhance its applicability as a policy evaluation tool. Ultimately, the success of smart village governance should be measured not by the presence of technology, but by the extent to which its benefits are widely diffused and accessible to all community members.

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