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Digital Villages as a Model of Rural Innovation: Governance Experiences from Punggul, Bali

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ABSTRACT

The increasing urgency of digital transformation in Indonesia has emphasized the need for innovation at the village level, where most of the country's population resides. This study aims to examine how rural digital governance is institutionalized through the case of Punggul Village in Badung, Bali, which has been nationally recognized as a model of digital village development. Employing a qualitative case study approach, the research collected data through interviews, observation, and document analysis to understand governance dynamics, leadership roles, and community participation in digital transformation. The findings reveal that Punggul's success stems from the integration of transformational leadership, institutional entrepreneurship, and participatory collaboration that fostered a culture of digital governance. Rather than focusing solely on technology, the transformation process emphasized human resource development, transparency, and adaptive institutional learning. The study proposes a model of rural digital innovation that highlights how technology, culture, and governance co-evolve to create sustainable public value. This research contributes to the discourse on digital governance by demonstrating that rural innovation can emerge from community-driven processes supported by leadership and cultural values, offering practical insights for scaling digital village initiatives in developing countries.

Keywords:
Digital Governance, Digital Village, Rural Innovation, Transformational Leadership, Collaborative Governance

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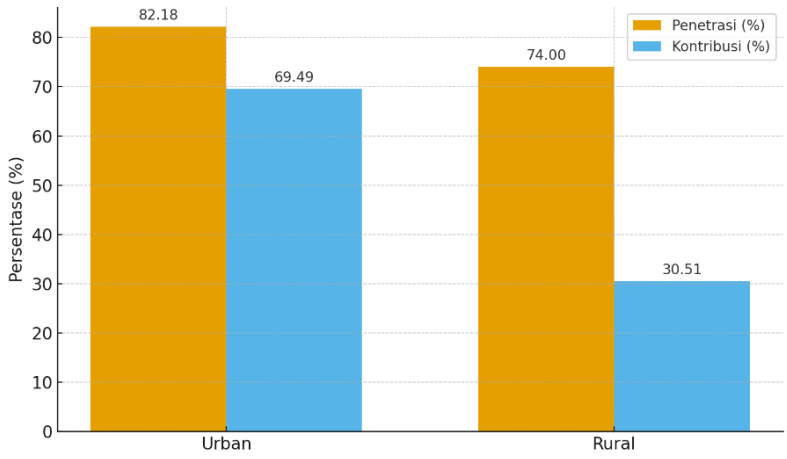
INTRODUCTION

Digital transformation has fundamentally reshaped public governance paradigms worldwide, emerging as a critical driver of efficiency, transparency, and citizen engagement in the 21st century (Mergel et al., 2019). It represents not merely a technological shift but a profound institutional and cultural reconfiguration within public administration. Ikwuanusi et. al. (2024) defines digital transformation as "the integration of digital technologies into public sector processes to enhance governance efficiency, inclusivity, and accountability". Similarly, Mergel, Edelmann, and Haug (2019) conceptualize it as a socio-technical process requiring institutional learning, leadership adaptation, and cross-sector collaboration. Within this framework, technology operates not only as an instrument but also as a catalyst for governance innovation and reform.

The emergence of Society 5.0 and the integration of the Sustainable Development Goals (SDGs) have further accelerated this paradigm shift, positioning technology as a key enabler of sustainable and inclusive governance (Calp & Bütüner, 2022). The OECD (2019) emphasizes that effective digital governance extends beyond digitizing public services. It redefines the relationship between government and citizens by promoting participation, openness, and collective value creation. However, the globaZl digital revolution has been highly uneven. Urban centers have rapidly advanced through smart city initiatives and digital government platforms, while rural regions (particularly in developing countries) remain at a disadvantage (OECD, 2019). This enduring urban–rural digital divide is not merely technological; it encompasses disparities in infrastructure, digital literacy, institutional capacity, and community participation (Hadi, 2018). Without effective policy intervention, such disparities risk widening socio-economic inequality and weakening the foundation for inclusive national development (Alvaro & Octavia, 2019).



Source: Asosiasi Penyelenggara Jasa Internet Indonesia, 2024.
Figure 1. Internet Users in Indonesia by Region

Addressing this divide is not simply a matter of technological equity but an essential prerequisite for sustainable national progress. Rural areas are not peripheral, they represent the social, cultural, and economic foundations of national development. In Indonesia, approximately 91 percent of the country's territory consists of rural regions, encompassing more than 74,000 villages that sustain the livelihoods of over 120 million people (Iskandar, 2020b). The Indonesian government recognizes that accelerating digital transformation at the village level is central to reducing inequality, enhancing transparency, and strengthening local governance capacity pet (Kristantyo Wisnubroto, 2021). Consequently, understanding

and facilitating digital transformation in rural contexts is indispensable for achieving national resilience and sustainable development in the digital era.

In response to these global and domestic imperatives, the Government of Indonesia has positioned Digital Village Development as a cornerstone of its national development strategy. This commitment is institutionalized through key policy frameworks, including the National Medium-Term Development Plan (RPJMN) 2020–2024 and Presidential Regulation No. 82 of 2023 concerning the Acceleration of Digital Transformation and Integration of National Digital Services. These frameworks explicitly aim to reduce regional disparities, strengthen digital infrastructure, and enhance governance innovation in rural settings.

Operationalizing this vision, the Ministry of Villages, Development of Disadvantaged Regions, and Transmigration (Kemendesa PDTT) launched the Digital Village Program as a comprehensive approach to rural digitalization. The program emphasizes four main strategies: (1) digitization of village databases for development planning and monitoring; (2) development of digital economic activities through e-commerce; (3) digitization of public administration services; and (4) enhancement of financial transparency and monitoring mechanisms (Iskandar, 2020a). Through these dimensions, the Digital Village initiative seeks to integrate information systems into governance processes, empower local communities, and build a culture of transparency within village administration.

Despite this strong policy direction, academic research on digital governance in rural Indonesia remains limited. Existing studies, such as those by Hidayaturrahman & Purwanto (2020) and Wijaya et al. (2013), often conceptualize the digital village as an extension of e-government, emphasizing efficiency and service delivery improvements. However, this technocratic focus neglects the socio-institutional and cultural aspects that determine the sustainability of digital transformation. Badruddin et. al. (2024) emphasize that digital transformation is not merely a technological reform but a comprehensive reconfiguration of governance models, requiring leadership, innovation, and adaptive institutional arrangements. Likewise, Subekti et. al. (2024) assert that public value creation in digital governance emerges from collaboration and shared learning among institutions rather than from technology adoption alone. This highlights a need for research that situates rural digital transformation within the broader contexts of governance innovation and cultural adaptation.

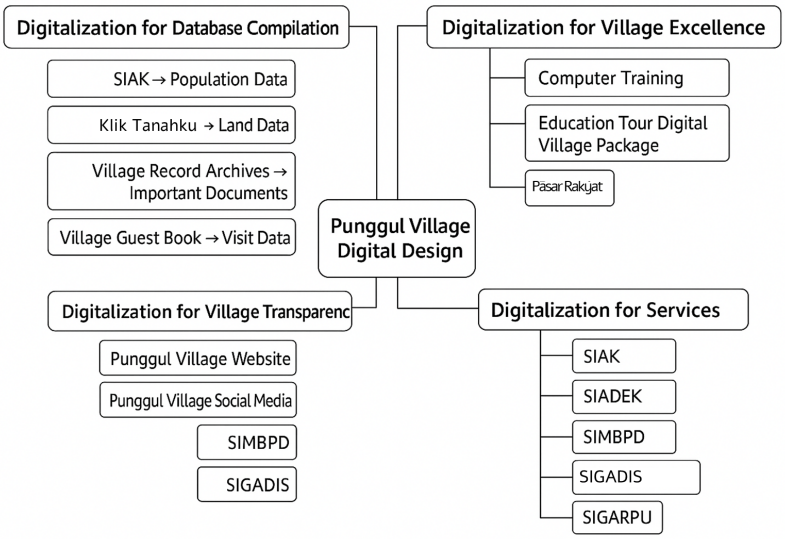
While these policy initiatives and scholarly contributions provide valuable foundations, they reveal a significant theoretical gap in understanding the holistic process of rural digital transformation. The prevailing technocratic paradigm in both policy and literature offers limited explanation of the underlying governance mechanisms and cultural adaptations required for sustainable digital ecosystem development. This gap becomes evident through three critical limitations in existing research.

First, there is insufficient attention to collaborative governance frameworks in digital village implementation. While multi-stakeholder partnerships are often mentioned in policy documents, the dynamics of how government institutions, private developers, and local communities negotiate authority, share resources, and build mutual trust remain underexplored in the Indonesian context. Second, the concept of digital culture remains under-theorized in rural transformation studies. Existing literature (Manoby et al., 2021); (Zhao et al., 2022); (Ummah et al., 2022); (Rusdianto et al., 2022); (Tirayoh et al., 2023) tends to focus on technical skill acquisition but rarely examines how shared values, organizational behavior, and community mindsets evolve to support digital workflows and innovation. The cultivation of digital culture that transcends individual tool proficiency and becomes embedded in collective community practice represents an important research frontier. Third,

the role of local leadership in orchestrating socio-technical change receives limited scholarly attention. Although leadership is frequently cited as a success factor in case studies, systematic analysis of how local leaders navigate institutional resistance, build collaborative coalitions, and sustain momentum for digital transformation remains lacking.

This study therefore addresses this theoretical void by developing an integrated analytical framework that explains rural digital transformation as a synergistic process, where technological systems, collaborative governance structures, and digital culture development converge to form sustainable digital ecosystems. Building on these theoretical gaps, it is evident that digital transformation cannot be understood merely as a technical or infrastructural project. It is a socio-technical process in which technology, culture, and governance continuously coevolve through collaboration among government institutions, private technology providers, and local communities. This perspective underscores the importance of examining how rural communities build, govern, and sustain digital ecosystems. This is a research agenda that remains underexplored in Indonesia's rural governance discourse.

Punggul Village in Badung Regency, Bali, provides a compelling example. Recognized nationally as a Digital Village since 2019, Punggul has demonstrated a culture-based model of digital transformation rooted in local leadership, institutional innovation, and multi-stakeholder collaboration (Sari et al., 2022). Rather than focusing solely on technological modernization, Punggul has pursued a holistic, bottom-up approach that integrates human resource development, digital infrastructure, and system customization. Over five years, the village government implemented three major pillars: (1) human resource innovation through mandatory digital training and integrity pacts for all village apparatus; (2) infrastructural development through partnerships; and (3) system integration via locally designed applications such as SIAK and SIADEK, supported by the Punggul Information Centre.



Source: Sari et al., 2022
Figure 2. Punggul Village Digital Design

This transformation reflects a governance vision that extends beyond digitization. As Village Head Kadek Sukarma stated, "Our goal is to make Punggul known for excellence in public service" (Rahmawati et al., 2022). Such a perspective indicates that the success of digital transformation depends on nurturing a digital culture that values integrity, collaboration, and community empowerment. Punggul's transformation also exemplifies hybrid governance, a model that combines formal governmental structures with participatory

collaboration involving civil society, private actors, and local innovation networks. Through this lens, the Punggul case contributes valuable insights into how digital governance and local culture intersect to produce sustainable innovation in rural contexts (Alvaro & Octavia, 2019).

By investigating these dynamics, the study highlights how governance innovation, participatory leadership, and adaptive collaboration serve as the true engines of rural digital transformation. The inquiry into Punggul Village thus offers an opportunity to explore how local actors co-create digital governance models that are both technologically advanced and culturally resonant. This phenomenon is still underexplored in the digital transformation literature.

Theoretically, this research contributes to the expanding body of knowledge in digital governance and public administration by proposing a holistic analytical lens that unites technological, institutional, and cultural dimensions. It moves beyond the prevailing technocratic paradigm, which views digitalization primarily as a tool for administrative efficiency, to conceptualize it as a complex process of institutional learning, leadership adaptation, and community empowerment (Subekti et al., 2024). Practically, the study provides policy-relevant insights for designing scalable digital village frameworks that harmonize technological advancement with local inclusivity. It underscores that sustainable digital transformation in rural contexts is achieved not through technology alone but through leadership that nurtures collaboration, innovation, and a shared digital culture. In this regard, Punggul Village serves as a living laboratory of rural innovation, demonstrating how digital governance, when rooted in community participation and local culture, can drive enduring, inclusive transformation across the public sector.

METHODS

This study employs a qualitative case study to explore governance dynamics underpinning rural digital transformation in Punggul Village, Badung Regency, Bali. Qualitative research is research that aims to find answers to a phenomenon or question through the systematic application of scientific procedures and presented narratively (Yusuf, 2019). The approach enables an in-depth understanding of complex socio-technical processes within their real-life context, capturing both institutional changes and cultural adaptations (Robert K. Yin, 2009)

Data were collected in 2022 through methodological triangulation to enhance validity (Yusuf, 2019). Primary sources included: (1) semi-structured interviews with key stakeholders (village leaders, IT staff, program coordinators, developers, and community representatives); (2) field observations of digital services and community training; and (3) document analysis of policies, reports, system prototypes, and media coverage. Participants were purposively selected to capture diverse roles and perspectives, with interviews lasting 45–90 minutes and focusing on leadership, collaboration, system design, and service outcomes.

Table 1. Research's Informants

No.	Informant	Description
1	The Punggul Village Head (1 person)	served as a key informant in this study because he was deemed to have detailed knowledge of the design, implementation, management, and monitoring and evaluation of the Digital Village implementation in Punggul Village.

No.	Informant	Description
2	The Punggul Village Information and Technology Staff (1 person)	was selected as a key informant because they are responsible for managing the information technology system in Punggul Village.
3	The Punggul Information Center Coordinator (1 person)	was selected as a key informant because they are deemed to have a role in disseminating public information online and managing the official social media channels of Punggul Village.
5	I Gusti Ngurah Nyoman Dharmajaya, a freelance full-stack developer (1 person)	was selected as an informant because he is a private sector player who assists in the development of information systems and digital applications in Punggul Village.
6	Punggul Village Community (3 person)	The community acts as informants because they directly experience the implementation of Digital Village in Punggul Village.

Source: Processed by Author, 2026

Data were analyzed using the Miles and Huberman iterative framework, which consists of data reduction, display, and conclusion drawing (Yusuf, 2019). Thematic coding was conducted manually through open and axial coding, followed by constant comparison across data sources. A pragmatic digital transformation heuristic guided the interpretation, integrating socio-technical perspectives to organize findings and explain governance dynamics.

Trustworthiness was addressed using Lincoln and Guba's criteria: credibility, transferability, dependability, and confirmability (Hasan et al., 2022). Triangulation, peer debriefing, and member checking enhanced validity, while an audit trail ensured dependability. The single-case design prioritizes depth over breadth, aiming for analytical rather than statistical generalization to generate transferable insights into rural digital governance.

RESULT AND DISCUSSIONS

From Digitalization to Rural Innovation: Reframing the Digital Village Concept

Digital transformation in public governance has evolved from a focus on efficiency and modernization toward a paradigm of institutional innovation and public value creation. In its early stages, digitalization was often perceived merely as an administrative improvement (an attempt to make government "faster and smarter"). This study is relevant to a study by (Athaya et. al., 2024) on the implementation of good governance principles in the Village Development Planning Meeting (*Musrenbangdes*) on Semambu Island, which showed that successful governance depends not only on formal structures but also on transparency, participation, and institutional understanding. The study's findings revealed limitations in accountability, transparency, community participation, and understanding of regulations, which resulted in suboptimal village development implementation. This situation emphasizes that digital transformation and governance innovation, such as that experienced in Punggul Village, require strengthening not only technological aspects but also institutional capacity and community participation for sustainable implementation.

However, as Osborne and Brown (2011) argue, public sector innovation entails more than introducing new technologies; it requires reconfiguring relationships, processes, and

values that shape how governments interact with citizens and deliver public services. Similarly, Torfing et al. emphasize that innovation in contemporary public governance is a process of co-creation involving multiple stakeholders (governments, communities, and non-state actors) who collaboratively produce solutions and shared value (Røiseland et al., 2024).

Within this framework, the notion of a digital village must not be reduced to the automation of administrative tasks. Instead, it represents a new form of governance innovation, where technology serves as an enabler of social and institutional transformation. Punggul Village in Badung Regency, Bali, exemplifies this paradigm shift. Rather than simply adopting digital systems, the village has reconstructed its governance ecosystem by balancing technological infrastructure with human capacity, local culture, and institutional learning. The digital transformation process in Punggul is structured around seven interrelated elements (Subekti et al., 2024), as summarized in Table 1.

Table 2. Key Elements of Digital Transformation in Punggul Village

Element	Key Implementation in Punggul	Governance Innovation Implications
Technology	Wireless network between sub-villages; integrated systems (SIADEK, SIGADIS, SIMBPD)	Technology as an enabler for integrated and efficient public services
Data	Centralized NIK-based population database; real-time validation of reports and incentives	Promotes evidence-based planning and accountable decision-making
Business Processes	Automated administrative services (<5 minutes); digital letter printing	Process reform toward responsive, citizen-centered services
Culture & Human Resources	Mandatory computer training; recruitment of local IT staff; integrity pacts for officials	Formation of a digital culture and professional bureaucratic mindset
Citizen Experience	Android/web-based access; digital outreach via WhatsApp and social media	Enhanced participation and accessibility in local governance
Strategic Management	Digital vision since 2014; adaptive incremental strategy; local server management	Long-term digital vision and institutional self-reliance
Ecosystem & Partnerships	Local developers; open sharing of digital systems with other villages	Community-based collaboration and open innovation practice

Source: Author's synthesis based on field data (2022).

As shown in Table 1, Punggul's digital transformation extends far beyond technological adoption. It reflects a systemic innovation in public governance by integrating digital infrastructure, human capacity, and institutional adaptation into a cohesive ecosystem. Technology serves not as an endt but as a means of foster service integration, data-driven decision-making, and citizen empowerment (Janssen & Estevez, 2013).

This orientation is reflected in the statement of Punggul's Village Head, Kadek Sukarma, who emphasized during an interview (2022): "We don't chase technology. What we pursue is to make this village known for having the best public services." Such a vision signifies a paradigm shift from *Old Public Administration*, which emphasizes hierarchy and procedure to *New Public Governance*, characterized by collaboration, adaptability, and citizen-centric service

delivery (Panyasiri, 2018). Through digital tools and participatory mechanisms, Punggul has redefined governance as a process of creating shared value rather than merely delivering administrative outputs.

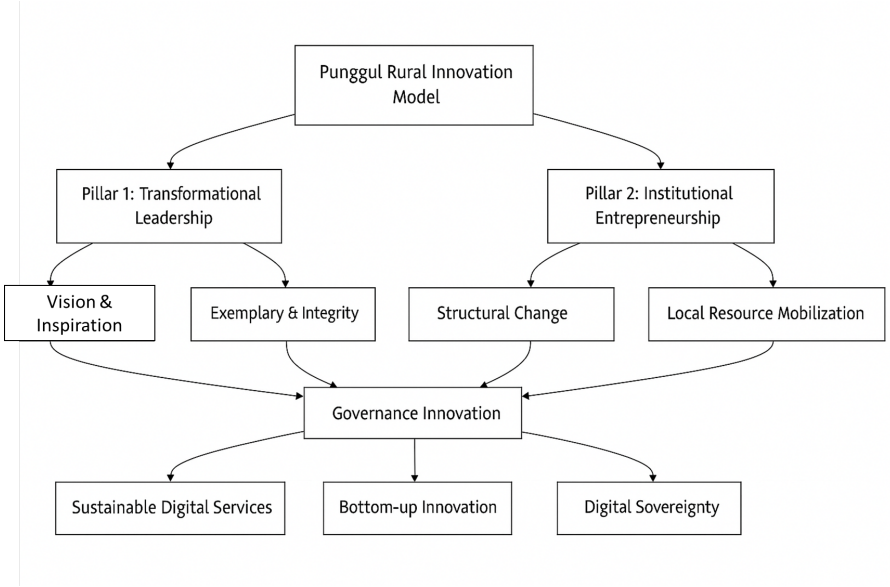
Moreover, the village's transformation unfolded through a reflective, iterative cycle comprising four stages: evaluation and planning, strategy formulation, implementation, and continuous evaluation. During the initial stage, the village assessed staff capacity and introduced regular digital training, cultivating awareness and digital readiness. The strategy stage emphasized in-house development using local resources and incremental budgeting, reflecting institutional independence. Implementation involved multi-stakeholder collaboration among village officials, the Punggul Information Center, and local citizens, aligning with Røiseland et al.'s (2024) notion of co-creation. Finally, continuous evaluation was conducted through open feedback, regular system updates, and participatory performance assessment.

This process illustrates that Punggul has moved from *doing digital* to *being digital*, transforming technology into an integral part of its governance identity. Digital transformation here is not an external intervention but an organic evolution, rooted in local leadership, cultural adaptation, and shared learning. The village demonstrates that rural digital innovation can emerge from local capacity and collective governance rather than top-down modernization. Hence, Punggul represents a model of rural governance innovation, where technology, data, and community collaboration converge to produce sustainable public value. This innovation is important, as co-production through multi-actor collaboration will have a significant influence in awakening local potential (Mardianti et Al., 2025).

This case underscores that successful digital transformation in rural areas is not determined by technological sophistication, but by the integration of cultural, institutional, and social dynamics that sustain it (Zerrer & Sept, 2020). These findings align with a study on Smart City implementation in Semarang, which demonstrated that the success of digital transformation is determined not only by the provision of technological infrastructure, but also by the integration of various dimensions such as public service governance, environmental strengthening, mobility, and technology-based community capacity development. This confirms that effective digital transformation requires synergy between technological, institutional, and social aspects, thus supporting the argument that the sustainability of digital innovation in Punggul Village also depends on the ability to integrate cultural, institutional, and community participation dynamics (Wahyuni et. al, 2021).

Institutional Capacity and Leadership as Drivers of Transformation

The governance experience of Punggul Village reveals that successful rural digital transformation depends not on technological sophistication, but on adaptive institutional capacity and contextual leadership. These findings constitute the first pillar of the Punggul rural innovation model. This is a framework that positions local leadership and agile institutions as the engine of change.



Source: Author's synthesis based on field data (2022).
Figure 3. Punggul Rural Innovation Mobile.

The figure below illustrates the Punggul Rural Innovation Model, which synthesizes the key elements underpinning the village's successful digital transformation. The model identifies two interrelated pillars (Transformational Leadership and Institutional Entrepreneurship) that interact to produce adaptive Governance Innovation. Through this synergy, the village achieves three main outcomes: Sustainable Digital Services, Bottom-up Innovation, and Digital Sovereignty.

The transformational leadership of Village Head Kadek Sukarma serves as the primary driver of change. His strong vision and exemplary integrity cultivated discipline, accountability, and collective motivation among village staff. This leadership approach not only reshaped bureaucratic behavior but also inspired a shared commitment to improving public services through digitalization.

In parallel, the Village Head and IT staff acted as institutional entrepreneurs who redesigned the village's governance structure and operational mechanisms. Initiatives such as mandatory computer training, locally developed applications like SIADEK, and the establishment of an independent internet network demonstrate creative mobilization of local resources. These efforts signify innovation emerging from institutional autonomy and collaboration rather than top-down directives.

The synergy between these two pillars fosters adaptive governance innovation. Transformational leadership provides strategic vision and public value orientation, while institutional entrepreneurship builds the structural and resource capacities to realize them. Together, they generate sustainable digital services, community-driven innovation, and digital sovereignty. This model illustrates that successful rural digital transformation depends not merely on technology, but on the balance between visionary leadership and adaptive institutional capacity.

Building a Digital Culture through Community Engagement

If leadership and institutional capacity serve as the initial driving forces of Punggul's digital transformation, community participation constitutes the foundation that ensures its sustainability and legitimacy. The formation of digital culture cannot be imposed structurally; it evolves through social interaction, shared learning, and collaborative practices between

local government and citizens. In this context, digitalization functions not only as an administrative tool but also as a social arena where villagers negotiate values, roles, and responsibilities within local governance. This perspective aligns with Subekti et al. (2024) and Badruddin et al. (2024), who emphasize that digital transformation represents a socio-technical process of institutional learning and cultural adaptation rather than mere technological modernization.

Findings from Punggul show that digitalization unfolds through co-production between the village government, local institutions, and citizens. While the government provides the institutional framework and resources, the community contributes social legitimacy through active participation and contextual adaptation. This co-productive dynamic is evident in the development of service applications such as SIAK and SIADEK, where residents were involved in testing and refining system features. Such collaboration ensures that the digital system is not only technically functional but also culturally resonant. For instance, by integrating simple interfaces and linking to familiar communication channels like WhatsApp Banjar.

Edler et al.(2024) argue, genuine public innovation arises from the reconfiguration of relationships rather than from the introduction of new tools. In Punggul, digital transformation thus materializes as a process of social negotiation between bureaucratic logic and community norms. Technology becomes culturally meaningful only when mediated through participation and shared ownership.

Community engagement also operates as a form of deliberative governance, where policy innovation is enacted through dialogue and consensus-building. Through online forums and offline meetings facilitated by the Punggul Information Centre (PIC), villagers provide feedback on service quality, application design, and administrative priorities. The PIC functions as a boundary organization, bridging the administrative sphere of the village government with the social networks of the community.

Rather than serving as a mere information outlet, the PIC creates a two-way communication channel that institutionalizes participatory norms at the village level. This deliberative mechanism reflects what Røiseland et al. [1] describe as "collaborative governance," where public value emerges from trust and co-creation among diverse stakeholders. As a result, the legitimacy of digital initiatives in Punggul stems not from formal authority but from shared understanding and reciprocal accountability between the government and its citizens.

Table 3. Social Dynamics Shaping Digital Culture

Social Dimension	**Observed Transformation**	**Implications for Digital Culture**
Power relations	Shift from hierarchical control to participatory coordination between officials and citizens	Digitalization perceived as a collective responsibility, not an elite project
Community identity	Citizens perceive themselves not merely as service recipients but as contributors to innovation	Strengthened sense of pride and ownership over digital systems
Social norms and routines	Daily communication through WhatsApp groups, social media, and online services	Technology becomes embedded in everyday life, normalizing transparency and responsiveness

Source: Author's synthesis based on field data (2022).

The table illustrates that Punggul's digital transformation operates through relational change rather than technological substitution. By reshaping how authority, participation, and communication are practiced, Punggul's experience exemplifies how digitalization can redefine local governance culture from within.

Punggul's case highlights that sustaining digital transformation in rural governance requires two interdependent social conditions: legitimacy and practice repetition. Legitimacy emerges when technology is perceived as fair, relevant, and beneficial, while repetition embeds new digital behaviors into collective routines. OECD (2023) note, long-term digital maturity is achieved not through large-scale investments but through consistent learning cycles and civic trust.

Theoretically, this study situates Punggul's experience within the concept of governance co-production, wherein public value is generated jointly by government and citizens through iterative adaptation of technology and norms (Sari & Pinatih, 2025). This challenges technocratic assumptions in much of the digital village literature and introduces a sociocultural dimension to understanding policy innovation at the grassroots. Practically, it suggests that the replication of digital village models elsewhere must include deliberate strategies to institutionalize participation, foster transparency, and enable continuous dialogue between local actors.

In summary, the formation of digital culture in Punggul demonstrates that the sustainability of rural digital transformation depends on the depth of social participation rather than the sophistication of technology. Through continuous interaction between local government and community members, digital practices have evolved into collective norms that sustain transparency, accountability, and shared learning. This collaborative cultural foundation provides the social infrastructure for the next stage of Punggul's transformation (the establishment of governance mechanisms and ecosystem collaboration) where digital culture becomes the enabling environment for multi-actor partnerships and policy innovation at the village level.

Governance Mechanisms and Ecosystem Collaboration

The model of digital governance innovation in Punggul Village illustrates how multi-actor collaboration has become the cornerstone of rural digital transformation. Governance in this context is not limited to formal administrative structures but extends to a collaborative ecosystem that connects village officials, local private actors, community organizations, and citizens. The Village Head acts as a policy entrepreneur who strategically fosters institutional change through commitment, consistency, and moral leadership, translating digitalization from a technological initiative into a participatory governance mechanism oriented toward public value creation (Sari et al., 2022). This alignment of leadership vision with social participation demonstrates a shift from government to governance, where authority is shared and negotiated among diverse stakeholders.

In practice, the digital governance of Punggul operates through a set of complementary functions among key actors. The village government serves as the policy coordinator and regulator of system direction, while local developers (particularly I Gusti Ngurah Nyoman Dharmajaya and CV Immortal Solutions) act as technical partners responsible for maintaining systems, updating servers, and adapting software to evolving needs. These developers occupy a semi-autonomous position: not long-term contractors but trusted collaborators whose engagement is based on need and mutual understanding. This partnership represents an adaptive collaboration model (van Assche et al., 2022), emphasizing flexibility, trust, and shared accountability rather than rigid contractual

arrangements. The IT staff, represented by I Gusti Ngurah Made Ardika, serves as a crucial intermediary, translating technical language into operational procedures and ensuring smooth communication between bureaucratic and technical spheres. Together, these interactions form an effective governance interface bridging the technical and social dimensions of innovation.

The success of this ecosystem also depends on the Punggul Information Centre (PIC), which functions as a social intermediary connecting government and citizens. The PIC manages public information, documents community activities, and communicates service updates through digital platforms and social media. Although non-formal and volunteer-based, the PIC significantly enhances transparency and public accountability, embodying what Scupola and Mergel (2022) describe as co-production in public service delivery. Its voluntary nature reinforces the idea that civic engagement can serve as social capital sustaining the legitimacy of digital governance at the local level. The synergy between government, developer, IT staff, and PIC constitutes a polycentric governance configuration, where no single actor dominates but mutual dependency ensures adaptability and resilience (Carlisle & Gruby, 2019).

Table 4. Collaborative Ecosystem and Governance Mechanisms in Punggul Village

Key Actor	Roles and Contributions	Mechanisms of Interaction	Governance Value and Impact
Village Government (Head and Officials)	Policy direction, decision-making, and institutional leadership	Regular coordination meetings, integrity pacts, and system monitoring	Ensures policy coherence, accountability, and strategic legitimacy
Village IT Staff (I Gusti Ngurah Made Ardika)	Technical liaison bridging bureaucratic and developer domains	Daily communication with developers, staff assistance, troubleshooting	Maintains operational continuity and builds digital competence among officials
Local Developers (Dharmajaya)	System design, maintenance, and innovation	Needs-based collaboration without rigid contracts, adaptive software updates	Produces context-sensitive and cost-efficient digital solutions
Punggul Information Centre (PIC)	Social mediator, public communicator, and transparency agent	Informal collaboration through social media, content creation, and information dissemination	Enhances transparency, citizen participation, and public trust
Community Members	Users, feedback providers, and social monitors	Participation in training, application use, and feedback forums	Strengthens social legitimacy and accountability of digital services
External Partners (Other Villages, Private Sector)	Replication, financial and training support, knowledge exchange	Horizontal collaboration via system sharing	Expands public value, fosters innovation diffusion, and reinforces sustainability

Source: Author's synthesis based on field data (2022).

The institutionalization of this collaborative ecosystem is supported by clear coordination mechanisms. Communication among village officials, IT staff, and developers occurs through regular meetings and real-time digital channels, allowing rapid responses to technical or administrative issues. At the same time, formal initiatives (such as mandatory digital training, integrity pacts, and internal literacy programs) strengthen the institutional base for innovation. The integration of multiple systems (SIAK, SIADEK, SIGADIS, SIMBPD) enables the government to provide real-time data, accelerate administrative services, and establish data-driven governance (Interview, 2022). These instruments create a feedback loop that continuously aligns digital systems with local governance needs.

Punggul's governance ecosystem also displays elements of institutional learning. Every digital initiative is developed incrementally, tested internally, and refined before public release. This cautious yet reflective approach allows the village to tailor each system to its unique administrative and social context. Importantly, the Village Head intentionally rejected patenting these applications, opting instead to share them freely with other villages. This principle of openness reflects the idea of public value networks that prioritize collective benefit and knowledge diffusion over proprietary control. Horizontally, this spirit of collaboration has led Punggul to become a regional learning hub for digital village innovation, formalized through BUMDes-led initiatives such as the "Digital Village Educational Tour," where other villages learn from Punggul's governance practices.

Nevertheless, maintaining this ecosystem involves several challenges. The system remains somewhat dependent on key actors (such as the local developer and PIC coordinator), while limited fiscal capacity constrains consistent funding for digital maintenance. Moreover, generational disparities in digital literacy occasionally slow adoption among older citizens. In response, the village government has pursued adaptive strategies: rotating IT and PIC personnel to promote knowledge transfer, organizing regular community digital literacy sessions, and allocating a dedicated portion of the annual budget (APBDes) for system maintenance. Informal trust-based communication continues to serve as the glue holding the ecosystem together, allowing issues to be resolved collaboratively and efficiently. As Wang & Ran (2023) emphasize, such trust-based governance networks are critical for sustaining innovation in small-scale public organizations.

In summary, the digital governance ecosystem in Punggul demonstrates that sustainable rural innovation depends not on advanced technology but on the strength of institutional collaboration and mutual trust. The interplay between formal coordination, adaptive partnership, and civic engagement has transformed Punggul's digitalization from a project-based effort into a living system of participatory governance. This ecosystemic model affirms that public innovation at the village level emerges not from top-down modernization but from continuous social learning and distributed responsibility among local actors. Through this collaborative mechanism, Punggul not only modernizes its administrative system but also redefines rural governance as a community-driven process that generates enduring public value.

Toward a Model of Rural Digital Innovation

The cumulative findings from the experience of Punggul Village provide the empirical foundation for conceptualizing "The Digital Village as a Model of Rural Governance Innovation." Synthesizing the four preceding dimensions (leadership and institutional capacity, community engagement and digital culture, governance mechanisms, and ecosystem collaboration) reveals that the essence of rural digital transformation lies not in technological sophistication, but in institutional adaptation grounded in local culture. This

model demonstrates how traditional governance structures can evolve into participatory and data-driven systems without losing their social embeddedness or cultural identity.

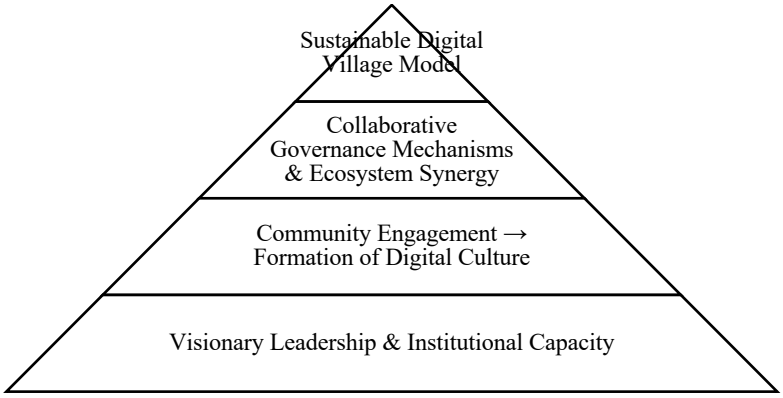
The trajectory of digital transformation in Punggul reflects a sequential yet interdependent process of institutional change. It starts with visionary leadership and organizational readiness, which together establish legitimacy, strategic direction, and commitment to continuous reform. Through this foundation, leadership plays a pivotal role in aligning digital initiatives with the core principles of transparency, accountability, and public value governance (Scupola & Mergel, 2022).

Building upon this foundation, community engagement fosters a digital culture through social interaction, shared learning, and collective responsibility. The Punggul Information Centre (PIC) and local volunteers act as cultural mediators who cultivate trust, inclusivity, and digital literacy. This cultural dimension transforms technology from a technical instrument into a shared social practice that sustains legitimacy and citizen trust (Adelia et al., 2025).

The third dimension, governance mechanisms and ecosystem collaboration, consolidates these social and institutional forces into structured coordination. Through adaptive partnerships between government, developers, and citizens, Punggul's digital governance becomes a polycentric system capable of institutional learning, feedback, and iterative improvement. Together, these four dimensions form a systemic model of rural innovation that integrates leadership (why), culture (how), and governance (what) into a coherent process of transformation. The model is guided by three principles:

1. Technology must serve as an enabler of local governance rather than an end in itself;
2. Social legitimacy must be built through participation and transparency; and
3. Collaboration must replace hierarchy as the foundation of institutional coordination.

The proposed model conceptualizes the Digital Village not merely as an e-government project but as a governance innovation ecosystem. It emphasizes the co-evolution of technology, institutions, and community practices within a socio-cultural framework. The conceptual model can be represented as follows:



Source: Author's synthesis based on field data (2022)
Figure 4. Conceptual Model of Rural Digital Innovation in Punggul

The digital village as a model of rural governance innovation in punggul is characterized by four interrelated features:

1. Culturally Embedded
   The digital innovation of Punggul Village is grounded in Balinese communal values, particularly menyama braya (social harmony) and gotong royong (collective cooperation). These values serve as the moral foundation that sustains social cohesion and legitimizes technology adoption. In contrast to standardized e-government frameworks, Punggul's

model mirrors local modes of communication and collective decision-making. This reinforces the argument that bureaucratic transformation must evolve in harmony with existing institutional logics rather than attempting to replace them.

2. Participatory and Inclusive
   Citizen participation is the core mechanism of Punggul's digital governance. Through the PIC and regular deliberative forums, participation is institutionalized into everyday governance routines. This participatory design ensures that digital systems remain socially meaningful and inclusive, avoiding the digital divide that often marginalizes rural communities (Hadi, 2018).
3. Service-Oriented and Data-Driven
   The integration of multiple applications (SIAK, SIADEK, SIGADIS, SIMPPD) demonstrates how digital systems enhance efficiency, transparency, and accountability. Open data and performance dashboards enable real-time evaluation and evidence-based policymaking, consistent Scupola & Mergel (2022), who emphasize public value creation through digitalization.
4. Sustainable and Adaptive
   Punggul's model achieves long-term sustainability through institutional learning and adaptive collaboration. Regular evaluations, staff rotation within IT and PIC teams, and dedicated village budget allocations ensure system continuity beyond leadership cycles. The open sharing of Punggul's digital innovations with neighboring villages further illustrates an adaptive and learning-oriented ecosystem (Sari & Pinatih, 2025).

Theoretically, the model contributes to the literature on rural digital governance by offering a socio-institutional framework that connects three theoretical strands: transformational leadership, collaborative governance, and institutional learning. By combining these perspectives, the model explains not only how innovation is initiated and legitimized but also how it is sustained through coordination and adaptation. This integrative perspective challenges the dominant technocentric approaches in rural digitalization studies, highlighting instead that innovation is a co-evolutionary process, one in which social norms, technological tools, and institutional practices evolve together to produce adaptive, citizen-centered governance systems (Scupola & Mergel, 2022)

From a policy standpoint, the Punggul model provides important lessons for designing inclusive and sustainable digital transformation in rural areas. It emphasizes the need for localization of digital policy, allowing villages to tailor digital systems to their cultural and administrative realities rather than adopting uniform templates. The institutionalization of citizen participation, through mechanisms such as village information centers (PICs), is essential to enhance transparency, accountability, and digital literacy. Furthermore, the model underscores the importance of sustainable funding mechanisms, where digital systems are embedded in routine village budgets (APBDes) to ensure continuity beyond project cycles. Building horizontal learning networks among villages can also accelerate innovation diffusion and mutual learning, while reflexive governance practices (periodic evaluation and institutional reflection) help maintain the alignment of digital systems with evolving community needs. Collectively, these insights demonstrate that effective rural digital transformation requires not only technology and funding but also adaptive institutions and participatory cultures capable of evolving alongside change.

The experience of Punggul Village demonstrates that rural digital innovation represents a transformation of governance rather than a technological modernization. The Digital Village emerges as a locally driven, socially negotiated, and culturally grounded innovation ecosystem. This model provides a conceptual foundation for rethinking rural public

administration, where trust, participation, and cultural integrity become the true engines of sustainable digital governance.

CONCLUSION

The digital transformation in Punggul Village, Badung Regency, demonstrates that rural innovation is rooted in governance built through collaboration, learning, and local culture. Its success is determined by the village government's ability to create an adaptive and participatory system. Through a qualitative case study, this research identified the integration of technology, human resource capacity, and intersectoral collaboration within daily governance practices. These findings confirm that digital transformation is a social and institutional process that shapes how government functions. Practically, Punggul's experience demonstrates the importance of strengthening human resource capacity, community engagement, and cross-sector collaboration for sustainable innovation. Further research and policy support, such as inter-village networking, integrated data management, and increased digital literacy, are needed to foster sustainable and inclusive transformation.

AI DICLOSURE STATEMENT

The generative AI tools were only used for language editing and paraphrasing to improve the clarity and readability of the text when preparing this manuscript. The author took all aspects of the research, including research design, data collection, data analysis, interpretation of findings and conclusions, independently, without the use of AI tools. The author is independently responsible for the originality, intellectual content and overall integrity of the manuscript.

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