OPEN ACCESS

E-ISSN 2776-3277, P-ISSN 2776-4729

Volume 5 (3), November 2025, 234-245

International Journal Education and Computer Studies (IJECS)

DOI: https://doi.org/10.35870/ijecs.v5i3.5751

Conceptual Model of Siskamling Information System Integration in Smart Village Architecture: A Theoretical Analysis of Efficiency and Sustainability

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Received: 12 October 2025; Accepted: 10 November 2025; Published: 30 December 2025.

Abstract

This study develops a conceptual model for integrating the *Siskamling* (Community Security System) into the Smart Village architecture by combining three core theoretical dimensions—information system efficiency, socio-technological sustainability, and digital governance integration. Through a conceptual–theoretical approach, the research synthesizes multiple frameworks, including Information System Integration Theory, the DeLone and McLean IS Success Model, Socio-Technical Systems Theory, and the Digital Sustainability Framework. The model positions *Siskamling* as more than a digital security platform; it is conceptualized as a socio-technical subsystem that fosters citizen participation, transparency, and institutional collaboration in rural governance. The findings highlight that Smart Village success depends not only on technological infrastructure but also on how digital systems align with social participation and collective resilience. Efficiency in information systems enhances trust and engagement, which in turn sustains socio-technical adaptation and supports integrative smart governance. Theoretically, the model bridges technological and social dimensions in community-based digitalization, while practically, it provides a reference for policymakers and local governments to design participatory and sustainable digital governance strategies. Future research is encouraged to empirically validate this conceptual framework using mixed methods, integrating variables such as digital literacy, policy support, and infrastructure readiness to ensure broader applicability.

Keywords: Smart Village; Digital Governance; Socio-Technical Sustainability; Information System Efficiency; Community Security.

Introduction

Digital transformation has substantially altered the modalities through which communities articulate communication, coordination, and collective security, resulting in the emergence of novel configurations of rural governance predicated on digital participation. Within this transformation, the Smart Village paradigm has emerged as a framework for integrating technology and participatory governance to enhance rural well-being (W. Li & Zhang, 2024; Permatasari & Walinegoro, 2023). In Indonesia, the implementation of the Siskamling Information System exemplifies this shift; it is a web-based platform that disseminates real-time security information and strengthens community vigilance (Hendrawan *et al*., 2023). The Smart Village approach aims not merely at digitizing administration but rather creating an adaptive ecosystem where technology supports inclusion, transparency, and collective problem-solving. Through this model, rural communities can overcome spatial and infrastructural disparities by adopting information and communication technologies (ICT) that encourage citizen participation as well as foster social innovation (Vakulenko *et al*., 2021; Yin *et al*., 2023).

OPEN ACCESS

E-ISSN 2776-3277, P-ISSN 2776-4729

Volume 5 (3), November 2025, 234-245

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The incorporation of systems such as Siskamling into Smart Village architectures reflects the growing importance of digital security infrastructures in shaping socially cohesive and responsive governance environments. However, this integration requires an understanding grounded in theory about how information systems relate to social structures and local institutions. Information Systems Integration Theory and Enterprise Architecture (EA) provide the conceptual foundation for explaining interoperability among digital subsystems in rural environments (Gobin-Rahimbux *et al*., 2020; Prasetyo & Habibie, 2022). Interoperability from this perspective embodies technical, semantic, and organizational alignment that allows platforms like Siskamling to run smoothly with citizen databases, network infrastructures as well as other Smart Village subsystems (Iacobescu *et al*., 2021; Zhang, 2025). This view places village digital architecture within an adaptive socio-technical system rather than a simple aggregation of technologies. But there is limited literature on how these principles apply specifically in rural settings where social capital varies and so does digital readiness.

Filling this gap demands attention not just to system architecture but also efficiency and sustainability factors that impact long-term commitment to digitization. Efficiency, as defined in the DeLone and McLean Information Systems Success Model, is a multidimensional construct covering system quality, information quality, user satisfaction, and net benefits (Makmur, 2023). In Siskamling, efficiency goes beyond technical performance such as response speed and data reliability (S. Wang *et al*., 2023) to include social factors like citizen trust and engagement in digital governance (Al-Khayari *et al*., 2024; Yang & Jin, 2024). An efficient system increases accessibility, transparency, and accountability that would in turn increase institutional legitimacy and user confidence. These dimensions support the argument that successful digital transformation requires not only technological capacity but also organizational and behavioral adaptation (Luo *et al*., 2023). Sustainability will be drawn from STS Theory and the Digital Sustainability Framework which assert that both technological and social dimensions are interdependent for building adaptive as well as enduring digital ecosystems (Alhassan *et al*., 2023; M. Li *et al*., 2021). For Siskamling, sustainability means the ability of a digital security network to keep running with community involvement through efficient use of resources management by participants plus flexibility in technology (Altwaijri *et al*., 2024; Balsalobre-Lorente *et al*., 2024).

This perspective agrees with findings that sustainable digital systems depend on trust, collective norms, and community ownership in technological maintenance and governance (Manea *et al*., 2021). A system that is socially embedded and adaptable to local contexts is more likely to endure and evolve alongside the community's digital maturity. There has been much research into smart governance and system integration but studies about community-based security systems within Smart Village frameworks are few. Previous analyses have looked at administrative efficiency, economic growth, or infrastructure management without consideration of the intersection between digital efficiency with socio-technological sustainability (Bazrafshan *et al*., 2023; Jenkins *et al*., 2023; Gönül-Sezer & Ocak, 2020). The absence of integrative models that connect these domains presents a theoretical gap this study will address by developing a conceptual model linking information system efficiency to socio-technological sustainability as well as digital governance integration. The proposed framework will conceptualize Siskamling as a digital security subsystem operating not only as an instrument but also an institutional mechanism for collective resilience plus community empowerment (Prastya *et al*., 2022; Zheng & Tian, 2023; Yılmaz & Alkan, 2024).

This study is to formulate a theoretically comprehensive model that explains the integration of Siskamling into Smart Village architecture towards efficiency and sustainability. The model integrates different disciplines, namely Information Systems Integration Theory, Socio-Technical Systems Theory, and the Smart Governance framework, to describe relational mechanisms between digital performance, citizen participation, and governance adaptation. This research further develops theoretical perspectives on community-based digitalization by conceptualizing Siskamling as a socially embedded information infrastructure that can be used as a basis for empirical validation in the future. This paper places social security digitalization within the strategic dimension of Smart Village development required for creating technologically connected rural environments with social cohesion and institutional resilience (Haixia *et al*., 2021; F. Wang *et al*., 2021; Yılmaz & Alkan, 2024).

OPEN ACCESS

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Literature Review

The literature review establishes the theoretical grounding for constructing a conceptual model that integrates the *Siskamling* information system within a Smart Village architecture. Rather than merely summarizing previous research, this section synthesizes insights from multiple disciplinary perspectives to develop a coherent and theoretically robust framework. The review is organized around five interrelated domains that collectively support the conceptual foundation of this study:

1) Smart Village Architecture and Smart Governance, which examine how digital infrastructures and participatory governance mechanisms shape rural transformation.
2) Information System Integration Theory, which explains the interoperability and architectural alignment among interconnected digital subsystems.
3) Information System Efficiency and Digital Performance, which analyze the dimensions of technical quality, usability, and social effectiveness in digital system implementation.
4) Socio-Technological Sustainability, encompassing both Socio-Technical Systems (STS) and Digital Sustainability perspectives that emphasize the interdependence between social engagement and technological adaptation; and
5) Conceptual Model Development in Information Systems Research, which provides methodological and epistemological guidance for synthesizing theoretical constructs into a unified analytical model.

Each domain is critically examined to clarify its relevance to the development of a digital *Siskamling* system as part of Smart Village governance. This structured synthesis not only integrates theoretical arguments from prior studies but also positions *Siskamling* as a socio-technical innovation capable of strengthening community security and digital inclusivity in rural settings (Hendrawan *et al*., 2023).

Smart Village Architecture and Smart Governance

The Smart Village framework extends the Smart City paradigm by adapting its technological principles to the social realities and participatory needs of rural communities. Unlike urban digitalization, which often emphasizes infrastructure and service optimization, Smart Villages prioritize community empowerment through technology adoption, local innovation, and collaborative governance models (W. Li & Zhang, 2024). This approach seeks to create digitally connected communities that leverage information and communication technologies (ICT) to enhance social inclusion, resilience, and local development capacity.
According to Permatasari and Walinegoro (2023), establishing a Smart Village requires a structural transformation in public administration—from conventional bureaucratic mechanisms toward digital governance systems that are inclusive, adaptive, and community-oriented. This transition aligns governance processes with the values of participation, transparency, and shared responsibility, enabling citizens to take a more active role in decision-making. Within this paradigm, smart governance emerges as a central pillar that connects technological innovation with participatory democracy.

Rather than functioning solely as a means of administrative efficiency, smart governance represents a framework for co-creation between government institutions and citizens, promoting openness, accountability, and responsiveness (Vakulenko *et al*., 2021; Yin *et al*., 2023). In the context of rural digitalization, this governance model provides the foundation for developing systems that integrate social engagement with technological infrastructure. The integration of smart governance principles is particularly relevant for designing community-based systems such as the digital *Siskamling* (Community Security System). By embedding mechanisms for information sharing, collective monitoring, and participatory decision-making, *Siskamling* embodies the values of transparency and cooperation that underpin Smart Village governance. Consequently, the Smart Village architecture should be viewed not merely as a technological ecosystem but as a governance model that cultivates social trust and digital inclusion through active citizen participation.

Information System Integration Theory

Information System Integration Theory underscores the need for interoperability and holistic architectural design in developing complex digital ecosystems. Integration ensures that distinct subsystems within an organization or community operate as a unified whole, enabling efficient data exchange, coordinated management, and consistent user experiences. Prasetyo and Habibie (2022) emphasize that effective integration must account for Enterprise Architecture (EA) principles, including the alignment of information flows, system components, and user interactions. Such alignment establishes a structural foundation where digital platforms can interconnect seamlessly while supporting diverse functional objectives. According to Iacobescu *et al.* (2021),

OPEN ACCESS

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Volume 5 (3), November 2025, 234-245
International Journal Education and Computer Studies (IJECS)
DOI: https://doi.org/10.35870/ijecs.v5i3.5751

successful integration requires coherence between organizational structures, data governance, and technological infrastructures. Without these alignments, digital initiatives often face fragmentation, leading to inefficiencies and limited interoperability. Building on this, Gobin-Rahimbux *et al*. (2020) introduced the concept of multi-layer interoperability, which operates across three dimensions: *technical* (data exchange and connectivity between platforms), *semantic* (consistency of data meaning and standards), and *organizational* (harmonization of governance processes and institutional coordination). These dimensions form the theoretical backbone for designing interconnected systems capable of operating across administrative, technological, and social layers.

In the context of Smart Village development, this theory provides a conceptual lens for understanding how digital subsystems—such as the *Siskamling* Community Security System—can be embedded within a broader digital ecosystem. The *Siskamling* platform, for instance, functions as a digital security subsystem that interacts dynamically with other village applications, including citizen databases, public information systems, emergency response modules, and digital service platforms. Achieving such interoperability requires both architectural consistency and adaptive flexibility to accommodate the evolving needs of rural communities. Zhang (2025) further highlights the relevance of microservices architecture in supporting modular and scalable system integration. Through this approach, *Siskamling* can be developed as an independent yet interconnected service component that integrates smoothly within the larger Smart Village framework. This modularity enables iterative development, maintenance, and system upgrades without disrupting other digital functions. Thus, Information System Integration Theory offers the conceptual foundation for understanding how connectivity, standardization, and adaptability can collectively enhance the efficiency and sustainability of *Siskamling* within the Smart Village digital architecture.

Information System Efficiency and Digital Performance

Efficiency serves as a fundamental indicator of success in information systems, reflecting how effectively technological solutions deliver value, usability, and reliability to their users. According to the Information System Success Model developed by DeLone and McLean, system performance can be evaluated through multiple dimensions—system quality, information quality, user satisfaction, and the resulting net benefits (Makmur, 2023). These dimensions collectively determine how well an information system supports decision-making, communication, and organizational effectiveness. In the context of Smart Village development, efficiency extends beyond technical metrics to encompass social and institutional outcomes. A system is considered efficient not only when it performs reliably but also when it facilitates public participation, transparency, and trust in digital governance processes. Studies by S. Wang *et al*. (2023) and Yang and Jin (2024) demonstrate that response speed, ease of access, and the clarity of information significantly influence citizens' confidence in government-managed digital platforms.

When digital systems are transparent and responsive, communities are more likely to engage in participatory governance and adopt digital tools as part of daily civic life. Empirical evidence from Hendrawan *et al*. (2023) reinforces this perspective, showing that the web-based *Siskamling* platform enhances communication efficiency between residents and local authorities, fostering collective awareness and coordination in maintaining neighborhood security. Similarly, Al-Khayari *et al*. (2024) emphasize that usability and reliability are critical factors shaping the long-term adoption and sustainability of community-level information systems. These findings indicate that efficiency operates not only as a technical attribute but also as a socio-behavioral catalyst that builds digital trust and participation. Within the conceptual framework of this study, information system efficiency is positioned as an enabling variable—a driving force that supports both socio-technological sustainability and digital governance integration. By enhancing performance and user confidence, efficient systems such as *Siskamling* become essential instruments for creating Smart Villages that are transparent, adaptive, and community-centered.

Socio-Technical Systems and Digital Sustainability

The Socio-Technical Systems (STS) theory and the Digital Sustainability framework both emphasize that the enduring success of information systems depends on achieving equilibrium between social and technical dimensions. These dimensions—comprising human participation, organizational structures, and technological infrastructure—must interact dynamically to ensure that digital systems remain adaptive and relevant over time. Alhassan *et al*. (2023) contend that sustainable digital innovation cannot rely solely on technical efficiency; it must be intentionally designed to strengthen human–technology interaction and community engagement. Within the context of the *Siskamling* Community Watch System, sustainability refers to the system's capacity to evolve in line with local social dynamics, maintain active citizen participation, and uphold data security standards. A sustainable *Siskamling* platform is therefore one that not only operates reliably but also fosters collective trust and a sense of ownership among users. Altwaijri *et al*. (2024) and Balsalobre-Lorente *et al*. (2024) expand this perspective by identifying three interdependent

OPEN ACCESS

E-ISSN 2776-3277, P-ISSN 2776-4729

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pillars of digital sustainability: social sustainability, which involves community engagement and trust-building; economic sustainability, which ensures the availability and efficient use of resources; and technological sustainability, which focuses on continuous system maintenance and innovation.

Empirical evidence supports these theoretical claims. Hendrawan *et al*. (2023) demonstrate that implementing a digital neighborhood watch system increases social solidarity and collective responsibility in maintaining community safety. Such findings affirm that technology adoption in rural areas achieves long-term stability only when supported by inclusive participation and a shared commitment to system upkeep. In the conceptual model developed in this study, STS theory forms the foundation for the socio-technical sustainability dimension, which functions as a mediating construct between system efficiency and digital governance integration. By highlighting the interplay between human, organizational, and technological elements, this perspective explains how the *Siskamling* system can evolve as both a digital infrastructure and a social mechanism that reinforces the resilience and inclusivity of Smart Village governance.

Conceptual Model Development in Information Systems Research

The development of a conceptual model in information systems research demands methodological clarity, epistemological validity, and theoretical coherence. A conceptual model functions as an analytical framework that explains the relationships among constructs within a complex system, linking technical, social, and organizational dimensions into a unified theoretical structure. Jenkins *et al*. (2023) argue that conceptual models play a critical role in visualizing and articulating these relationships, thereby enabling scholars to connect diverse domains of knowledge through a coherent analytical lens. To strengthen theoretical rigor, Paudel and Ligmann-Zielińska (2023) propose the framework synthesis method, an iterative process that integrates theories from multiple disciplines to refine conceptual clarity and internal consistency. Similarly, Bazrafshan *et al*. (2023) and Yılmaz and Alkan (2024) highlight that combining distinct theoretical perspectives allows researchers to construct broader and more adaptable frameworks capable of addressing multidimensional problems. This interdisciplinary approach ensures that conceptual models in information systems research are not only theoretically grounded but also applicable across varied digital governance contexts.

In this study, the conceptual model is constructed by integrating Information System Integration Theory, Information System Efficiency, and Socio-Technological Sustainability to explain the mechanisms through which the *Siskamling* (Community Watch) system can be embedded within the Smart Village architecture. This integration captures the interplay between technological interoperability, system performance, and the socio-technical processes that sustain digital governance. Following the design principles outlined by Gönül-Sezer and Ocak (2020), the model is developed with an emphasis on epistemological consistency and conceptual coherence, ensuring that the relationships between constructs are logically aligned and theoretically justified. The resulting framework serves as a foundational reference for future empirical validation and theoretical advancement in community-based information system research. The literature synthesis presented in Table 1 consolidates the theoretical foundations underpinning this conceptual model. It systematically summarizes five interrelated domains—Smart Village Governance, Information System Integration, System Efficiency, Socio-Technological Sustainability, and Conceptual Model Development—each contributing distinct insights to the formulation of an integrated *Siskamling* model. Collectively, these domains establish the theoretical scaffolding necessary to design an adaptive, community-oriented, and sustainable digital security system within the broader Smart Village ecosystem.

Table 1. Conceptual Literature Synthesis: Integration of Siskamling Information Systems within Smart Village Architecture

Domain of Study	Theoretical Focus	Key Contributors	Main Findings	Implications for Conceptual Model
Smart Village Architecture & Governance	Explains how Smart Villages are structured through the integration of digital governance, technology, and community innovation.	Hendrawan *et al*. (2023); W. Li & Zhang (2024); Permatasari & Walinegoro (2023); Vakulenko *et al*. (2021); Yin *et al*. (2023)	Smart Villages prioritize participatory governance and digital inclusion, aligning with *Siskamling*'s goal of fostering collective security awareness.	Provides foundational understanding for integrating community-based systems like *Siskamling* into Smart Village frameworks.

OPEN ACCESS

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Information System Integration Theory	Examines interoperability and system architecture frameworks within digital ecosystems.	Gobin-Rahimbux *et al*. (2020); Iacobescu *et al*. (2021); Prasetyo & Habibie (2022); Zhang (2025)	Integration requires multi-layer interoperability—technical, semantic, and organizational.	Explains how *Siskamling* can interact technically and institutionally with other Smart Village subsystems.
Information System Efficiency & Digital Performance	Investigates system quality, reliability, usability, and user satisfaction as determinants of digital performance.	Al-Khayari *et al*. (2024); Hendrawan *et al*. (2023); Makmur (2023); Yang & Jin (2024); Yin *et al*. (2023)	Efficiency and reliability enhance user adoption and public trust.	Positions efficiency as an enabling factor linking technical performance with governance effectiveness.
Socio-Technical Systems & Digital Sustainability	Explores the interdependence between social engagement and technological adaptation for sustainable digital adoption.	Alhassan *et al*. (2023); Altwaijri *et al*. (2024); Balsalobre-Lorente *et al*. (2024); Hendrawan *et al*. (2023); M. Li *et al*. (2021)	Sustainability emerges from ongoing community participation and adaptive technological practices.	Provides the socio-technical mediation linking efficiency to digital governance integration.
Conceptual Model Development in IS Research	Outlines epistemological coherence and framework synthesis methodologies for conceptual modeling.	Gönül-Sezer & Ocak (2020); Jenkins *et al*. (2023); Paudel & Ligmann-Zielińska (2023); Yılmaz & Alkan (2024)	Conceptual models integrate multiple theories into a coherent analytical structure.	Guides the construction of the integrated *Siskamling* conceptual model.

The synthesis in Table 1 serves as a theoretical framework guiding the formulation of the *Siskamling* information system integration model within the Smart Village architecture, ensuring that each theoretical strand contributes cohesively to the overarching conceptual design.

Methodology

This study adopts a conceptual–theoretical approach with the objective of developing a model for integrating the *Siskamling* information system into the Smart Village architecture. This approach was chosen because the research does not aim to test empirical hypotheses but to construct a theoretical framework that explains the interrelationships among information system efficiency, socio-technological sustainability, and community-based digital governance. In this context, the primary data source is not field observation but scholarly literature obtained from internationally indexed journals such as *Scopus*, *Web of Science*, and *Scite.ai*. The theoretical foundation draws on multiple perspectives, including Smart Governance Theory, Information System Integration Theory, the DeLone and McLean Information System Success Model, Socio-Technical Systems (STS) Theory, and the Digital Sustainability Framework. By systematically integrating these theories, the study aims to develop a conceptual framework that can later be empirically validated in future research. The research design follows the principles of systematic conceptual synthesis, which involves a structured and argumentative process of integrating and analyzing literature.

The first stage involved identifying and classifying relevant academic sources using targeted keywords such as *Smart Village architecture*, *information system integration*, *digital governance*, *ICT efficiency*, and *socio-technical sustainability*. Each selected publication was evaluated based on theoretical relevance, methodological rigor, and its contribution to the research objective. The selected studies were then grouped into five key domains: (1) Smart Village Architecture and Governance, (2) Information System Integration Theory, (3) Information System Efficiency and Digital Performance, (4) Socio-Technical Sustainability, and (5) Conceptual Model Development in Information Systems Research. This classification ensured that the theoretical foundation covered both technological and social dimensions of Smart Village governance. The second stage consisted of conceptual analysis

OPEN ACCESS

E-ISSN 2776-3277, P-ISSN 2776-4729

Volume 5 (3), November 2025, 234-245

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DOI: https://doi.org/10.35870/ijecs.v5i3.5751

and theoretical synthesis, which aimed to identify and connect the logical relationships among key concepts derived from the selected literature. Following the framework synthesis methodology proposed by Paudel and Ligmann-Zielińska (2023), the analysis combined theories from different domains to generate a more comprehensive understanding of Smart Village integration mechanisms.

For instance, Information System Integration Theory was applied to explain the interoperability between digital subsystems, while STS and Digital Sustainability frameworks were used to understand how social participation and technological adaptation contribute to long-term system sustainability. This integrative approach also helped to identify gaps in existing literature and propose new conceptual linkages, particularly regarding the incorporation of digital community security systems (*Siskamling*) within the broader Smart Village framework. The third stage involved the formulation of the conceptual model, developed through the synthesis of findings from the previous analytical stages. The resulting model illustrates the relationships among three main conceptual variables: Information System Efficiency, Socio-Technical Sustainability, and Smart Governance Integration. It describes how system efficiency enhances citizen participation, which in turn reinforces digital sustainability and governance effectiveness. Each relationship in the model is supported by theoretical arguments drawn from prior studies, following the principles of integrative theoretical modeling as outlined by Gönül-Sezer and Ocak (2020). The model development process emphasized logical coherence, epistemological consistency, and theoretical robustness to ensure the framework's scientific validity.

To strengthen the validity and credibility of the conceptual model, the study applied a theoretical triangulation strategy, comparing and aligning the proposed framework with established theories and conceptual models from related fields, including Smart City studies, Digital Governance, and Community Informatics. This triangulation ensured that the resulting model was theoretically sound, conceptually coherent, and academically generalizable. Ultimately, this methodological process produced an integrative conceptual model that explains how the *Siskamling* information system can function as a community-based digital security subsystem within an efficient, sustainable, and participatory Smart Village architecture. The model serves as a theoretical foundation for future empirical research and as a reference for policymakers seeking to design inclusive and resilient digital governance systems in rural contexts.

Results and Discussion

Results

The conceptual model proposed in this study is an extension of the findings by Hendrawan *et al*. (2023), which stated that digital Siskamling improves communication efficiency and community awareness. This research develops a theoretical model that connects information system efficiency, socio-technological sustainability, and smart governance integration to describe the dynamics of community-based digital systems in Smart Village ecosystems. The model is constructed based on an interdisciplinary synthesis of theories such as Information System Integration Theory, DeLone and McLean Information System Success Model, Socio-Technical Systems Theory, and Digital Sustainability Framework. It does not aim to empirically test any variables but rather provides a theoretical basis for understanding how Siskamling can operate as an efficient security subsystem with sustainability at the community level within the governance of Smart Villages. The model emphasizes that technological effectiveness must be complemented by social participation, institutional support, and alignment with governance processes if long-term digital sustainability is to be achieved.

The conceptual model comprises three interrelated constructs: information system efficiency, socio-technological sustainability, and smart governance integration. Information system efficiency refers to the performance of the system in enabling digital security activities in terms of usability, reliability, response time, and user satisfaction (Makmur, 2023). Socio-technological sustainability indicates a balance between social participation, institutional support, and technological adaptability for the longevity of the system (Alhassan *et al*., 2023). Smart governance integration describes how the Siskamling system interacts with other subsystems within the Smart Village such as public information services, citizen data management, and digital emergency communication (W. Li & Zhang, 2024; Yin *et al*., 2023). These three elements are mutually reinforcing forming a feedback loop where more efficiency leads to more community participation which in turn enhances sustainability that supports further governance integration. This relationship among these elements creates a feedback loop where each element influences and strengthens the others.

OPEN ACCESS

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International Journal Education and Computer Studies (IJECS)

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Information system efficiency is an enabler by improving accessibility and data reliability to foster public participation as well as digital trust. Sustained socio-technical alignment then allows continuous adaptation to community needs and technological changes which in turn supports governance systems integration. In this way, Siskamling becomes not only a digital tool for community security but also a driver for collaboration as well as transparency in rural governance. The model can be visualized as a circular system among efficiency, sustainability, and governance integration within the architecture of Smart Village showing how community-based digital systems adaptively and inclusively evolve over time. Figure 1. The Conceptual Model of the Integration of Digital Siskamling in the Smart Village Architecture System Efficiency of Information → Socio-Technological Sustainability → Integration of Smart Governance Reinforcing Feedback Loop in each dimension This conceptual model integrates the synthesis of literature systematically using complementary theories.

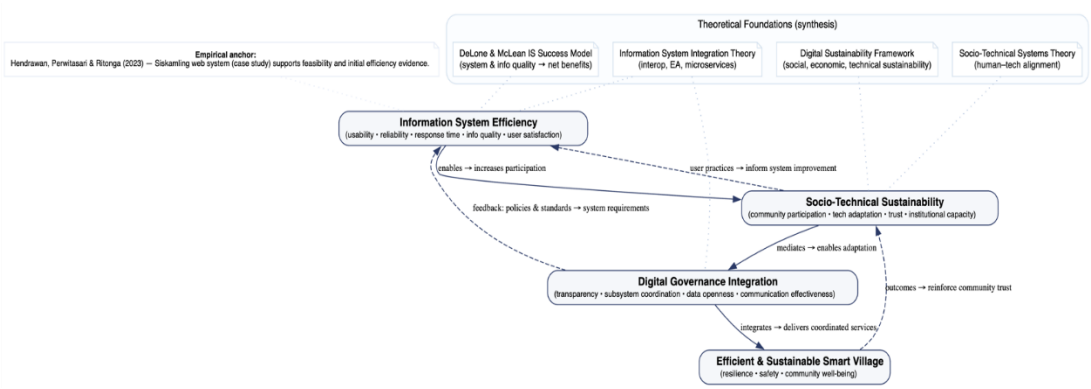

Figure 1. Conceptual Model of Digital Siskamling Integration within Smart Village Architecture

The theory of integration information systems serves as the basis for interoperability among subsystems (Gobin-Rahimbux *et al*., 2020; Prasetyo & Habibie, 2022). DeLone and McLean models are used to explain how quality systems affect performance and satisfaction (Makmur, 2023). The frameworks of sustainability in Socio-Technical and Digital Sustainability emphasize balance between human participation and technological adaptation (Alhassan *et al*., 2023; Balsalobre-Lorente *et al*., 2024). Governance theory enhances smart governance by including participatory and collaborative dimensions into digital management (W. Li & Zhang, 2024). These perspectives come together to indicate that a sustainable Siskamling system is possible only with technical efficiency, social engagement, and governance coordination. Several conceptual indicators can be derived from this synthesis for future empirical research. Information system efficiency could be measured by usability, reliability, and satisfaction of users; socio-technological sustainability could use participation, trust, adaptability as well as institutional capacity to measure governance integration through transparency in data openness and inter-system coordination (Permatasari & Walinegoro, 2023; Yin *et al*., 2023).

These are indicators that show the function of Siskamling not only as a security system but also an empowerment social system and a collaborative digital governance system. In general terms, it theoretically contributes by extending Information System Integration Theory into community-based security domains unifying system efficiency with socio-technological sustainability under one roof and advocating a paradigm for community-driven governance characterized by participation and trust. This model basically describes the synergistic relationship between efficiency, sustainability, and governance which can be used as a basis for testing empirically in different contexts of villages. It places digital Siskamling at the same time both as technological innovation and social innovation to strengthen resilience inclusivity sustainability toward Smart Village development.

Discussion

The conceptual model developed in this study emphasizes that the success of Smart Village development relies on the convergence of information system efficiency, socio-technological sustainability, and digital governance integration. These three dimensions are interdependent — system efficiency without social sustainability produces non-adaptive technology, while sustainability without efficiency creates rigid digital bureaucracy that hinders innovation. This finding supports W. Li and Zhang (2024), who argue that Smart Village development requires technological integration and citizen participation to achieve collaborative governance. The digital *Siskamling* model reflects this principle by positioning security systems as channels for civic engagement and collective governance. In line with Yin *et al*. (2023), this study affirms that Smart Village effectiveness depends on the system's ability to facilitate two-way digital communication between residents and local authorities. Thus, village digitalization should be viewed not merely as technological progress, but as a process of social transformation based on participation and knowledge sharing.

OPEN ACCESS

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DOI: https://doi.org/10.35870/ijecs.v5i3.5751

Within the framework of Information Systems Integration (ISI) theory, this study positions *Siskamling* as a community security subsystem within the Smart Village architecture. This perspective extends the ISI theory, which was previously applied mostly in urban and corporate contexts (Gobin-Rahimbux *et al*., 2020; Prasetyo & Habibie, 2022). By integrating *Siskamling* into the Smart Village Enterprise Architecture, the study shows that interoperability in digital governance is not only technical but also social. As Iacobescu *et al*. (2021) highlight, successful integration requires both unified digital structures and flexible social coordination. This model illustrates that digital village security involves interactions among residents, officials, and local institutions through platform-based communication mechanisms. Hence, the study expands ISI theory toward a socio-communitarian context, relevant for developing countries advancing rural digitalization. In relation to the DeLone and McLean IS Success Model (Makmur, 2023), this study broadens the definition of efficiency beyond technical quality to include social and institutional dimensions.

The findings show that the usability, reliability, and responsiveness of digital *Siskamling* systems are critical in building community trust (Al-Khayari *et al*., 2024; Luo *et al*., 2023). When systems are perceived as fast, accurate, and transparent, citizen participation naturally increases. As Yang and Jin (2024) assert, transparency fosters public accountability. Therefore, efficiency in Smart Villages is multidimensional, encompassing system performance, user behavior, and governance integrity — a shift from purely technical efficiency toward a holistic perspective. From the Socio-Technical Systems (STS) theory, the model confirms that sustainable digital transformation is achieved when social structures and technological systems operate in harmony (Alhassan *et al*., 2023). In this study, socio-technological sustainability functions as a mediating link between system efficiency and digital governance. This aligns with Altwaijri *et al*. (2024) and Balsalobre-Lorente *et al*. (2024), who define sustainability through three dimensions: social (participation and trust), economic (resource efficiency), and technological (maintenance and innovation).

In digital *Siskamling*, these dimensions interact dynamically — participation fosters ownership, efficiency reduces costs, and technology ensures continuity. Thus, sustainability emerges not merely as an outcome but as a mechanism that sustains digital governance and resilience. This research also advances the concept of Smart Governance, especially in rural contexts. Smart governance extends beyond administrative efficiency toward collaborative co-creation between communities and local governments (Permatasari & Walinegoro, 2023; Vakulenko *et al*., 2021). In this model, governance integration is the culmination of efficiency and sustainability, showing that digital *Siskamling* can drive grassroots transformation. Studies by Prastya *et al*. (2022) and Zheng & Tian (2023) similarly show that community-based innovation enhances responsiveness and social cohesion. This aligns with the view that digital *Siskamling* represents community-driven governance, where citizens are both system users and security co-managers. Hence, the model strengthens smart governance by embedding social security as a core pillar of Smart Village architecture.

Theoretically, this model establishes an integrative framework bridging information systems, socio-technical sustainability, and governance integration. It reframes digital systems as socio-digital ecosystems, not isolated technologies. Practically, it provides guidance for policymakers and system designers to develop inclusive digital governance based on citizen participation. Following M. Li *et al*. (2021) and Manea *et al*. (2021), sustainable digital policy should balance social, economic, and technological factors. Therefore, this model can serve as a conceptual foundation for implementing digital *Siskamling* across regions pursuing Smart Village initiatives. From a policy perspective, the model highlights the importance of integrating community-based digital security into national Smart Village programs. It shows that digital social security enhances citizen trust, institutional accountability, and responsiveness to local issues. Supporting F. Wang *et al*. (2021), data from such systems can improve evidence-based decision-making and early response mechanisms. Hence, the proposed model holds both theoretical and practical significance for developing adaptive, participatory, and welfare-oriented rural governance.

As with other conceptual research, this study has limitations. The model is theoretical and has not been empirically validated, so further research is needed to test its external validity. Future studies should examine relationships among system efficiency, sustainability, and participation using mixed methods approaches in real village contexts. Additionally, external factors such as infrastructure, policy support, and digital literacy warrant further exploration. Despite these limitations, this study contributes substantially to Smart Village research by introducing a contextual, integrative framework that bridges technology, society, and governance for sustainable digital transformation.

Conclusion

The model described in this study is a conceptual one that integrates the Siskamling information system into the architecture of Smart Village. It interrelates three theoretical dimensions: information system efficiency, socio-technological sustainability, and digital governance integration. Built using a conceptual synthesis approach, this model synthesizes key theories — Information System Integration Theory, DeLone and McLean IS Success Model, Socio-Technical Systems Theory, and Digital Sustainability

OPEN ACCESS

E-ISSN 2776-3277, P-ISSN 2776-4729

Volume 5 (3), November 2025, 234-245

International Journal Education and Computer Studies (IJECS)

DOI: https://doi.org/10.35870/ijecs.v5i3.5751

Framework among others. The results of the synthesis emphasize that success for Smart Village does not depend only on having digital infrastructure but also on aligning technology with social participation for achieving long-term system sustainability. Conceptually, efficiency in an information system is viewed as the major driver improving quality and reliability of service to gain public trust which fosters socio-technical sustainability through active community participation, institutional collaboration, and technology adaptation — all forming the basis for integrated collaborative digital governance (Smart Governance). Therefore, digital Siskamling should not be seen merely as a security mechanism but rather as a medium that empowers social resilience in rural communities.

This study theoretically contributes to information systems and digital governance studies by creating an integrative framework that connects efficiency, sustainability, and governance in one model. It extends Information Systems Integration Theory by inserting social dimensions into technical structures and enriches the discourse on Smart Governance by placing digital social security as an important pillar of sustainable Smart Villages. This model puts forth a new paradigm where community-based digital security is placed at the heart of Smart Village sustainability - driven by trust among citizens in transparency and shared ownership. As conceptual research, this model needs empirical validation through future studies. Researchers are invited to test its relationships using a mixed methods approach — qualitative methods like interviews and focus groups with village officials and residents combined with quantitative surveys measuring perceptions of digital efficiency and participation. Future works may also incorporate moderating variables such as policy support for infrastructure readiness to enhance the applicability of the model across contexts. The results can be used as a base in establishing participatory and sustainable digital security policies within national Smart Village programs.

Local governments may also be encouraged to include the Siskamling system in their Smart Village roadmaps, with support for community training and the development of digital infrastructure. Academics and practitioners may use this model to evaluate digital readiness and develop appropriate technology interventions that take into account local social characteristics. This study furthers theoretical discourse about Smart Village governance, as well as providing practical guidance on how rural communities can turn into secure, effective, and sustainable digital ecosystems.

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