Published by University of Muhammadiyah Makassar

DOI: 10.26618

e-ISSN 2686-5467 | p-ISSN 1858-2192

Balance: Jurnal Ekonomi

journal homepage: https://journal.unismuh.ac.id/index.php/jeb

Systematic Literature Review Study: Smart Village as A Strategy for Enhancing Rural Economic Independence in The Digital Era

Lidia Sari Uli Sitorus[1], Putra Perdana[2]
Faculty of Economics and Business, Universitas Pembangunan Nasional"Veteran"Jawa Timur
Email: lidiasariuli@gmail.com; putra.perdana.ep@upnjatim.ac.id

ARTICLE INFO

Keywords:
Rural Digital Transformation, Community Empowerment, Digital Governance, Sustainable Rural Development, Inclusive Innovation

Article History
- Received: 15 December 2025
- First Revision: 20 February 2026
- Second Revision: 05 April 2026
- Third Revision: 10 May 2026
- Accepted: 30 May 2026

ABSTRACT

This study analyzed the role of Smart Villages as a strategic approach to enhancing rural economic independence in the digital era through a Systematic Literature Review (SLR) of 21 peer-reviewed articles published between 2021 and 2025. The literature was collected from Scopus and Google Scholar databases using the keywords ("Smart Village" OR "Digital Village") AND ("Economic Empowerment" OR "Digital Economy"), and screened by title and abstract according to inclusion criteria. Data were thematically analyzed based on the Digital Empowerment Theory (DET), which emphasizes five dimensions of digital development: industry, ecology, culture, services, and governance. The findings revealed that Smart Village implementation significantly contributed to improving economic productivity, governance transparency, and community empowerment through structured and sustainable digitalization. In the industrial dimension, digitalization strengthened MSME transformation, supply chain efficiency, and e-commerce market expansion. The ecological dimension highlighted the role of green technologies, spatial information systems, and precision agriculture in promoting resource sustainability. The cultural dimension fostered local identity and creative industries, while the service and governance dimensions enhanced digital literacy, inclusivity, and citizen participation through e-governance and penta-helix collaboration. Overall, the success of rural digital development depends not only on infrastructure availability but also on community innovation capacity and participatory engagement. The study recommends strengthening multi-level policy integration, digital literacy initiatives, and Smart Village models grounded in Digital Empowerment Theory to promote inclusive and sustainable rural transformation in developing countries.

1. Introduction

The Digital transformation has become a global phenomenon that influences various dimensions of development, including rural areas. One of the emerging approaches is the Smart Village concept, which integrates digital technologies and social innovation to improve public service delivery, strengthen local economic growth, and promote social and environmental sustainability in rural communities (Cai et al., 2023; Emerllahu & Bogataj, 2024; Stojanova et al., 2021). As rural regions continue to face challenges related to economic inequality, limited access to public services, and digital exclusion, Smart Village has gained increasing attention as a strategic framework for achieving sustainable rural development. The concept is closely aligned with Digital Empowerment Theory, which emphasizes the utilization of digital technologies to strengthen five interrelated dimensions of development, namely industry, ecology, culture, public services, and governance (Zhao & Li, 2022; Agusta, 2023).

DOI: 10.26618

Within this theoretical perspective, digital empowerment enables rural communities to improve their capacities and resilience through technology-driven innovation, making Smart Village an appropriate model for accelerating rural transformation.

Previous studies have demonstrated that Smart Village initiatives generate substantial socio-economic benefits. Empirical evidence indicates that Smart Village development contributes to regional economic growth (Wang et al., 2023), reduces income disparities between urban and rural areas (Y. Liu et al., 2024), and enhances the resilience of rural households through digital innovation and community empowerment (Cai et al., 2023). Nevertheless, the implementation of Smart Village remains uneven across countries and regions. Existing studies consistently report challenges related to the scalability of Smart Village models, the inclusion of marginalized communities, inadequate digital infrastructure, financial constraints, and differences in socio-cultural contexts that influence implementation outcomes (Emerllahu & Bogataj, 2024; Junaidi et al., 2025; Muhtar et al., 2023). These findings suggest that although Smart Village has considerable potential, its effectiveness depends on contextual factors that require comprehensive policy support and collaborative governance.

In Indonesia, the Smart Village concept has gradually been implemented through the Smart Village Nusantara program initiated by Telkom Indonesia in collaboration with the Ministry of Villages (Keputusan Menteri Nomor 55 Tahun 2024; Telkom Indonesia, 2020). This initiative supports the achievement of the Village Sustainable Development Goals (Village SDGs) and the National Medium-Term Development Plan (RPJMN) 2025–2029 (Kementerian Sekretariat Negara Republik Indonesia, 2025; Presiden Republik Indonesia, 2025). The program aims to strengthen community economic empowerment through digital technologies, promote micro, small, and medium-sized enterprises (MSMEs), improve digital literacy, enhance village governance, and encourage youth participation in rural development (Ririn Yulianti et al., 2025; Susanti et al., 2023). Despite these policy initiatives, Smart Village implementation in Indonesia continues to encounter substantial challenges. In Cijantra Village, Tangerang, the Smart Village program has not been fully realized due to low levels of digital literacy, limited public awareness, and weak program sustainability (Siti Khaerunisa, 2024). Similarly, research conducted in Waru Village, Sidoarjo, indicates that although community readiness is relatively high, successful implementation largely depends on physical infrastructure and village leadership (Ramadhani & Rohmadiani, 2024). Furthermore, in Grogol and Tugu Villages, Ponorogo, inadequate internet connectivity, limited dissemination of information, and weak environmental monitoring have become major barriers to Smart Village implementation (Bilyastuti et al., 2023).

Although empirical studies on Smart Village in Indonesia have expanded in recent years, most have primarily focused on the digitalization of public services rather than examining how Smart Village can systematically promote rural economic empowerment (Muhtar et al., 2023; Susilowati et al., 2024). Moreover, previous research has identified weak cross-sector coordination and insufficient institutional support as major obstacles to program sustainability, emphasizing the need for multi-level governance policies that accommodate local characteristics while actively engaging rural communities in digital transformation (Leviäkangas et al., 2025). Consequently, important aspects of Smart Village implementation remain underexplored, particularly regarding the mechanisms through which digital transformation enhances rural economic independence.

Based on the existing literature, several research gaps can be identified. First, limited studies have comprehensively explained how Smart Economy initiatives operate as mechanisms for strengthening village

DOI: 10.26618

economic empowerment. Second, empirical evidence regarding multi-actor collaboration through the penta-helix model remains scarce, despite its strategic role in supporting sustainable digital transformation. Third, there is still a lack of integrated Smart Village models that simultaneously combine digital innovation, community empowerment, and collaborative governance to achieve long-term rural economic sustainability (Emerllahu & Bogataj, 2024; Harsanto & Wahyuningrat, 2024; Manapa Sampetoding & Er, 2024). These gaps indicate the necessity of developing a more comprehensive conceptual framework capable of explaining how multiple dimensions of Smart Village interact to strengthen village economic independence.

Accordingly, the research problem addressed in this study concerns the absence of an integrated Smart Village strategy capable of systematically promoting rural economic independence through the integration of digital innovation, community empowerment, and multi-actor collaboration. To address this problem, this study reviews the existing literature to synthesize a contextual Smart Village framework suitable for rural development in Indonesia. The proposed framework is developed based on three complementary pillars: Smart Economy, which emphasizes MSME digitalization, online marketing, and financial inclusion (Ren et al., 2024; Ririn Yulianti et al., 2025; Xing et al., 2023); Smart Community, which focuses on digital literacy assistance provided by village cadres and digital ambassadors (Ardhian Nugroho & Galan Prakoso, 2025; Ikram et al., 2024); and penta-helix collaboration, involving government, academia, the private sector, communities, and the media to accelerate innovation and promote evidence-based village decision-making through data utilization (Husnah et al., 2024).

Based on the identified research problem, this study addresses two primary research questions: (1) how has Smart Village been implemented in Indonesia, and what factors influence its successful implementation? and (2) what Smart Village strategy is most appropriate for strengthening rural economic independence in Indonesia? Accordingly, the primary objective of this study is to review and synthesize the existing Smart Village literature in order to formulate an integrated strategy that is adaptive to local village characteristics while strengthening economic independence in the digital era.

Theoretically, this study contributes to the Smart Village literature by extending the application of Digital Empowerment Theory beyond the digitalization of public services toward an integrated perspective that emphasizes rural economic independence through Smart Economy, Smart Community, and penta-helix collaboration. Practically, the findings are expected to provide valuable insights for policymakers, village governments, private-sector organizations, academics, and community stakeholders in designing inclusive, sustainable, and context-sensitive Smart Village programs. The novelty of this study lies in positioning rural economic independence as the primary objective of Smart Village development rather than merely focusing on public service digitalization. Furthermore, this study proposes an integrated Smart Village framework that combines digital innovation, community empowerment, and multi-actor collaboration to support sustainable rural development in Indonesia.

2. Literature Review

2.1 Conceptual and Theoretical Foundations

This study is primarily grounded in Development Planning Theory, which emphasizes that sustainable development should be strategically planned, participatory, and responsive to local needs. Within the context of rural development, this theory argues that development planning should integrate economic, social, and institutional dimensions to improve community welfare in a sustainable manner. In the digital era, development planning is no longer limited to physical infrastructure but also encompasses digital transformation, technological readiness,

DOI: 10.26618

and community participation as essential components of inclusive rural development. As argued by S. Liu et al. (2023), contemporary development planning requires the integration of policy strategies, local needs, and community preparedness to effectively respond to technological transformation. Consequently, village development should be understood as a collaborative social process involving multiple stakeholders in creating sustainable economic and social value.

Development Planning Theory is complemented by Digital Empowerment Theory, which explains how digital technologies enhance individual and community capacities by improving access to information, knowledge, markets, and public services (Agusta, 2023; Zhao & Li, 2022). Rather than serving merely as technological tools, digital technologies function as instruments of empowerment that enable rural communities to participate more actively in economic activities, strengthen local governance, and expand development opportunities. Digital empowerment encourages communities to develop new economic capabilities, improve productivity, and increase participation in decision-making processes through broader access to digital resources. Supporting this perspective, Harsanto and Wahyuningrat (2024) emphasize that digital inclusiveness constitutes a critical determinant of rural economic competitiveness and community self-reliance.

The integration of Development Planning Theory and Digital Empowerment Theory provides a comprehensive theoretical foundation for explaining Smart Village development. Development Planning Theory explains how rural development should be systematically designed through participatory planning and sustainable governance, whereas Digital Empowerment Theory clarifies the mechanisms through which digital technology strengthens community capabilities and promotes economic independence. Together, these complementary perspectives suggest that successful rural transformation depends not only on development planning but also on the ability of communities to utilize digital technologies to expand access to information, markets, social capital, and economic opportunities.

Within this theoretical perspective, the Smart Village model adopted in this study is structured around two principal dimensions: Smart Community and Smart Economy. The Smart Community dimension focuses on strengthening digital literacy, community participation, and social capacity in managing local resources (Manapa Sampetoding & Er, 2024). Community empowerment is achieved through digital literacy training, assistance for micro, small, and medium-sized enterprises (MSMEs), and the establishment of village digital facilitators who encourage innovation and knowledge sharing within local communities. These initiatives strengthen the social foundation necessary for achieving sustainable and independent rural development.

Meanwhile, the Smart Economy dimension emphasizes the utilization of digital technologies to improve productive economic activities and strengthen local economic competitiveness (Ren et al., 2024). The digitalization of rural economic sectors enhances production efficiency, expands distribution networks, facilitates market access, and increases the added value of local products. Through digital economic transformation, rural communities become not only technology users but also active economic actors capable of independently managing businesses, developing innovation, and responding to changing market demands.

The interaction between Smart Community and Smart Economy establishes an integrated ecosystem for inclusive and sustainable Smart Village development. Smart Community strengthens human and social capital through improved digital capabilities and collaborative participation, while Smart Economy translates these capabilities into productive economic outcomes through technology-driven entrepreneurship and

DOI: 10.26618

market expansion. This synergy reflects the practical implementation of Digital Empowerment Theory, whereby technology-based empowerment serves as the principal mechanism for enhancing rural economic independence while simultaneously supporting the objectives of participatory and sustainable development envisioned by Development Planning Theory.

2.2 Review of Empirical Studies

Recent empirical studies consistently demonstrate that Smart Village implementation contributes significantly to rural socio-economic development by integrating digital technologies, community empowerment, and collaborative governance. Based on the synthesis of previous literature, the existing body of knowledge can be classified into three major themes: (1) digitalization and digital infrastructure, (2) economic empowerment and rural MSMEs, and (3) governance and multi-stakeholder collaboration. Collectively, these studies indicate that Smart Village is not merely a technological innovation but also a knowledge-based rural development strategy that promotes sustainable economic independence.

The first research stream focuses on digitalization and digital infrastructure as fundamental drivers of rural transformation. Empirical evidence suggests that digital infrastructure significantly improves regional economic performance by enhancing logistics efficiency, strengthening supply chain integration, and facilitating data-driven market connectivity. Wang et al. (2023) demonstrated that Digital Village development in China directly contributes to county-level economic growth through the optimization of digital production systems and transportation networks. Similarly, Deng et al. (2024) found that big data analytics strengthens evidence-based rural governance by improving planning accuracy and supporting informed policy decisions. Comparable findings were reported by Ikram et al. (2024), who identified digital infrastructure readiness and digital literacy as the primary determinants of the successful implementation of the Smart Village Nusantara program in Indonesia. Extending these findings to a broader international context, Leviäkangas et al. (2025) argued that sustainable rural communication infrastructure constitutes a prerequisite for achieving equitable regional development through digital transformation. These empirical findings reinforce the arguments of Digital Empowerment Theory by demonstrating that digital accessibility and technological capability represent essential resources for strengthening rural communities (Agusta, 2023; Zhao & Li, 2022).

A second group of studies emphasizes the role of Smart Village in economic empowerment and the development of rural micro, small, and medium-sized enterprises (MSMEs). The literature consistently indicates that rural digitalization expands economic participation, increases productivity, and creates new employment opportunities. Guo and Li (2024) together with Tian et al. (2023) found that the digital economy accelerates rural industrial transformation through the expansion of e-commerce activities and improvements in agribusiness productivity. Likewise, Lu et al. (2024) and Wang et al. (2023) reported that digital technology adoption generates multiplier effects by improving supply chain efficiency and increasing the added value of local products. Within the Indonesian context, Ririn Yulianti et al. (2025) and Agusta (2023) highlighted the importance of co-production involving government institutions, local communities, and business actors in promoting social innovation and expanding digital market opportunities for village-based MSMEs. Furthermore, Annshori et al. (2024) provided empirical evidence that the implementation of the Internet of Things (IoT) and big data technologies in rural production and distribution systems significantly enhances local economic competitiveness. Taken together, these studies demonstrate that digital transformation not only modernizes traditional economic activities but also strengthens

DOI: 10.26618

collaborative socio-economic structures capable of supporting long-term rural development.

The third research theme concerns governance and multi-stakeholder collaboration, which has become increasingly important in Smart Village implementation. Previous studies indicate that digital governance improves administrative transparency, bureaucratic efficiency, and public participation in local decision-making processes. Susilowati et al. (2024) and Geohansa et al. (2025) demonstrated that e-governance initiatives strengthen institutional accountability while encouraging greater citizen engagement in village governance. Similarly, Muhtar et al. (2023) and Emerllahu and Bogataj (2024) found that cross-sector collaboration based on the Penta Helix model—incorporating government, academia, the private sector, media, and local communities—facilitates participatory governance that integrates data-driven decision-making with local values and knowledge. Complementing these findings, Purnamasari et al. (2024) and Stojanova et al. (2021) showed that digital governance enhances institutional legitimacy, broadens democratic participation, and reduces disparities in public service delivery between rural and urban areas. These studies collectively suggest that the success of Smart Village initiatives depends not only on technological innovation but also on equitable access, collaborative governance, and policy consistency across multiple stakeholders.

Overall, the empirical literature indicates that digital transformation functions as a transformative catalyst for strengthening the economic, social, and institutional dimensions of rural development. The integration of digital technology, participatory governance, and collaborative economic activities has enabled Smart Village initiatives to create more inclusive and sustainable development pathways. Nevertheless, despite substantial progress in the existing literature, empirical evidence remains fragmented regarding the causal mechanisms through which digital transformation directly enhances rural economic independence, particularly within developing countries such as Indonesia, where digital infrastructure disparities, uneven technological literacy, and policy implementation challenges continue to constrain Smart Village development.

2.3 Identification of the Research Gap

Although the existing literature consistently reports the positive contribution of Smart Village initiatives to rural development, several important research gaps remain unresolved. Recent empirical evidence suggests that Smart Village implementation has successfully improved public service delivery, strengthened community capacity, enhanced digital inclusion, and expanded economic opportunities in rural areas (Y. Liu et al., 2024; Zhao & Li, 2022). Nevertheless, the current body of knowledge remains fragmented in terms of theoretical integration, research focus, and contextual application, thereby limiting a comprehensive understanding of how digital transformation contributes to sustainable rural economic independence.

First, previous studies have predominantly emphasized digital administration and public service innovation, while comparatively limited attention has been devoted to understanding how Smart Village initiatives foster community economic empowerment and long-term economic self-reliance. Existing research has primarily examined the effectiveness of digital governance systems and administrative modernization, with fewer studies investigating the mechanisms through which digital transformation generates productive economic activities and sustainable livelihoods within rural communities (Muhtar et al., 2023; Susilowati et al., 2024).

Second, many empirical investigations adopt sector-specific perspectives, examining technological innovation, governance, or economic development independently rather than integrating these dimensions into a

DOI: 10.26618

comprehensive analytical framework. Consequently, the dynamic interactions among social capacity, economic transformation, digital infrastructure, and institutional governance remain insufficiently explored (Ikram et al., 2024; Ren et al., 2024). This limitation restricts a holistic understanding of Smart Village as an integrated rural development model.

Third, within the Indonesian context, the majority of previous studies have concentrated on assessing digital readiness and infrastructure availability at the village level. While these studies provide valuable insights into technological preparedness, relatively few have evaluated whether digital transformation has generated measurable improvements in village economic independence and sustainable local development (Ramadhani & Rohmadiani, 2024). As a result, empirical evidence explaining the socioeconomic outcomes of Smart Village implementation in Indonesia remains limited.

Fourth, despite the increasing global interest in rural digital transformation, research examining the relationship between digitalization and local economic independence in developing countries remains relatively scarce (Emerllahu & Bogataj, 2024). Most international studies have been conducted in developed economies with relatively advanced technological ecosystems, making their findings difficult to generalize to developing countries characterized by unequal digital infrastructure, varying levels of digital literacy, and institutional constraints. These contextual differences highlight the need for further investigation into the applicability of Smart Village strategies within emerging economies.

To address these limitations, the present study adopts Digital Empowerment Theory as its applied theoretical perspective. This theory emphasizes that digital technology should be understood not merely as an administrative instrument but as a strategic resource for strengthening industrial development, ecological sustainability, cultural preservation, public services, and village governance (Agusta, 2023; Zhao & Li, 2022). Through this perspective, digital transformation is expected to enhance community productivity, expand market access, strengthen local entrepreneurial capacity, and improve financial independence within rural communities.

Accordingly, this study contributes to the existing literature in several respects. First, it integrates the social, economic, and governance dimensions of Smart Village into a unified analytical perspective rather than examining them separately. Second, it extends the application of Digital Empowerment Theory beyond digital governance by explaining its role in promoting sustainable rural economic independence. Third, by synthesizing recent international and Indonesian empirical evidence through a systematic literature review, this study provides a more comprehensive conceptual understanding of how Smart Village initiatives support inclusive and sustainable rural development in the digital era.

2.4 Development of the Conceptual Framework

The conceptual framework of this study is developed through the integration of Development Planning Theory, Digital Empowerment Theory, and the empirical evidence synthesized from recent Smart Village studies. Rather than examining causal relationships among measurable variables, this framework provides a conceptual explanation of how Smart Village contributes to sustainable rural economic independence through the interaction between technological innovation, community empowerment, and participatory governance.

The framework is centered on two fundamental pillars of Smart Village implementation, namely Smart Community and Smart Economy. The Smart Community dimension represents the social foundation of digital transformation by emphasizing digital literacy, community participation, collaborative capacity, and local institutional

DOI: 10.26618

strengthening. Previous studies indicate that strengthening community capabilities through digital education, village facilitators, and participatory governance enables rural communities to utilize digital technologies more effectively while fostering social innovation and collective action (Agusta, 2023; Harsanto & Wahyuningrat, 2024; Manapa Sampetoding & Er, 2024).

Complementing this social dimension, Smart Economy represents the productive utilization of digital technology to improve local economic performance. The adoption of digital platforms, e-commerce, Internet of Things (IoT), big data, and digital marketing enhances production efficiency, expands market accessibility, strengthens supply-chain integration, and increases the competitiveness of local products (Guo & Li, 2024; Lu et al., 2024; Ren et al., 2024; Tian et al., 2023; Wang et al., 2023; Annshori et al., 2024). Consequently, digital transformation enables rural communities not only to access technology but also to generate sustainable economic value through innovation and entrepreneurship.

The interaction between Smart Community and Smart Economy forms an integrated Smart Village ecosystem that supports inclusive and sustainable rural development. Within this ecosystem, community empowerment strengthens human and social capital, while digital economic transformation converts these capabilities into productive economic outcomes. This relationship reflects the practical application of Development Planning Theory, which emphasizes participatory and sustainable development planning (S. Liu et al., 2023), together with Digital Empowerment Theory, which explains how technology expands community capacity and promotes economic independence (Agusta, 2023; Zhao & Li, 2022).

Accordingly, the conceptual framework positions Smart Village as an integrated development model in which digital infrastructure, community participation, technological capability, collaborative governance, and economic innovation operate as complementary components for strengthening rural economic resilience and achieving sustainable village development.

Conceptual Framework Statement

Unlike quantitative studies that normally present a graphical research model illustrating relationships among variables, this study employs a Systematic Literature Review (SLR) approach. Therefore, no conceptual framework diagram (Fig. 1) is presented. Instead, the conceptual framework is developed narratively by synthesizing the theoretical foundations and empirical evidence concerning Smart Community, Smart Economy, Development Planning Theory, and Digital Empowerment Theory as an integrated analytical framework for understanding Smart Village development.

2.5 Hypotheses or Research Propositions

This study does not formulate research hypotheses or research propositions because it adopts a Systematic Literature Review (SLR) methodology rather than a quantitative or qualitative empirical research design. The primary objective of this study is to synthesize existing theoretical perspectives and empirical evidence to develop a comprehensive conceptual understanding of Smart Village implementation and its contribution to rural economic independence.

Instead of statistically testing causal relationships among variables, this study critically examines recent scholarly literature to identify dominant research themes, theoretical developments, empirical findings, and existing knowledge gaps. The synthesis integrates Development Planning Theory and Digital Empowerment Theory with recent empirical evidence to explain how digital transformation, community empowerment, and collaborative governance collectively contribute to sustainable rural development.

Consequently, the contribution of this research lies in the development of an integrated conceptual perspective that explains Smart Village as a multidimensional rural development strategy. This perspective

DOI: 10.26618

provides a theoretical foundation for future empirical studies that may quantitatively examine the relationships among Smart Community, Smart Economy, digital governance, and rural economic independence across different geographical and institutional contexts.

3. Research Methods

3.1 Research Design

This study adopts a Systematic Literature Review (SLR) as its primary research design. The SLR approach was selected because it enables researchers to systematically identify, evaluate, and synthesize previous scientific evidence related to Smart Village implementation and rural economic independence in the digital era. Furthermore, this approach provides a transparent and replicable framework for identifying research trends, synthesizing empirical evidence, and revealing research gaps.

The review addresses two primary research questions: (1) how Smart Village has been implemented in Indonesia and which factors influence its success, and (2) what Smart Village strategy is most appropriate for enhancing rural economic independence in Indonesia. The review process follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines together with the systematic review methodology developed by Kitchenham (2007). These methodological frameworks ensure transparency in article selection, systematic synthesis of research findings, and the identification of research gaps that serve as the foundation for developing an integrated conceptual Smart Village model relevant to contemporary rural development.

3.2 Research Context and Setting

The research focuses on the implementation of Smart Village and rural economic empowerment within the context of Indonesia's digital transformation. The review encompasses empirical studies discussing Smart Village, Digital Village, digital empowerment, rural economic development, and Penta-Helix collaboration published between 2016 and 2025.

To ensure comprehensive literature coverage, publications were retrieved from Scopus, ScienceDirect, and Google Scholar, representing internationally recognized academic databases containing high-quality peer-reviewed studies relevant to Smart Village implementation and digital rural development.

3.3 Population and Sample / Research Participants

Since this study employs a Systematic Literature Review, the unit of analysis is not individual respondents but published scientific articles.

The literature selection followed predefined inclusion and exclusion criteria.

The inclusion criteria consisted of:

a. peer-reviewed national and international journal articles published between 2016 and 2025;
b. articles written in English or Indonesian;
c. studies discussing Smart Village, Digital Village, digital empowerment, and rural economic development.

The exclusion criteria included:

a. duplicate publications;
b. conference proceedings without peer-review;
c. publications focusing exclusively on physical infrastructure without addressing rural economic empowerment.

The systematic search initially identified 883 publications from the selected databases. After duplicate removal and preliminary screening using Mendeley, 195 articles remained for title and abstract screening. Subsequently, 174 articles were excluded due to irrelevance to the research objectives. Finally, 21 articles satisfied all eligibility criteria and were included in the qualitative synthesis.

DOI: 10.26618

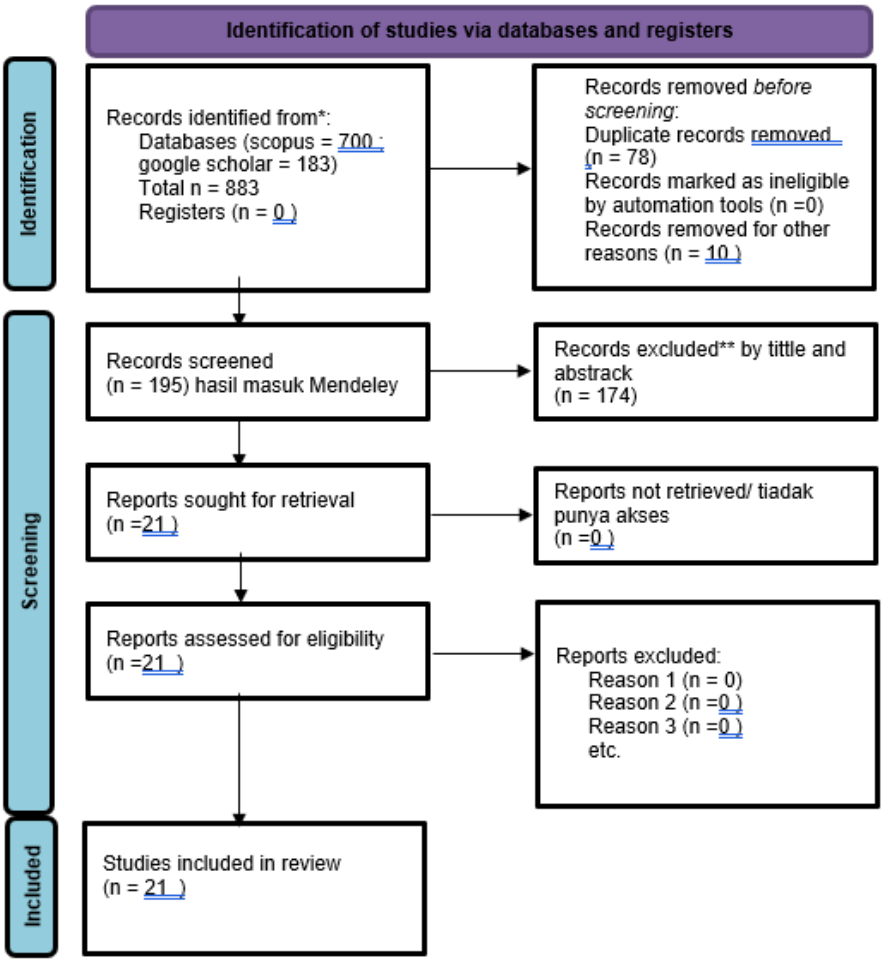

Fig. 1. PRISMA

3.4 Data Sources and Data Collection

This study exclusively utilizes secondary data obtained from published scientific literature. The literature search was conducted using the following search string:
("Smart Village" OR "Digital Village") AND ("Economic Empowerment" OR "Digital Economy")

The data collection process consisted of several sequential stages. First, relevant literature was retrieved from Scopus, ScienceDirect, and Google Scholar. Second, title and abstract screening was conducted to determine the relevance of each publication to Smart Village implementation and rural economic independence. Third, article quality was assessed using the PRISMA checklist to ensure consistency between research objectives, methodology, investigated variables, and research context. Finally, systematic data extraction was performed to record:

a. article identity (authors, publication year, journal, and country);
b. research objectives and research questions;
c. research design and methodology;
d. principal findings; and
e. research limitations identified by the original authors.

This systematic procedure ensured that every selected article met the required quality and relevance standards before inclusion in the synthesis.

3.5 Measurement of Variables and Research Instruments

As this study is based on a Systematic Literature Review, no quantitative variables were directly measured. Instead, the primary research instrument was a systematic data extraction form developed based on the framework proposed by Kitchenham (2007)

DOI: 10.26618

and the PRISMA 2020 guidelines.

The extraction form systematically documented:

a. bibliographic information;
b. research objectives;
c. research methods;
d. theoretical frameworks;
e. key variables or concepts;
f. principal findings;
g. identified research gaps; and
h. research limitations.

The extracted information subsequently served as the basis for thematic synthesis and conceptual model development.

3.6 Data Analysis Techniques

The collected literature was analyzed using descriptive thematic analysis. The analytical procedures consisted of four stages. First, the findings of each selected article were classified according to the major research themes represented by:
("Smart Village" OR "Digital Village") AND ("Economic Empowerment" OR "Digital Economy")

Second, the existing literature was synthesized to identify research gaps that remain insufficiently explored. Third, an integrated conceptual framework of Smart Village implementation was developed based on the thematic synthesis. Finally, the literature selection process was visualized through the PRISMA flow diagram, while the synthesized findings were summarized in a literature matrix containing theoretical foundations, research methods, and major findings from each reviewed study.

3.7 Validity, Reliability, and Trustworthiness

The trustworthiness of this review was ensured through several methodological procedures. First, the review followed the internationally recognized PRISMA 2020 reporting standards. Second, article selection was conducted using explicit inclusion and exclusion criteria to minimize selection bias. Third, systematic data extraction based on Kitchenham (2007) ensured consistency during literature analysis. Finally, thematic synthesis was performed across multiple empirical studies to improve analytical robustness and reduce subjective interpretation.

3.8 Ethical Considerations

This research did not involve human participants, personal data collection, or experimental interventions. All analyzed materials were obtained from publicly accessible scientific publications. Proper academic integrity was maintained by accurately citing all original sources and ensuring that every analyzed article received appropriate acknowledgment throughout the review process.

3.9 Research Procedure

The research procedure followed the standard stages of a Systematic Literature Review.

3.9.1 Planning Phase

The review began with formulating research questions based on Smart Village implementation, digital empowerment, Penta-Helix collaboration, and rural economic independence. Subsequently, the databases (Scopus, ScienceDirect, and Google Scholar), search keywords, and eligibility criteria were established.

3.9.2 Implementation Phase

Literature was systematically searched using predefined keywords. Retrieved articles underwent title and abstract screening, followed by quality assessment using the PRISMA checklist. Eligible studies were then subjected to systematic data extraction covering bibliographic information, research objectives, methodologies, major findings, and research limitations.

3.9.3 Reporting Phase

The selected studies were synthesized through descriptive thematic analysis. A

DOI: 10.26618

literature matrix summarizing theories, methodologies, determinants of Smart Village success, and research gaps was developed. Narrative synthesis was conducted to identify global Smart Village development trends and their relevance to Indonesia. The article selection process was documented using the PRISMA flow diagram.

Based on the systematic search, 883 records were initially identified from Scopus and Google Scholar. Following duplicate removal and screening through Mendeley, 195 articles remained for eligibility assessment. After excluding 174 irrelevant articles, 21 studies satisfied all eligibility criteria and were included in the final synthesis.

3.10 Methodological Limitations

Several methodological limitations should be acknowledged. First, this review relied exclusively on published literature indexed in Scopus, ScienceDirect, and Google Scholar, which may have excluded relevant studies available in other databases or unpublished sources. Second, the review only included publications published between 2016 and 2025, potentially omitting earlier foundational studies. Third, despite following PRISMA 2020 and Kitchenham (2007), thematic synthesis inevitably involves a degree of researcher interpretation.

Nevertheless, the systematic search strategy, transparent selection process, predefined eligibility criteria, and structured synthesis procedures enhance the methodological rigor, transparency, and replicability of the study.

4. Results and Discussion

4.1 Research Results

4.1.1 Sample Description and Descriptive Statistics

This study employed a Systematic Literature Review (SLR) to synthesize empirical evidence regarding the implementation of Smart Village as a rural development strategy in the digital era. The units of analysis consisted of 21 national and international peer-reviewed journal articles that substantively discuss Smart Village implementation, digital transformation, rural economic development, and digital empowerment.

The literature selection and synthesis process focused on identifying patterns, similarities, and differences across previous studies. To facilitate systematic analysis, the reviewed studies were classified into two primary research categories: Smart Village Implementation and Economic Independence (Digital Economy). Furthermore, each article was analyzed using two conceptual units of analysis, namely Digital Empowerment and Digital Economy, enabling a comprehensive understanding of the contribution of digital technologies to rural transformation.

The descriptive synthesis indicates that most studies emphasize Digital Empowerment as the dominant analytical perspective, highlighting the importance of digital literacy, community capacity building, digital governance, and information and communication technology (ICT) adoption in supporting sustainable rural development. Meanwhile, several studies focus specifically on the role of the Digital Economy in accelerating rural industrial transformation, agricultural productivity, and local economic revitalization.

The reviewed literature consistently demonstrates that Smart Village implementation extends beyond technological adoption, encompassing institutional strengthening, community participation, collaborative governance, and digital innovation to achieve inclusive and sustainable rural development.

4.1.2 Data Quality and Preliminary Analysis

Because this study adopts a Systematic Literature Review (SLR) approach, conventional statistical data quality assessments such as normality tests, reliability analysis, multicollinearity diagnostics, or model fit evaluation were not applicable. Instead, data quality was ensured through a systematic literature selection and screening

DOI: 10.26618

process that identified peer-reviewed journal articles directly relevant to the research objectives.

The selected studies were evaluated based on their substantive relevance to Smart Village implementation, digital empowerment, and digital economy development. The classification of articles into predefined analytical categories and conceptual units ensured consistency throughout the synthesis process and enhanced the credibility of the resulting evidence.

4.1.3 Main Analytical Results

The synthesis of the 21 selected studies demonstrates a strong relationship between Smart Village implementation, digital empowerment, and rural economic transformation. Across the reviewed literature, Smart Village initiatives consistently contribute to improving rural governance, strengthening community digital competencies, expanding access to information and communication technologies (ICT), and promoting sustainable local economic development.

The literature review further indicates that digital technologies serve not only as instruments for improving administrative efficiency but also as strategic enablers of rural economic growth. Digital transformation enhances entrepreneurial opportunities, supports Village-Owned Enterprises (BUMDes), encourages collaborative governance, facilitates digital public services, and improves agricultural and industrial productivity.

Overall, the findings reveal that successful Smart Village implementation depends on three interconnected dimensions:

a. Digital empowerment, including digital literacy, technological capability, and community participation.
b. Adequate digital infrastructure, enabling effective access to ICT and digital services.
c. Multi-stakeholder collaboration, involving government institutions, local communities, academic institutions, and private-sector actors in rural digital transformation.

These dimensions collectively accelerate digital economy adoption while fostering inclusive, resilient, and sustainable village development.

Table 1. Results of the Systematic Literature Review (SLR)

No.	Authors	Journal Title	Category	Unit of Analysis	Main Focus
1	Apri Junaidi, Mohd Shahizan Bin Othman, Siti Zaiton Mohd Hashim, Mohd Murtadha Mohamad, Deni Danial Kesa, and Ari Nurfikri	Smart Villages: A Systematic Review of Trends, Models, and Metrics	Smart Village Implementation	Digital Empowerment	Digital empowerment of rural communities
2	Anindya Puteri Eka Susilowati, Rini Rachmawati, and R. Rijanta	Smart Village Concept in Indonesia: ICT as Determining Factor	Smart Village Implementation	Digital Empowerment	ICT as a key success factor
3	Entang Adhy Muhtar, Abdillah Abdillah, Ida Widianingsih, and Qinthara Mubarak	Smart Villages, Rural Development and Community Vulnerability in Indonesia	Smart Village Implementation	Digital Empowerment	Digital empowerment and public participation

DOI: 10.26618

	Adikancana				
4	Visar Emerllahu and David Bogataj	Smart Villages as Infrastructure of Rural Areas	Smart Village Implementation	Digital Empowerment	Cross-sector collaboration for Smart Villages
5	Pekka Leviakangas, Signe Sønvisen, Diego Casado-Mansilla, Marius Mikalsen, Andrea Cimmino, Anastassios Drosou, and Shahid Hussain	Towards Smart, Digitalised Rural Regions and Communities	Smart Village Implementation	Digital Empowerment	Strengthening digital skills
6	Eliyah Acantha Manapa Sampetoding and Mahendrawathi ER	Digital Transformation of Smart Village	Smart Village Implementation	Digital Empowerment	Digital literacy and village technological capacity
7	Pingping Wang, Chaozhu Li, and Chenghao Huang	The Impact of Digital Village Construction on County-Level Economic Growth	Smart Village Implementation	Digital Empowerment	Impact of digital empowerment on economic growth
8	Guo, T., and Li, Z. (2024)	Leveraging the Digital Economy to Drive Rural Industrial Transformation: A Case Study of County-Level Economies in Southern Shaanxi	Economic Independence	Digital Empowerment	The role of the digital economy in promoting rural industrial transformation
9	Nugroho, C., Wulandari, A., Yusanto, F., Lestari, M. T., Kalaloi, A. F., and Rudi Zulfikar; Helmi Yazid	Exploring Digital Village Development for Circular Economy: A Case Study of Padaringan Village-Owned Enterprise, Langonsari, Bandung Regency, Indonesia	Smart Village Implementation	Digital Empowerment	Village-Owned Enterprise (BUMDes) Padaringan, Bandung Regency
10	S. Stojanova, P. Niederer, G. Lentini, N. Čvar, A. Kos, T. Egger, and E. Stojmenova Duh	Smart Villages Policies: Past, Present and Future	Smart Village Implementation	Digital Empowerment	Cross-country rural development in the Alpine region
11	Ririn Yulianti, Mira Andriani, and	Model Pengembangan	Smart Village Implementation	Digital Empowerment	Village self-reliance through

DOI: 10.26618

	Widya Yeshiana	Desa Cerdas dengan Pendekatan Penta-Helix			multi-stakeholder collaboration
12	Muhaidir Ikram M, Muh Rizal B, Muh. Alhifka Syahrir D, Dini Fauziyah Utomo, Marini Ummul Khasanat, Dilla Apriliana Mahrun, Marina Ummul Khairat, and Alvina Asyafa	Pengembangan Konsep Desa Digital atau Smart Village Nusantara	Smart Village Implementation	Digital Empowerment	Integration of Smart Village and Smart City concepts
13	Pingping Wang, Chaozhu Li, and Chenghao Huang	Digital Village Index (DVI) for Indonesia Case Study	Smart Village Implementation	Digital Empowerment	Evaluation of village digitalization in Indonesia
14	Yudi Agusta	A Co-Production Model of Digital Village Transformation in Indonesia	Smart Village Implementation	Digital Empowerment	Village transformation through a co-production model
15	Ahmad Geohansa, Eeng Sumarna, and Ikeu Kania	Digitization of Village Government as a Sustainable Development Strategy	Smart Village Implementation	Digital Empowerment	Digitalization of village governance
16	Wu Zhao, Zhiye Liang, and Binrong Li	Realizing a Rural Sustainable Development through a Digital Village Construction	Smart Village Implementation	Digital Empowerment	Strengthening governance and public services
17	Muhammad Faqih Annshori, Hafizoh Yuelsa Bela, and Mikyal Marshalita	Insight Industry 4.0: An Answer to Smart Village Policy Transformation in Indonesia	Smart Village Implementation	Digital Empowerment	IoT implementation in Smart Village policies
18	Ye Tian, Qin Liu, Yiting Ye, Zhaofang Zhang, and Ribesh Khanal	How the Rural Digital Economy Drives Rural Industrial Revitalization	Smart Village Implementation	Digital Economy	Rural industrial revitalization through the digital economy
19	Yuanquan Lu, Yuan Meng, Li Chen, and	Can the Digital Economy	Smart Village Implementation	Digital Economy	Impact of the digital economy

DOI: 10.26618

	Yuan Zhang	Contribute to Rural Revitalization?			on rural development
20	Xiaoling Zhang, Wenjing Wang, and Jie Zhang	Does the Digital Economy Exhibit Multiplier Effects?	Smart Village Implementation	Digital Economy	Effects of the digital economy on agricultural production
21	Hemanta Kumar Doloi	Digital Inclusion for Rural Growth: Internet Usage and Smart Villages Development	Smart Village Implementation	Digital Empowerment	Digital inclusion for rural growth

Source: Processed by authors, 2026

4.1.4 Key Findings

The synthesis of the selected literature addresses the primary research objective by identifying the key determinants of successful Smart Village implementation in promoting rural digital transformation and economic development.

The principal findings can be summarized as follows:

a. The majority of reviewed studies identify digital empowerment as the principal mechanism through which Smart Village initiatives improve rural development outcomes.
b. Information and Communication Technology (ICT) infrastructure and digital literacy consistently emerge as critical prerequisites for successful Smart Village implementation.
c. Smart Village programs contribute significantly to strengthening rural governance, improving public service delivery, increasing community participation, and enhancing institutional capacity.
d. The digital economy promotes rural industrial transformation, agricultural modernization, entrepreneurial development, and Village-Owned Enterprise (BUMDes) innovation.
e. Sustainable Smart Village development requires effective collaboration among governments, local communities, academic institutions, and private-sector stakeholders.

4.1.5 Visual Presentation of Results

Table 1 summarizes the complete findings of the Systematic Literature Review by presenting the characteristics of all 21 selected studies, including the authors, journal titles, research categories, analytical units, and principal research focus.

The visual synthesis demonstrates that Digital Empowerment constitutes the dominant analytical framework across the reviewed literature, whereas Digital Economy serves as a complementary perspective emphasizing rural economic revitalization through digital transformation. Collectively, these findings illustrate that Smart Village implementation integrates technological innovation, community empowerment, institutional strengthening, and digital economic development to support inclusive, resilient, and sustainable rural development.

4.2 Research Discussion

4.2.1 Interpretation of Key Findings

The findings of this Systematic Literature Review (SLR), which synthesized evidence from 21 empirical studies, demonstrate that Smart Village development plays a fundamental role in promoting the economic and social self-reliance of rural communities through a structured and sustainable digital transformation process. Across various national contexts, including Indonesia, the reviewed studies consistently indicate that the implementation of digital technologies in rural areas not only improves economic efficiency

DOI: 10.26618

but also expands community access to productive resources, information, public services, and new business opportunities. Through digital transformation, rural communities are able to strengthen local economic structures based on Micro, Small, and Medium Enterprises (MSMEs), broaden market access through e-commerce platforms, and improve the quality of public services through transparent and participatory digital governance systems. These findings confirm that Smart Village should not be understood merely as a technological innovation initiative but rather as an inclusive rural development strategy that emphasizes human empowerment, digital capacity building, and cross-sector collaboration to achieve equitable and sustainable rural welfare.

The results directly address the primary objective of this study by demonstrating that the effectiveness of Smart Village implementation is determined by the integration of multiple dimensions of digital empowerment rather than by technological infrastructure alone. The synthesis reveals that successful Smart Village initiatives simultaneously strengthen economic productivity, environmental sustainability, cultural resilience, public service delivery, and participatory governance. Consequently, digital transformation functions as a multidimensional development mechanism capable of enhancing both community resilience and village competitiveness within the digital economy.

These findings are consistent with the perspective of Digital Empowerment Theory (Agusta, 2023; Zhao & Li, 2022), which conceptualizes digitalization as a strategic instrument for strengthening rural competitiveness and community self-reliance through five interrelated dimensions: industry, ecology, culture, services, and governance. According to this theoretical perspective, digital empowerment extends beyond providing access to digital technologies by enabling communities to effectively utilize, manage, innovate, and exercise control over technological resources for sustainable development. The integration of these five dimensions establishes a comprehensive digital ecosystem that balances economic growth, environmental conservation, cultural preservation, improved public service quality, and participatory governance. Consequently, villages evolve from passive recipients of technological innovation into active development actors possessing stronger adaptive capacity, innovation capability, and resilience in responding to the challenges of global digital transformation.

From a theoretical perspective, these findings reinforce Digital Empowerment Theory by providing systematic empirical evidence that the five dimensions of digital empowerment operate as mutually reinforcing components rather than isolated development domains. The review demonstrates that sustainable rural transformation emerges from the interaction between technological innovation, institutional capacity, human capital development, and community participation. Therefore, the findings extend the theoretical understanding of digital empowerment by emphasizing that Smart Village development should be interpreted as an integrated socio-technical ecosystem capable of simultaneously generating economic, social, environmental, cultural, and governance benefits.

Furthermore, the synthesis addresses the research gap identified in the literature review. Previous studies have generally examined individual dimensions of Smart Village implementation—such as digital economy, public services, environmental management, or governance—without providing a comprehensive synthesis of how these dimensions collectively contribute to rural economic independence. By integrating empirical evidence from 21 studies conducted across different geographical contexts, this review provides a holistic conceptual understanding of Smart Village as a multidimensional digital empowerment framework that supports sustainable rural

DOI: 10.26618

development. This integrative perspective constitutes the primary academic contribution of the present study by consolidating fragmented evidence into a coherent theoretical explanation of the mechanisms through which Smart Village promotes rural economic and social resilience.

a. Industry (Smart Economy)

The industry (Smart Economy) dimension emerged as the most dominant component in evaluating the effectiveness of Smart Village implementation in strengthening rural economic self-reliance. The findings of this Systematic Literature Review indicate that digital empowerment constitutes the primary foundation for transforming traditional rural economic structures into innovation-driven, technology-oriented, and knowledge-based economies. Rural digitalization expands community participation in productive economic activities through the development of digital Micro, Small, and Medium Enterprises (MSMEs), the adoption of e-commerce, the utilization of Internet of Things (IoT) technologies, and the integration of digital data and connectivity that collectively enhance production capacity, market competitiveness, and local economic resilience (Annshori et al., 2024; Junaidi et al., 2025). These findings suggest that Smart Village functions as a strategic instrument for accelerating rural economic transformation from conventional agrarian systems toward digitally enabled economic ecosystems capable of generating sustainable value creation.

The reviewed studies consistently demonstrate that digital transformation contributes positively to rural economic growth across diverse geographical contexts. In China, Wang et al. (2023) reported that Digital Village development significantly enhanced county-level economic performance by improving resource allocation efficiency and strengthening local innovation capacity. Their analysis of 622 counties during the 2018–2021 period showed that rural digitalization reduced the income gap between urban and rural communities while simultaneously stimulating the growth of local creative industries. Similar findings were reported by Y. Liu et al. (2024) and Tian et al. (2023), who found that a one-percent increase in the digital economy index contributed to approximately a 0.066 percent increase in rural industrial revitalization, indicating a direct relationship between digital empowerment and rural economic resilience. Furthermore, Stojanova et al. (2021) demonstrated that rural digitalization in Central Europe enhanced regional connectivity, accelerated the circulation of goods, services, and knowledge, and strengthened the competitiveness of local economies. Collectively, these studies confirm that digital transformation serves not only as a technological innovation but also as a catalyst for sustainable rural economic development.

The Indonesian evidence supports these international findings while highlighting the importance of collaborative governance in promoting rural digital economies. Ririn Yulianti et al. (2025) emphasized that the Penta-Helix collaboration model involving government, academia, businesses, communities, and media facilitates knowledge exchange, resource integration, and digital innovation that strengthens village economic foundations. Similarly, Agusta (2023) demonstrated that the application of the co-production model enables communities to participate actively in managing village resources through transparent and collaborative digital mechanisms, thereby improving local economic capacity and self-reliance. Complementing these findings, Annshori et al. (2024) argued that the adoption of Industry 4.0 technologies, including IoT and big data analytics, accelerates production processes, improves information flows, and promotes data-driven innovation capable of strengthening local economic resilience.

Additional empirical evidence is provided by Ardhian Nugroho and Galan Prakoso (2025) through their study *Exploring Digital Village Development for Circular Economy*, which demonstrated that the

DOI: 10.26618

implementation of circular economy principles in BUMDes Padaringan, Bandung Regency, strengthened local value chains and optimized digital-based waste management. Their findings illustrate that digital empowerment extends beyond improving economic efficiency by simultaneously supporting environmental sustainability and social welfare within rural industrial systems. This evidence reinforces the argument that Smart Village contributes to sustainable rural development by integrating economic productivity with ecological responsibility.

Compared with previous empirical studies, the findings of this review consistently support the growing body of literature emphasizing the positive relationship between rural digitalization and economic transformation. However, while many previous studies have examined individual aspects of digital economy—such as e-commerce adoption, digital entrepreneurship, or technological innovation—this review demonstrates that sustainable rural economic independence is achieved through the integration of multiple digital empowerment mechanisms rather than isolated technological interventions. By synthesizing evidence from various national contexts, this study extends previous research by presenting Smart Economy as a multidimensional ecosystem in which technological infrastructure, institutional collaboration, community participation, and digital capability collectively determine rural economic performance.

From a theoretical perspective, these findings strongly reinforce the propositions of Digital Empowerment Theory (Agusta, 2023; Zhao & Li, 2022), which argues that successful digital transformation depends on the ability of communities not merely to access technology but also to understand, utilize, manage, and innovate through digital resources. The reviewed studies provide systematic empirical evidence that digital empowerment facilitates structural transformation from traditional production systems toward knowledge-based and innovation-oriented rural economies. When rural communities receive adequate access to digital infrastructure, technological training, and institutional support, they become capable of maximizing local resources, generating higher economic value, increasing productivity, and strengthening long-term economic resilience. Consequently, this review extends the theoretical application of Digital Empowerment Theory by demonstrating that digital empowerment functions as a strategic mechanism for promoting inclusive and sustainable rural economic development.

The findings also generate important practical and policy implications. Governments should prioritize policies that strengthen digital entrepreneurship, expand digital infrastructure, improve internet accessibility, and enhance the technological capabilities of rural MSMEs. Investments should not be limited to physical infrastructure but should also include digital literacy programs, entrepreneurial training, innovation incubation, and collaborative partnerships among government institutions, universities, private sectors, and local communities. The successful implementation of collaborative models such as Penta-Helix and co-production demonstrates that cross-sector partnerships are essential for maximizing the economic benefits of Smart Village initiatives and ensuring that digital transformation contributes to inclusive and sustainable rural development.

Finally, these findings contribute directly to addressing the research gap identified in the literature. Previous Smart Village studies have predominantly focused on technological implementation or rural digital infrastructure without comprehensively explaining how digital empowerment transforms rural economic structures into self-reliant and sustainable systems. By integrating empirical findings from multiple countries, this review demonstrates that Smart Economy should be understood as the core pillar of Smart Village development, where digital technologies, institutional collaboration, community empowerment, and innovation capacity

DOI: 10.26618

interact synergistically to create resilient, competitive, and sustainable rural economies. This integrative perspective represents an important contribution to the Smart Village literature by providing a more comprehensive explanation of the mechanisms through which digital transformation promotes long-term rural economic independence.

b. Ecology (Smart Environment)

The ecology (Smart Environment) dimension represents a fundamental component of Smart Village implementation by positioning environmental sustainability as the foundation of rural digital transformation. The findings of this Systematic Literature Review indicate that the integration of digital technologies into natural resource management establishes adaptive systems capable of improving energy efficiency, mitigating climate change, and supporting environmental conservation. Within the perspective of Digital Empowerment Theory (Agusta, 2023; Zhao & Li, 2022), environmental digitalization should not be viewed merely as a technological intervention but rather as a process of ecological empowerment that strengthens rural communities' capacity to understand, monitor, and manage their ecosystems through participatory and data-driven approaches. Consequently, Smart Environment reflects the balance between technological innovation and ecological responsibility, thereby reinforcing the long-term sustainability of rural development.

The empirical evidence synthesized in this review consistently demonstrates that digital transformation contributes positively to environmental sustainability. Studies conducted in China by Tian et al. (2023) and Z. Liu et al. (2024) revealed that the development of the digital economy is positively associated with rural revitalization and improvements in environmental quality. Complementing these findings, Xie et al. (2025) reported that every one-percent increase in the digital economy index was associated with approximately a 0.066 percent increase in rural industrial revitalization, accompanied by improvements in clean energy efficiency and more effective production waste management. Similarly, Lu et al. (2024) confirmed that environmentally friendly technologies—including green logistics systems, renewable energy, and precision agriculture—create synergies between economic productivity and ecological sustainability. Zhang and Zhang (2020) further demonstrated that integrating weather information, soil condition monitoring, and digital supply chains through the Internet of Things (IoT) significantly reduces ecosystem degradation while simultaneously increasing agricultural productivity. Supporting evidence from Stojanova et al. (2021) showed that digital sensor systems implemented in the European Alpine region successfully maintained ecological balance while supporting the development of environmentally sustainable digital tourism. Collectively, these studies confirm that digital technologies enhance environmental management while simultaneously supporting rural economic development.

The Indonesian literature presents findings that are generally consistent with international evidence while emphasizing the importance of contextual adaptation. Ikram et al. (2024), through their study of Smart Village Nusantara, highlighted the importance of integrating digital information systems into natural resource management and environmental monitoring at the village level. Ririn Yulianti et al. (2025) further demonstrated that the Penta-Helix collaboration model involving government, academia, private sectors, communities, and media serves as a catalyst for creating collaborative digital ecosystems that support environmental conservation. Likewise, Geohansa et al. (2025) found that the application of Geographic Information Systems (GIS) significantly improves spatial planning accuracy and enhances the efficiency of natural resource monitoring. Annshori et al. (2024) emphasized the strategic role of IoT technologies in monitoring air quality, water

DOI: 10.26618

resources, and energy consumption within rural digitalization initiatives, while Wang et al. (2023) highlighted the contribution of digital technologies to energy data management and precision agriculture in rural China. These findings collectively demonstrate that digital technologies function not only as management tools but also as participatory mechanisms that enable communities to actively preserve environmental quality.

When compared with previous empirical studies, the findings reveal substantial consistency regarding the positive relationship between digitalization and environmental sustainability. Nevertheless, most previous studies have tended to investigate individual technological applications, such as IoT-based agriculture, GIS implementation, renewable energy, or environmental monitoring systems, as separate research topics. In contrast, this review synthesizes these fragmented findings into a broader conceptual framework, demonstrating that environmental sustainability within Smart Village is achieved through the integration of digital technologies, institutional governance, community participation, and environmental awareness. Consequently, Smart Environment should be understood not simply as the adoption of green technologies but as an integrated ecological transformation supported by digital empowerment.

From a theoretical perspective, these findings extend Digital Empowerment Theory by demonstrating that digital empowerment encompasses ecological capacity in addition to economic and institutional dimensions. The reviewed evidence indicates that providing communities with access to digital technologies, environmental information, and technical knowledge enhances their ability to make informed decisions regarding natural resource management. As communities become digitally empowered, they increasingly adopt environmentally responsible practices, strengthen local environmental governance, and develop innovative green solutions that support sustainable rural development. Therefore, ecological sustainability emerges not only as an outcome of technological advancement but also as a consequence of strengthened community empowerment and collective environmental responsibility. This finding expands the theoretical application of Digital Empowerment Theory by highlighting its relevance in promoting environmentally sustainable rural transformation.

The findings also provide significant practical and policy implications. Policymakers should prioritize the integration of digital environmental management into Smart Village development strategies by promoting investments in renewable energy systems, IoT-based environmental monitoring, GIS-supported spatial planning, precision agriculture, and digital climate adaptation programs. Moreover, environmental digitalization policies should be accompanied by continuous environmental education and digital literacy initiatives to strengthen communities' capacity to manage natural resources effectively. Collaborative governance involving local governments, universities, private sectors, and village communities is equally important to ensure that technological innovations remain environmentally sustainable and responsive to local ecological conditions.

These findings also contribute to addressing the research gap identified in the literature review. Previous Smart Village studies have predominantly emphasized the economic and governance dimensions of rural digitalization, while comparatively limited attention has been devoted to understanding how environmental sustainability interacts with digital empowerment in supporting long-term rural resilience. By integrating evidence from diverse geographical contexts, this review demonstrates that Smart Environment constitutes a critical pillar of Smart Village development, where digital technologies strengthen environmental governance, promote sustainable resource management, and foster ecological resilience alongside economic growth. This comprehensive

DOI: 10.26618

synthesis enriches the Smart Village literature by positioning ecological sustainability as an integral component of digital empowerment rather than as a secondary outcome of technological development.

Overall, the Smart Environment dimension illustrates that the success of Smart Village development depends on achieving a balanced relationship between technological innovation and environmental sustainability. Rural communities equipped with adequate digital literacy, environmental awareness, and resource management capabilities are better positioned to become active stewards of ecological conservation while simultaneously supporting green economic development. Consequently, environmental digitalization represents not only a technological strategy but also a comprehensive empowerment process that strengthens the resilience, sustainability, and adaptive capacity of rural communities in the digital era.

c. Culture (Cultural Empowerment)

The culture (Cultural Empowerment) dimension constitutes a fundamental pillar of Smart Village implementation by ensuring that digital transformation is grounded in local identity, social values, and community traditions. The findings of this Systematic Literature Review indicate that culture functions as the social foundation through which digital technologies interact with local knowledge, creating opportunities for social innovation, creative economic development, and sustainable community empowerment. Within the framework of Digital Empowerment Theory (Agusta, 2023; Zhao & Li, 2022), cultural empowerment extends beyond preserving traditional values; it strengthens collective awareness, social cohesion, and local identity through participatory digital spaces. Consequently, cultural digitalization represents a form of social transformation that enables rural communities to preserve their cultural heritage while simultaneously adapting to the opportunities and challenges of the digital era.

The reviewed empirical studies consistently demonstrate that digital technologies play a pivotal role in preserving, promoting, and revitalizing local cultural assets. Stojanova et al. (2021), in their study of rural communities in the European Alpine region, found that rural digitalization contributed significantly to cultural preservation through digital archives, online promotion of cultural heritage, and the strengthening of local creative industries. Digital technologies enabled communities to document traditional knowledge, disseminate cultural products to wider markets, and encourage intergenerational knowledge transfer. These findings illustrate that Smart Village serves as a bridge between cultural preservation and innovation by safeguarding local identities while simultaneously creating new economic opportunities based on cultural resources (Stojanova et al., 2021).

Similar findings were reported by Zhao and Li (2022), who demonstrated that the integration of digital technologies into rural life in China expanded cultural awareness and created hybrid spaces where tradition and modernity coexist. Digital platforms enabled rural communities to manage cultural information, distribute creative products, and reinforce their collective identity within rapidly changing socio-economic environments. Comparable evidence was presented by Doloi (2025) in India, where improved digital literacy strengthened social solidarity and facilitated the preservation of local cultural traditions. Through the utilization of social media and digital communication platforms, rural communities successfully negotiated traditional values within global digital networks without losing their unique cultural characteristics. These findings collectively suggest that digital transformation creates inclusive and adaptive cultural spaces that support both heritage preservation and social innovation.

Evidence from Indonesia further supports these international findings while emphasizing the importance of local wisdom and community participation in Smart Village

DOI: 10.26618

development. Muhtar et al. (2023) demonstrated that Smart Village implementation reinforces traditional values of gotong royong (mutual cooperation) and strengthens community participation through digital platforms. Digital transformation enables collective values such as cooperation and social solidarity to be expressed in new forms, including digital cultural tourism promotion, the digitization of village historical archives, and the development of creative industries rooted in local traditions. Furthermore, Ririn Yulianti et al. (2025) argued that the successful integration of cultural values into Smart Village initiatives depends largely on the effectiveness of the Penta-Helix collaboration model involving government institutions, academic organizations, private sectors, communities, and media. Such collaboration ensures that technological innovation remains embedded within local cultural values, allowing modernization to reinforce rather than erode rural identities.

Compared with previous empirical studies, the findings reveal broad agreement regarding the importance of culture as a supporting element of rural digital transformation. However, earlier studies have generally examined cultural preservation, digital tourism, creative industries, or community participation independently without comprehensively explaining their interconnected role within the broader Smart Village ecosystem. This review contributes by integrating these diverse perspectives into a unified conceptual framework, demonstrating that cultural empowerment is not merely a complementary aspect of Smart Village development but rather an essential mechanism through which digital transformation achieves long-term social sustainability. The synthesis therefore broadens existing understanding by highlighting the reciprocal relationship between cultural preservation and digital innovation.

From a theoretical perspective, the findings reinforce and extend Digital Empowerment Theory (Agusta, 2023; Zhao & Li, 2022). The reviewed evidence demonstrates that digital empowerment strengthens communities not only through economic and technological capacity but also by enhancing their ability to reinterpret, preserve, and utilize cultural values as strategic social and economic resources. When communities gain equitable access to digital technologies and develop adequate digital literacy, they become capable of transforming local cultural assets into sources of innovation, entrepreneurship, tourism development, and community resilience. Consequently, culture functions as both a social asset and a catalyst for sustainable digital transformation, extending the explanatory power of Digital Empowerment Theory beyond technological adoption toward broader socio-cultural empowerment.

The findings also generate important practical and policy implications. Policymakers should ensure that Smart Village initiatives integrate cultural preservation into digital development strategies by supporting digital archives, virtual cultural exhibitions, digital storytelling platforms, creative economy ecosystems, and community-based digital tourism. Governments should also facilitate collaborations among cultural institutions, educational organizations, technology providers, local communities, and creative industries to preserve local heritage while promoting innovation. Investments in digital literacy programs should incorporate cultural content so that technological advancement remains aligned with local values and strengthens rather than diminishes community identity.

Furthermore, these findings directly address the research gap identified in the literature review. Previous Smart Village studies have predominantly emphasized economic growth, technological infrastructure, and governance, while comparatively limited attention has been devoted to examining culture as a strategic dimension of digital

DOI: 10.26618

empowerment. By synthesizing evidence across multiple countries, this review demonstrates that Cultural Empowerment serves as a critical mechanism through which digital transformation reinforces social cohesion, preserves cultural identity, stimulates creative economic activities, and enhances community resilience. This integrative perspective enriches the Smart Village literature by positioning culture as a central component of sustainable rural digital transformation rather than merely a supporting social factor.

Overall, the Cultural Empowerment dimension confirms that sustainable Smart Village development requires a balanced integration of technological innovation with local cultural values. Digital technologies should not replace traditional identities but instead strengthen community creativity, preserve cultural heritage, and expand opportunities for inclusive socio-economic development. Through the integration of local wisdom and digital innovation, rural communities become active creators of knowledge, culture, and sustainable development, thereby establishing themselves as resilient and adaptive actors within the evolving digital society (Nugroho et al., 2024).

d. Smart Services

The Smart Services dimension represents one of the most tangible manifestations of Smart Village implementation by emphasizing the digital transformation of public service delivery to improve efficiency, transparency, accountability, and citizen participation. The findings of this Systematic Literature Review (SLR), based on the synthesis of 21 empirical studies, indicate that eight studies consistently reported that the digitalization of public services significantly improves service quality, accelerates administrative processes, and expands opportunities for community participation in village governance (Acantha et al., 2024; Agusta, 2023; Geohansa et al., 2025; Ikram et al., 2024; Junaidi et al., 2025; Purnamasari et al., 2024; Xing et al., 2023; Zhao & Li, 2022). Within the framework of Digital Empowerment Theory (Agusta, 2023; Zhao & Li, 2022), Smart Services represent a practical expression of digital empowerment, where rural communities are positioned not merely as recipients of public services but also as active participants in the planning, monitoring, and evaluation of technology-based public administration.

The international evidence consistently demonstrates that digital public services contribute substantially to improving governance effectiveness and promoting social inclusion in rural areas. Wang et al. (2023) found that the implementation of Digital Village initiatives in China significantly accelerated data-driven public services while increasing citizen satisfaction with local government performance. Villages utilizing integrated online information systems experienced considerable improvements in service delivery speed, population administration, and data management efficiency. Similarly, Zhao and Li (2022) reported that digital transformation enhanced intergovernmental coordination and expanded the accessibility of public services to remote rural communities. These findings suggest that digital technologies function not merely as administrative tools but as institutional innovations capable of improving governance capacity and ensuring equitable access to essential public services.

Additional empirical evidence highlights the contribution of digital systems to strengthening transparency and administrative accountability. Purnamasari et al. (2024) demonstrated that the implementation of digital information systems and technology-based internal control mechanisms significantly enhanced village government accountability while reducing the risks of maladministration. Digital bureaucratic systems enabled real-time monitoring of village financial activities, expanded public access to financial information, and strengthened community-based oversight

DOI: 10.26618

mechanisms. Likewise, Junaidi et al. (2025) found that integrated digital service infrastructure improved the dissemination of public information, strengthened coordination across different levels of government, and increased citizen participation in local policy formulation. Consequently, Smart Services foster a more collaborative, adaptive, and transparent governance model while enhancing administrative efficiency and public trust in village institutions.

The Indonesian experience further confirms the growing maturity of Smart Services implementation within Smart Village initiatives. Ikram et al. (2024) reported that the Smart Village Nusantara program has successfully implemented digital systems for population administration, financial reporting, and village development management. Geohansa et al. (2025) further demonstrated that digital technologies enhance public transparency and improve decision-making processes at the village government level through integrated information systems. Agusta (2023) explained that the co-production model positions citizens as active partners throughout the planning, implementation, and evaluation of digital village policies, thereby creating reciprocal and productive relationships between local governments and rural communities. This participatory approach contributes to more inclusive, responsive, and citizen-centered public service delivery. Supporting this argument, Manapa Sampetoding and Er (2024) emphasized that the effectiveness of digital public services depends heavily on the digital literacy and technological competence of village officials. Strengthening the digital capabilities of local government personnel enhances bureaucratic efficiency, accelerates service responsiveness, and reinforces public confidence in village governance.

Compared with previous empirical studies, the findings consistently support the positive relationship between public service digitalization and governance improvement. However, while earlier studies primarily examined individual aspects such as e-government implementation, digital administration, financial transparency, or citizen participation separately, this review demonstrates that these elements collectively constitute an integrated Smart Services ecosystem. Rather than functioning as isolated digital innovations, these service components interact synergistically to strengthen governance capacity, improve administrative performance, and promote inclusive community participation. This integrated perspective extends previous literature by emphasizing that the success of Smart Services depends not only on technological adoption but also on institutional readiness, human resource capacity, and collaborative governance.

From a theoretical perspective, these findings reinforce and expand Digital Empowerment Theory by demonstrating that digital empowerment within public services extends beyond technological accessibility to encompass institutional transformation and democratic participation. The reviewed studies consistently show that digital technologies empower citizens by improving access to information, increasing transparency, and creating opportunities for meaningful engagement in governance processes. At the same time, digital empowerment strengthens institutional capacity by enabling governments to provide more efficient, accountable, and responsive public services. Therefore, Smart Services illustrate that digital transformation simultaneously empowers citizens and modernizes public institutions, thereby extending the theoretical scope of Digital Empowerment Theory toward public sector governance.

The findings also generate important practical and policy implications. Governments should prioritize the development of integrated digital public service platforms capable of connecting administrative services, financial management, public information systems, and citizen feedback mechanisms within a unified digital ecosystem. Investments

DOI: 10.26618

should extend beyond technological infrastructure to include continuous digital competency development for village officials, standardized digital governance procedures, cybersecurity measures, and public digital literacy programs. Moreover, participatory governance models such as co-production should be institutionalized to ensure that citizens remain actively involved in designing, implementing, and evaluating digital public services. Such collaborative approaches will strengthen transparency, improve service quality, and promote sustainable community trust in digital governance.

These findings also contribute directly to addressing the research gap identified in the literature review. Previous Smart Village studies have largely concentrated on technological implementation without comprehensively explaining how digital public services contribute to broader processes of community empowerment and institutional transformation. By synthesizing evidence from multiple international and Indonesian contexts, this review demonstrates that Smart Services function as a strategic bridge connecting digital innovation, governance modernization, and citizen empowerment. This comprehensive perspective enriches the Smart Village literature by positioning public service digitalization not merely as an administrative reform but as a multidimensional mechanism for achieving inclusive, transparent, and sustainable rural development.

Overall, the Smart Services dimension highlights the essential role of digital public services in strengthening the relationship between village governments and rural communities. Through integrated digital infrastructure, enhanced administrative capacity, cross-sector collaboration, and active citizen participation, Smart Village initiatives create transparent, efficient, and inclusive public service systems capable of supporting sustainable rural development (Ririn Yulianti et al., 2025). These findings further confirm that effective digital transformation in public services depends on the simultaneous development of technological capability, institutional capacity, and community empowerment, thereby ensuring that digital governance contributes to long-term rural resilience and self-reliance.

e. Governance and Participation (Smart Governance)

The Governance and Participation (Smart Governance) dimension represents a core component of Smart Village implementation because it determines the quality of transparency, accountability, and citizen participation within digitally enabled village governance systems. The findings of this Systematic Literature Review indicate that digital governance functions as a strategic mechanism for strengthening institutional effectiveness while simultaneously expanding opportunities for public engagement in village decision-making processes (Junaidi et al., 2025). Within the framework of Digital Empowerment Theory (Agusta, 2023; Zhao & Li, 2022), digital governance is not merely an administrative modernization initiative but a process of redistributing decision-making capacity through equal access to information, participatory digital platforms, and collaborative governance mechanisms. Consequently, Smart Governance promotes a governance ecosystem in which technological innovation and democratic participation reinforce one another to achieve sustainable rural development.

The reviewed empirical evidence consistently demonstrates that digitalization improves governance quality by enhancing transparency, accountability, and public participation. Junaidi et al. (2025) emphasized that digital governance strengthens the integration of village information systems, resulting in faster, more accountable, and participatory public service delivery. Likewise, Susilowati et al. (2024) reported that the utilization of Information and Communication Technology (ICT) expands village leadership capacity by facilitating online citizen participation. Through digital platforms,

DOI: 10.26618

community members are able to participate directly in policy formulation, provide feedback on public services, and monitor government performance transparently. These findings indicate that digital governance extends beyond administrative efficiency to represent a form of digital democracy, fundamentally transforming the relationship between governments and citizens into one characterized by collaboration, transparency, and evidence-based decision-making.

The Indonesian experience further illustrates that digital governance serves as an important driver of social transformation by strengthening community participation in village supervision and decision-making. Muhtar et al. (2023) and Emerllahu and Bogataj (2024) demonstrated that the Penta-Helix collaboration model reinforces cooperation among governments, academic institutions, private sectors, media organizations, and civil society in developing adaptive village governance systems capable of responding to digital transformation. This collaborative model expands coordination networks, accelerates policy innovation, and ensures that participatory and inclusive values remain central within the digital governance ecosystem. Complementing these findings, Wang et al. (2023) and Y. Liu et al. (2024) found that data-driven governance contributes significantly to reducing regional development disparities while strengthening fiscal efficiency and social equity between rural and urban areas. Their studies indicate that digital governance enhances institutional resilience and improves the capacity of village governments to respond effectively to the challenges of the digital economy.

Further empirical support is provided by Purnamasari et al. (2024) and Geohansa et al. (2025), who demonstrated that the implementation of internal control systems and digital reporting tools significantly improves bureaucratic transparency and administrative efficiency within village governments. Digital platforms enable communities to access financial reports, development information, and public policy documents openly, thereby strengthening their role as citizen controllers capable of monitoring government performance. In addition, Ririn Yulianti et al. (2025) argued that effective digital governance depends upon sustained collaboration among multiple stakeholders to ensure that technological innovation remains rooted in local cultural values and community wisdom. This integration represents a balanced approach in which modernization complements rather than replaces traditional governance principles.

Compared with previous empirical studies, the findings consistently confirm the positive influence of digital governance on administrative effectiveness and citizen participation. Nevertheless, previous studies have generally examined governance transparency, public participation, digital reporting, or institutional collaboration independently. This review advances the existing literature by integrating these dimensions into a comprehensive Smart Governance framework, demonstrating that successful digital governance emerges through the interaction of transparent institutions, active community participation, collaborative partnerships, and digital technologies. Therefore, governance transformation should be understood as a multidimensional process involving technological innovation, institutional reform, and democratic empowerment rather than simply the adoption of digital administrative systems.

From a theoretical perspective, the findings substantially reinforce and extend Digital Empowerment Theory (Agusta, 2023; Zhao & Li, 2022). The synthesized evidence demonstrates that digital empowerment redistributes governance capacity by enabling citizens to access information, participate in public decision-making, monitor government performance, and collaborate with public institutions through digital platforms. This participatory governance model transforms citizens from passive recipients of public policies into strategic partners in village

DOI: 10.26618

development. Simultaneously, transparent access to digital information strengthens governmental legitimacy and institutional accountability while deepening democratic practices at the grassroots level. Consequently, this review expands the theoretical application of Digital Empowerment Theory by illustrating that governance empowerment constitutes a central mechanism through which digital transformation promotes inclusive, transparent, and resilient rural institutions.

The findings also have important practical and policy implications. Governments should prioritize the development of integrated digital governance systems that combine village information systems, financial transparency platforms, digital reporting mechanisms, public consultation portals, and community feedback applications. Strengthening institutional capacity through continuous digital training for village officials is equally essential to ensure effective implementation of digital governance initiatives. Furthermore, collaborative governance approaches such as the Penta-Helix model should be institutionalized to encourage sustained cooperation among governments, universities, private sectors, civil society organizations, and local communities. These strategies will enhance transparency, improve public accountability, strengthen citizen trust, and ensure the long-term sustainability of Smart Village governance.

The findings also contribute directly to addressing the research gap identified in the literature review. Previous Smart Village research has predominantly emphasized technological infrastructure and service digitalization while providing limited explanation of how digital governance mechanisms collectively strengthen institutional resilience, democratic participation, and sustainable village development. By synthesizing empirical evidence from multiple countries, this review demonstrates that Smart Governance serves as the institutional foundation that integrates digital technologies, transparent administration, collaborative policymaking, and citizen participation into a unified governance ecosystem. This comprehensive perspective represents a significant contribution to the Smart Village literature by providing a more holistic understanding of the governance mechanisms through which digital empowerment enhances rural self-reliance and sustainable development.

Overall, the Governance and Participation (Smart Governance) dimension illustrates that effective digital transformation depends on achieving a balance between technological innovation and participatory democracy. Digital governance strengthens institutional effectiveness while empowering communities to participate actively in policy formulation, implementation, monitoring, and evaluation. Through transparent data management, collaborative decision-making, and inclusive digital participation, Smart Village initiatives create governance systems that are more accountable, adaptive, and resilient, thereby establishing a strong institutional foundation for sustainable rural development in the digital era.

4.2.2 Comparison with Previous Studies

The findings of this Systematic Literature Review are broadly consistent with previous empirical studies that identify Smart Village as an integrated rural development approach capable of enhancing economic resilience, public service quality, governance effectiveness, and community participation through digital transformation. Similar to the findings reported by Ikram et al. (2024) and Annshori et al. (2024), this review confirms that digital technologies function not merely as technological innovations but also as strategic instruments for empowering rural communities, strengthening local entrepreneurship, and improving access to public services. These studies collectively demonstrate that the effectiveness of Smart Village initiatives depends on the integration of digital infrastructure with human capacity development and institutional support.

DOI: 10.26618

The present review also corroborates the findings of Geohansa et al. (2025) and Purnamasari et al. (2024), which emphasize that the implementation of Smart Village in Indonesia has progressed considerably but remains uneven across regions due to disparities in digital infrastructure, financial capacity, and digital literacy. Similar implementation challenges have also been documented in international contexts, indicating that technological readiness alone is insufficient to achieve sustainable rural transformation without complementary governance reforms and community empowerment strategies.

Furthermore, the synthesis is consistent with the arguments presented by Muhtar et al. (2023) and Stojanova et al. (2021), who highlight the importance of socio-cultural compatibility in determining the long-term sustainability of Smart Village initiatives. While most previous studies acknowledge the significance of cultural values and local participation, the current review demonstrates that these dimensions continue to receive less empirical attention than economic and governance aspects. Consequently, socio-cultural sustainability remains an underexplored area within the Smart Village literature.

Despite these similarities, this review also identifies several important differences from previous studies. Most empirical research reviewed focuses on specific implementation cases, technological applications, or policy evaluations within particular countries. In contrast, the present study synthesizes findings across multiple geographical contexts through a systematic literature review, enabling the identification of recurring implementation patterns, research gaps, and emerging theoretical trends. Moreover, unlike many previous studies that primarily employ descriptive or exploratory approaches, this review explicitly highlights the limited empirical validation of causal relationships among the dimensions of Digital Empowerment Theory and rural development outcomes. This finding indicates that the current body of literature has not yet fully established the mechanisms through which digital empowerment contributes to sustainable rural transformation.

Overall, by integrating evidence from twenty-one international and national studies, this research provides a more comprehensive understanding of Smart Village development while identifying methodological, theoretical, and contextual gaps that require further investigation.

4.2.3 Theoretical Contributions

This study makes several important theoretical contributions to the growing body of knowledge on Smart Village development and Digital Empowerment Theory. First, the findings reinforce the theoretical proposition that digital transformation should be understood as a multidimensional empowerment process rather than merely a process of technology adoption. The synthesis demonstrates that sustainable rural development is achieved through the interaction of digital infrastructure, institutional governance, economic innovation, environmental sustainability, public service improvement, and socio-cultural empowerment. This perspective strengthens the conceptual relevance of Digital Empowerment Theory in explaining the mechanisms through which digital technologies generate broader developmental outcomes in rural communities.

Second, this review extends existing theoretical discussions by integrating evidence from diverse geographical contexts into a unified conceptual framework. While previous studies frequently examine isolated dimensions of Smart Village—such as governance, digital entrepreneurship, or public service innovation—the present synthesis illustrates that these dimensions are highly interconnected and mutually reinforcing. Therefore, successful Smart Village implementation should be conceptualized as a holistic ecosystem in which technological

DOI: 10.26618

capability, institutional quality, human capital, and community participation interact dynamically to produce sustainable development outcomes.

Third, the review identifies significant theoretical gaps within the current literature. Although Digital Empowerment Theory provides a comprehensive conceptual foundation, most existing empirical studies remain descriptive and exploratory, with limited quantitative testing of the causal relationships among its five dimensions—industry, ecology, culture, public services, and governance—and their impacts on economic, social, and environmental outcomes. Consequently, this study highlights the need for stronger empirical validation using advanced analytical approaches such as Structural Equation Modeling (SEM) or Partial Least Squares Structural Equation Modeling (PLS-SEM). Such empirical investigations would refine the theoretical framework by identifying the relative influence of each dimension and the interactions among them.

Finally, this study contributes to the literature by emphasizing the importance of socio-cultural sustainability within Smart Village development. Existing theoretical discussions predominantly prioritize technological innovation, governance efficiency, and economic performance, whereas cultural compatibility and local social values receive comparatively limited attention. The present synthesis suggests that integrating technological innovation with local identity, community norms, and indigenous knowledge constitutes a critical theoretical extension necessary for explaining the long-term sustainability of rural digital transformation. Accordingly, this study broadens the application of Digital Empowerment Theory by positioning socio-cultural integration as a fundamental determinant of successful and inclusive Smart Village development.

4.2.4 Practical and Policy Implications

The findings of this Systematic Literature Review have important practical and policy implications for governments, policymakers, development agencies, academic institutions, and rural communities seeking to accelerate sustainable Smart Village development. The synthesis of twenty-one empirical studies demonstrates that successful digital transformation requires integrated, inclusive, and multi-level policy frameworks that combine technological innovation with community empowerment and institutional strengthening.

First, the reviewed studies consistently indicate that rural digitalization cannot rely solely on investments in digital infrastructure such as broadband networks, communication facilities, or digital equipment. Junaidi et al. (2025), Xing et al. (2023), and Ririn Yulianti et al. (2025) emphasize that technological investments must be complemented by continuous improvements in digital literacy, entrepreneurial capability, and community innovation capacity. Therefore, governments should prioritize digital education, vocational training, entrepreneurship development, and technology-based business incubation to ensure that rural communities become active producers of digital innovation rather than passive users of technology.

Second, effective Smart Village implementation requires transparent data governance and integrated digital management systems. Geohansa et al. (2025), Purnamasari et al. (2024), and Annshori et al. (2024) conclude that the integration of village information systems, data-driven governance, digital reporting mechanisms, and technology-based monitoring systems significantly improves administrative efficiency, transparency, and public accountability. Local governments therefore play a strategic role in allocating financial resources for digital infrastructure while simultaneously strengthening the digital competencies of village officials. Consistent with best practices reported in Europe (Stojanova et al., 2021), the adoption of multi-level governance can strengthen coordination among different governmental levels and ensure the long-term

DOI: 10.26618

sustainability of Smart Village policies.

Third, the findings highlight the strategic importance of community participation and collaborative governance in promoting rural innovation. Ikram et al. (2024) and Muhtar et al. (2023) demonstrate that digital transformation enables rural citizens to become active contributors to online public services, digital entrepreneurship, creative economy initiatives, and community-based cultural tourism. Similarly, Agusta (2023) explains that the co-production model facilitates direct collaboration between technology providers, MSMEs, village governments, and local communities in developing digital solutions tailored to local needs. Such cross-sector collaboration strengthens local innovation ecosystems and supports sustainable socio-economic development.

Fourth, higher education institutions, research organizations, and innovation centers have an increasingly important role in strengthening rural digital transformation. Leviäkangas et al. (2025) and Doloi (2025) emphasize that digital education and technological capacity building are essential for preparing adaptive rural workforces capable of competing in the digital economy. The Penta-Helix collaboration model involving academia, government, private sectors, communities, and media provides a sustainable framework for promoting applied research, technological innovation, and community empowerment while ensuring that digital transformation remains socially and culturally relevant.

From the perspective of Digital Empowerment Theory, the findings indicate that sustainable Smart Village development depends upon maintaining a balance among its five interconnected dimensions. Smart Economy requires accelerating the digitalization of MSMEs and data-driven agriculture. Smart Environment emphasizes environmentally sustainable technologies and digital natural resource management. Cultural Empowerment encourages the utilization of digital platforms for preserving cultural heritage and promoting creative industries. Smart Services require transparent, inclusive, and citizen-centered digital public service systems. Finally, Smart Governance demands participatory, accountable, and evidence-based decision-making supported by integrated digital governance mechanisms. Together, these five dimensions establish an adaptive, collaborative, and sustainable policy framework capable of strengthening rural economic independence in the digital era.

Overall, the policy implications generated by this review extend beyond the modernization of digital infrastructure. The findings underline the importance of human empowerment, institutional transformation, collaborative governance, and continuous innovation as the primary drivers of Smart Village success. Consequently, Smart Village should be viewed not merely as a digitalization project but as a comprehensive socio-economic development strategy that places rural communities at the center of sustainable innovation and inclusive development.

4.2.5 Integration with the Research Gap

One of the principal contributions of this study lies in addressing the research gap identified in the literature concerning the fragmented understanding of Smart Village implementation. Previous empirical studies have predominantly examined individual dimensions of Smart Village development, including digital economy, governance, environmental sustainability, public services, or cultural preservation, as separate research domains (Annshori et al., 2024; Geohansa et al., 2025; Ikram et al., 2024; Junaidi et al., 2025; Muhtar et al., 2023; Purnamasari et al., 2024; Ririn Yulianti et al., 2025; Wang et al., 2023; Zhao & Li, 2022). Consequently, limited attention has been devoted to understanding how these dimensions interact collectively to strengthen rural economic and social self-reliance through digital transformation.

The findings of this Systematic Literature Review bridge this gap by integrating evidence from 21 empirical studies into a

DOI: 10.26618

comprehensive conceptual framework based on Digital Empowerment Theory (Agusta, 2023; Zhao & Li, 2022). The synthesis demonstrates that Smart Village should be understood as an integrated digital empowerment ecosystem in which Smart Economy, Smart Environment, Cultural Empowerment, Smart Services, and Smart Governance operate as interconnected dimensions rather than isolated development initiatives. Each dimension reinforces the others by simultaneously improving economic productivity, environmental sustainability, cultural resilience, public service quality, institutional accountability, and community participation.

Unlike many previous studies that primarily emphasized technological infrastructure or digital applications, this review demonstrates that the effectiveness of Smart Village depends fundamentally on human empowerment, institutional capacity, collaborative governance, and community participation. Digital technologies alone are insufficient to generate sustainable rural transformation unless they are accompanied by improvements in digital literacy, local innovation capacity, cross-sector collaboration, and participatory governance mechanisms. Therefore, this study extends the existing Smart Village literature by providing a holistic explanation of the mechanisms through which digital empowerment contributes to sustainable rural development.

Furthermore, the conceptual synthesis generated by this review provides an important theoretical foundation for future empirical research. The integrated framework developed from this review offers opportunities for future studies to quantitatively examine the relationships among the five dimensions of Digital Empowerment Theory using Structural Equation Modeling (SEM) or Partial Least Squares Structural Equation Modeling (PLS-SEM). Consequently, this study contributes not only by consolidating fragmented empirical evidence but also by establishing a comprehensive conceptual model that supports future theory development and empirical validation within the Smart Village literature.

4.2.6 Acknowledgement of Study Limitations

Although this Systematic Literature Review provides a comprehensive synthesis of the Smart Village literature, several limitations should be acknowledged when interpreting the findings. First, the reviewed studies are geographically concentrated in East Asia, particularly China, and several European countries, whereas empirical evidence from Indonesia remains relatively limited (Junaidi et al., 2025; Ririn Yulianti et al., 2025). This geographical imbalance restricts the generalizability of the findings because rural communities differ substantially in terms of socio-economic conditions, institutional capacity, cultural characteristics, and levels of digital readiness.

Second, although several reviewed studies, including Ikram et al. (2024) and Annshori et al. (2024), provide detailed analyses of digital technologies and Smart Village implementation, relatively few studies empirically examine the causal relationships between digital empowerment and rural economic independence. Most existing studies remain descriptive and primarily focus on implementation experiences rather than testing theoretical relationships associated with Digital Empowerment Theory. Consequently, further empirical validation is required to strengthen the theoretical propositions identified in this review.

Third, the review indicates that cultural and social dimensions remain underrepresented within the current Smart Village literature. While Muhtar et al. (2023) and Stojanova et al. (2021) emphasize the importance of local cultural values and social cohesion, most existing studies continue to prioritize economic development, technological innovation, and governance. The synthesized findings suggest that compatibility between digital technologies, local cultural

DOI: 10.26618

norms, social institutions, and community interaction patterns constitutes a critical determinant of long-term Smart Village sustainability. Greater scholarly attention to these socio-cultural dimensions is therefore necessary.

Fourth, evidence from Indonesia presented by Geohansa et al. (2025) and Purnamasari et al. (2024) indicates that the implementation of digital village governance remains uneven across regions. Variations in digital literacy, technological infrastructure, financial resources, and institutional capacity continue to create significant disparities in Smart Village implementation. These contextual differences suggest that successful digital transformation depends heavily on local conditions and cannot be generalized uniformly across rural communities.

Based on these limitations, several directions for future research are recommended. First, future studies should develop a Digital Empowerment Index capable of measuring the level of digital maturity among rural communities. Second, quantitative studies employing Structural Equation Modeling (SEM) or Partial Least Squares Structural Equation Modeling (PLS-SEM) should empirically examine the relationships among the five dimensions of Digital Empowerment Theory and their impacts on economic, social, environmental, and governance outcomes. Third, mixed-methods approaches are recommended to provide a more comprehensive understanding of the interactions between technological innovation and rural social dynamics. Finally, comparative studies involving ASEAN countries and other developing regions would broaden the international applicability of the Smart Village framework and contribute to the development of globally relevant digital rural development policies.

Overall, these limitations do not diminish the contribution of this review but instead highlight important opportunities for advancing Smart Village research. By expanding empirical evidence, strengthening theoretical validation, and incorporating more diverse geographical and socio-cultural contexts, future studies can further establish Smart Village as a globally relevant framework for achieving inclusive, adaptive, and sustainable rural development in the digital era.

5. Conclusion

5.1 Summary of Key Findings

The findings of this Systematic Literature Review reveal several important conclusions regarding Smart Village development. First, the reviewed studies consistently demonstrate that digital transformation has significantly improved the quality of public services, strengthened rural governance, increased economic opportunities through digital entrepreneurship, and enhanced community participation in village development. The literature also confirms that Digital Empowerment Theory provides a comprehensive conceptual framework for explaining how digital transformation contributes to rural development through the interconnected dimensions of industry, ecology, culture, public services, and governance.

Nevertheless, the synthesis also reveals considerable disparities in Smart Village implementation across countries and regions. In particular, most empirical evidence originates from East Asia, especially China, and Western Europe, whereas empirical studies focusing on Indonesia remain relatively limited (Junaidi et al., 2025; Ririn Yulianti et al., 2025). Furthermore, although Indonesia has experienced substantial progress in rural digital transformation, implementation remains uneven because of differences in digital literacy, infrastructure availability, and fiscal capacity across villages (Geohansa et al., 2025; Purnamasari et al., 2024). These findings indicate that the success of Smart Village initiatives depends on contextual factors beyond technological adoption alone.

DOI: 10.26618

5.2 Theoretical Contributions

This study contributes to the Smart Village literature by synthesizing recent empirical findings within the perspective of Digital Empowerment Theory and identifying several theoretical gaps that require further investigation. Although studies such as Ikram et al. (2024) and Annshori et al. (2024) emphasize technological innovation and digital empowerment, relatively few studies empirically examine the causal relationships between Smart Village implementation and rural economic independence. Most existing studies remain descriptive and exploratory rather than quantitatively validating the theoretical assumptions underlying Digital Empowerment Theory.

Moreover, this review highlights that current Smart Village research predominantly emphasizes economic performance and governance outcomes, while the socio-cultural and digital sustainability dimensions receive considerably less attention. Previous studies by Muhtar et al. (2023) and Stojanova et al. (2021) demonstrate that cultural compatibility constitutes an essential determinant of Smart Village success; however, this perspective has not yet been sufficiently incorporated into mainstream Smart Village research. Accordingly, this study extends existing theoretical discussions by emphasizing that sustainable rural digital transformation should integrate technological innovation with local social values, cultural identity, and community interaction patterns.

5.3 Practical and Policy Implications

The findings generate several practical implications for policymakers and rural development stakeholders in Indonesia. First, the government should design and allocate dedicated funding for continuous digital literacy and technology-based entrepreneurship training programs targeting rural communities, particularly micro, small, and medium enterprises (MSMEs) and rural youth. Strengthening digital competencies will improve community readiness to utilize digital technologies for economic development and public service delivery.

Second, integrated village-level open data governance platforms should be established in collaboration with local governments to promote financial transparency, development monitoring, and community participation in public oversight. Such digital governance systems can improve accountability while strengthening public trust in village administration.

Third, institutionalized penta-helix collaboration involving government, academia, industry, communities, and media should be promoted through fiscal incentives for private-sector investment in rural digital infrastructure and business incubation. Universities should also be encouraged to conduct applied research and provide technological assistance that aligns with local socio-economic potential.

The urgency of implementing these recommendations is supported by several critical considerations. Economically, persistent digital disparities between urban and rural areas will widen income inequality and reduce regional competitiveness. Socially, inadequate digital literacy may isolate rural communities from the mainstream digital economy, while insufficient integration of local cultural values into digital transformation may increase social vulnerability. Since many existing Smart Village initiatives remain fragmented and short-term, coherent regulatory and institutional frameworks are required to ensure long-term sustainability and successful implementation.

5.4 Limitations of the Study

Several limitations should be acknowledged when interpreting the findings of this review. First, the reviewed literature is characterized by geographical imbalance, as most studies originate from East Asia, particularly China, and Western Europe, whereas empirical evidence from Indonesia remains relatively scarce (Junaidi et al., 2025; Ririn Yulianti et al., 2025). Consequently, the generalizability of the findings to Indonesia's

DOI: 10.26618

highly diverse socio-cultural and economic contexts remains limited.

Second, the existing literature is dominated by descriptive and exploratory studies. Although research by Ikram et al. (2024) and Annshori et al. (2024) provides valuable insights into technological innovation and digital empowerment, empirical investigations employing quantitative causal models remain limited. As a result, the causal relationships between Smart Village implementation and rural economic independence have not yet been comprehensively validated.

Finally, despite studies by Muhtar et al. (2023) and Stojanova et al. (2021) emphasizing the importance of socio-cultural dimensions, most reviewed studies continue to prioritize economic and governance aspects. This imbalance limits understanding of how cultural compatibility, local norms, and community interaction patterns influence the long-term sustainability of rural digital transformation.

5.5 Directions for Future Research

Based on the identified limitations, several directions for future research are recommended. First, future studies should develop and validate a Digital Empowerment Index specifically designed to measure the level of digital maturity in rural communities, particularly within the Indonesian context. Such an index would provide a standardized measurement framework for evaluating Smart Village implementation across different regions.

Second, future empirical research should quantitatively examine the causal relationships among the five dimensions of Digital Empowerment Theory—industry, ecology, culture, public services, and governance—and their impacts on economic, social, and environmental outcomes. Advanced analytical approaches such as Structural Equation Modeling (SEM) or Partial Least Squares Structural Equation Modeling (PLS-SEM) are recommended to improve empirical validation of the proposed conceptual framework.

Third, future research should adopt mixed-methods approaches to obtain a more comprehensive understanding of the interactions between technology adoption and rural communities, including technological adaptation, social resistance, and locally driven innovation. Such approaches would facilitate deeper exploration of how digital technologies interact with local wisdom, social identity, and cultural practices in shaping sustainable rural transformation.

Finally, future studies should expand the research context beyond Indonesia by conducting comparative analyses across ASEAN countries. Cross-national comparative research would enrich the global understanding of Smart Village development, facilitate the identification of context-specific implementation strategies, and strengthen the theoretical and practical relevance of Digital Empowerment Theory in supporting inclusive, adaptive, and sustainable digital rural development.

6. References

Acantha, E., Sampetoding, M., & Er, M. (2024). *ScienceDirect CENTERIS – International Conference on ENTERprise Information Systems / ProjMAN – Health and Social Care Information Systems and Technologies 2023 Digital Transformation of Smart Village : A Systematic Literature Review*. *239*, 1336–1343.

Agusta, Y. (2023). Managing the Development of a Sustainable Digital Village. *Sustainability (Switzerland)*, *15*(9). https://doi.org/10.3390/su15097575

Annshori, M. F., Bela, H. Y., & Mikyal Marshalita, M. (2024). Insight Industry 4.0: An Answer to Smart Village Policy Transformation in Indonesia. *Indo-MathEdu Intellectuals Journal*, *5*(2), 1602–1610. https://doi.org/10.54373/imeij.v5i2.922

Ardhian Nugroho, R., & Galan Prakoso, S. (2025). *Contributing Factors of Smart Village Implementation in Rural Area: A Systematic Literature Review*.

DOI: 10.26618

Bilyastuti, M. P., Suyani, Suryanto, A., Heriana, T., Nawawi, I., & Yuanita, A. (2023). Penguatan Desa Model Smart Village Berbasis Teknologi Informasi dan Komunikasi. *I-Com: Indonesian Community Journal*, *3*(4), 2180–2188. https://doi.org/10.33379/icom.v3i4.3557

Cai, Z., Li, S., & Cheng, D. (2023). Has Digital Village Construction Improved Rural Family Resilience in China? Evidence Based on China Household Finance Survey. *Sustainability (Switzerland)*, *15*(11). https://doi.org/10.3390/su15118704

Deng, J., Li, X., & Zhang, N. (2024). The Impact of Digital Rural Construction on Rural Revitalization-Empirical Evidence from Chinese County Panel Data. *Agriculture (Switzerland)*, *14*(11). https://doi.org/10.3390/agriculture14111903

Doloi, H. K. (2025). Digital Inclusion for Rural Growth: Internet Usage and Smart Villages Development. *Asia-Pacific Journal of Rural Development*, *35*(1), 40–57. https://doi.org/10.1177/10185291251343357

Emerllahu, V., & Bogataj, D. (2024). Smart Villages as infrastructure of rural areas: Literature review and research agenda. *IFAC-PapersOnLine*, *58*(3), 268–273. https://doi.org/10.1016/j.ifacol.2024.07.162

Geohansa, A., Sumarna, E., & Kania, I. (2025). Digitization of Village Government as a Sustainable Development Strategy Towards the Realization of Smart Villages. *Jurnal Polisci*, *2*(4), 254–267. https://doi.org/10.62885/polisci.v2i4.742

Guo, T., & Li, Z. (2024). *Leveraging the Digital Economy to Drive Rural Industrial Transformation: A Case Study of County-Level Economies in Southern Shaanxi*. 7261–7266. https://doi.org/10.1109/CAC63892.2024.10864822

Harsanto, B. T., & Wahyuningrat, W. (2024). Investigating the keys to the failure of inter-village government collaboration in developing rural economic potentials in Indonesia. *Regional Science Policy and Practice*, *16*(5). https://doi.org/10.1016/j.rspp.2024.100023

Husnah, W., Athar, M., Muzakir, I., Chairu, T., & Ardianti, E. A. (2024). *The International Journal of Education Management and Sociology Strengthening Penta Helix Collaboration for Enhancement Quality of Education (Case Study: Synergy of Education Quality Improvement Program in Gorontalo Province, Riau Islands Province, Bali Province and Bangka Belitung Islands Province, Indonesia)*.

Ikram, M. M., Rizal, M. B., Alhifka Syahrir, M. D., Fauziyah Utomo, D., Ummul Khasanat, M., Apriliana Mahrun, D., Ummul Khairat, M., & Asyafa, A. (2024). Pengembangan Konsep Desa digital atau Smart Village Nusantara untuk Penguatan Smart City (Studi Smart Governance pada Pelayanan Prima Desa-Desa). *Jurnal Lepa-Lepa Open*, *4*(4), 1024–1032.

Junaidi, A., Othman, M. S. Bin, Mohd Hashim, S. Z., Mohamad, M. M., Danial Kesa, D., & Nurfikri, A. (2025). Smart villages: a systematic review of trends, models, and metrics. *Cogent Social Sciences*, *11*(1). https://doi.org/10.1080/23311886.2025.2492833

Kementerian Sekretariat Negara Republik Indonesia. (2025, March 7). *RPJMN 2025-2029: Fondasi Awal Wujudkan Visi Indonesia Emas 2045*. Https://Www.Setneg.Go.Id/Baca/Index/Rpjmn_2025_2029_fondasi_awal_wujudkan_visi_indonesia_emas_2045.

Keputusan Menteri Nomor 55 Tahun 2024 Tentang Panduan Umum Pengembangan Desa Cerdas

Leviäkangas, P., Sønvisen, S., Casado-Mansilla, D., Mikalsen, M., Cimmino, A., Drosou, A., & Hussain, S. (2025). Towards smart, digitalised rural regions and communities – Policies, best practices and case studies. *Technology in Society*, *81*. https://doi.org/10.1016/j.techsoc.2025.102824

Liu, S., Zhu, S., Hou, Z., & Li, C. (2023). Digital village construction, human capital and the development of the rural older adult care service industry. *Frontiers in Public Health*, *11*. https://doi.org/10.3389/fpubh.2023.1190757

Liu, Y., Zhang, H., Ning, M., & Wang, L. (2024).

DOI: 10.26618

Has Digital Village Construction Narrowed the Urban–Rural Income Gap: Evidence from Chinese Counties. *Sustainability (Switzerland)* , *16*(13). https://doi.org/10.3390/su16135330

Liu, Z., Wu, H., & Badar, I. H. (2024). Impact of Rural Digital Economy Development on Rural Revitalisation—Evidence from China. *Sustainability (Switzerland)*, *16*(11). https://doi.org/10.3390/su16114573

Lu, Y., Meng, Y., Chen, L., & Zhang, Y. (2024). Can the digital economy contribute to rural revitalization? A case of from China? *PLoS ONE*, *19*(10 October). https://doi.org/10.1371/journal.pone.0310313

Manapa Sampetoding, E. A., & Er, M. (2024). Digital Transformation of Smart Village: A Systematic Literature Review. *Procedia Computer Science*, *239*, 1336–1343. https://doi.org/10.1016/j.procs.2024.06.304

Muhtar, E. A., Abdillah, A., Widianingsih, I., & Adikancana, Q. M. (2023). Smart villages, rural development and community vulnerability in Indonesia: A bibliometric analysis. *Cogent Social Sciences*, *9*(1). https://doi.org/10.1080/23311886.2023.2219118

Nugroho, C., Wulandari, A., Yusanto, F., Lestari, M. T., & Kalaloi, A. F. (2024). *Exploring Digital Village Development for Circular Economy: A Case Study of Padaringan Village-Owned Enterprise, Langonsari, Bandung Regency, Indonesia*. 205–209. https://doi.org/10.1109/SIBF63788.2024.10883836

Presiden Republik Indonesia. (2025). *Peraturan Presiden Republtk Indonesia Nomor 12 Tahun 2025 Tentano Rencana Pembangunan Jangka Menengah Nasional Tahun 202*2029*.

Purnamasari, R., Hasanudin, A. I., Zulfikar, R., & Yazid, H. (2024). Do internal control and information systems drive sustainable rural development in Indonesia? *Journal of Open Innovation: Technology, Market, and Complexity*, *10*(1). https://doi.org/10.1016/j.joitmc.2024.100242

Ramadhani, G. A., & Rohmadiani, L. D. (2024). Readiness to Implement the Digital Village Program: A Case Study: Waru Village, Waru Sub-district, Sidoarjo Regency. *Formosa Journal of Science and Technology (FJST)*, *3*(12), 2629–2646. https://doi.org/10.55927/fjst.v3i12.12623

Ren, J., Chen, X., Shi, L., Liu, P., & Tan, Z. (2024). Digital Village Construction: A Multi-Level Governance Approach to Enhance Agroecological Efficiency. *Agriculture (Switzerland)*, *14*(3). https://doi.org/10.3390/agriculture14030478

Ririn Yulianti, Mira Andriani, & Widya Yeshiana. (2025). Model Pengembangan Desa Cerdas (Smart Village) Dengan Pendekatan Penta-Helix Untuk Mewujudkan Kemandirian Masyarakat Desa Di Era Society 5.0. *Moderat : Jurnal Ilmiah Ilmu Pemerintahan*, *11*(1), 132–138. https://doi.org/10.25157/moderat.v11i1.4503

Siti Khaerunisa1✉, U. S. M. I. R. (2024). *Implementasi Smart Village dalam Mewujudkan Desa Digital di Desa Cijantra Kecamatan Pagedangan Kabupaten Tangerang*.

Stojanova, S., Lentini, G., Niederer, P., Egger, T., Cvar, N., Kos, A., & Duh, E. S. (2021). Smart villages policies: Past, present and future. In *Sustainability (Switzerland)* (Vol. 13, Issue 4, pp. 1–28). MDPI AG. https://doi.org/10.3390/su13041663

Susanti, E., Harta, R., Diana, B. A., & Utami, S. B. (2023). A Co-Production Model of Digital Village Transformation in Indonesia. *Public Policy and Administration*, *22*(4), 488–502. https://doi.org/10.13165/VPA-23-22-4-08

Susilowati, A. P. E., Rachmawati, R., & Rijanta, R. (2024). Does the digital divide matter? Comparison between Java and the rest of Indonesia in developing smart villages. *Human Geographies*, *18*(2). https://doi.org/10.5719/hgeo.2024.182.6

Telkom Indonesia. (2020). *Dukung Digitalisasi dan Perkembangan Ekonomi Desa, Telkom Hadirkan Smart Village Nusantara*.

Tian, Y., Liu, Q., Ye, Y., Zhang, Z., & Khanal, R. (2023). How the Rural Digital Economy Drives Rural Industrial Revitalization—Case Study of China's 30 Provinces.

DOI: 10.26618

Sustainability (Switzerland), *15*(8). https://doi.org/10.3390/su15086923

Wang, P., Li, C., & Huang, C. (2023). The Impact of Digital Village Construction on County-Level Economic Growth and Its Driving Mechanisms: Evidence from China. *Agriculture (Switzerland)*, *13*(10). https://doi.org/10.3390/agriculture13101917

Xie, G., Tian, Y., Huang, L., Li, M., & Blenkinsopp, J. (2025). What Kind of Rural Digital Configurations Contribute to High County-Level Economic Growth? A Study Conducted in China's Digital Village Pilot Counties. *Systems*, *13*(6). https://doi.org/10.3390/systems13060488

Xing, Z., Zhao, S., & Wang, D. (2023). Performance and sustainability evaluation of rural digitalization and its driving mechanism: evidence from Hunan province of China. *Frontiers in Environmental Science*, *11*. https://doi.org/10.3389/fenvs.2023.1326592

Zhang, X., & Zhang, Z. (2020). How do smart villages become a way to achieve sustainable development in rural areas? Smart village planning and practices in China. *Sustainability (Switzerland)*, *12*(24), 1–20. https://doi.org/10.3390/su122410510

Zhao, Y., & Li, R. (2022). Coupling and Coordination Analysis of Digital Rural Construction from the Perspective of Rural Revitalization: A Case Study from Zhejiang Province of China. *Sustainability (Switzerland)*, *14*(6). https://doi.org/10.3390/su14063638