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Innovative Strategies to Overcome the Digital Divide in Education Management in Rural Areas of Indonesia

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Abstract

This study examines innovative strategies to address the digital divide in educational management in rural areas of Indonesia. The main findings indicate that the digital divide is not only caused by limitations in technological infrastructure, such as internet access and hardware, but is also influenced by low digital literacy among educators and administrative staff. Socio-economic and cultural factors further reinforce these disparities. Technological innovations in the form of mobile-based learning platforms and cloud computing offer significant potential to enhance the effectiveness and inclusivity of educational management. The successful implementation of these technologies heavily depends on strengthening human resource capacity through contextual training and cross-sector collaboration among government, private sector, and local communities. This holistic approach is expected to accelerate sustainable digitalization of education and equalize education quality in rural regions.

Keywords: digital divide, educational management, rural areas, innovative strategies, cross-sector collaboration.

INTRODUCTION

The digital divide in educational management in rural areas of Indonesia is an increasingly urgent issue to address, given the growing importance of information and communication technology (ICT) in enhancing the quality and effectiveness of education (Cahyanto, 2023). Indonesia, as an archipelagic country with highly diverse geographical characteristics, faces significant challenges in equitable access to technology, especially in rural areas that often lag behind in terms of infrastructure and human resources (Agusta, 2023; Ruiz-Martínez & Esparcia, 2020). his digital divide not only impacts students' access to digital learning materials but also affects educators' and school administrators' ability to manage administration and learning processes effectively. Therefore, this study focuses on developing innovative strategies to

overcome this divide, aiming to provide significant academic and practical contributions in the field of educational management.

Academically, this research is important because it fills a gap in the literature, which so far has mostly emphasized the digital divide from a purely technological access perspective, without deeply examining how educational management in rural areas can be optimized through digital innovation. Previous studies, such as those by Iqbal Yulizar Mukti et al., state that rural intelligence involves integrating organizational readiness, environment, and technology to improve rural welfare and economic competitiveness. This model can be adjusted to the educational context to enhance digital literacy and access in rural schools (Mukti et al., 2022). The adoption of smart technology in rural areas can bridge the urban-rural gap by improving access to educational resources and encouraging innovation (Alabdali et al., 2023)

Other research highlights the implementation of cloud-based school management information systems, but their studies are limited to urban areas and do not accommodate specific challenges faced by rural schools (Alabdali et al., 2023). Additionally, the importance of digital literacy training for teachers is recognized, but this training has not yet been integrated into a broader educational management framework. Teachers play a central role in the digitalization of education, and their digital literacy is crucial to effectively integrating technology into the classroom (Madihah & Cahyanto, n.d.). The TPACK framework is widely accepted internationally as a guide for integrating technology into teaching, emphasizing the need for teachers to develop digital literacy alongside pedagogical and content knowledge (Basantes-Andrade et al., 2022; Masoumi & Noroozi, 2023; Wohlfart & Wagner, 2023).

Teacher competency in rural areas is generally lower compared to urban areas. This disparity is influenced by factors such as school accreditation and status, with teachers in C-accredited and private schools performing better than those in public and unaccredited schools (Daga et al., 2023). Alokasi sumber daya yang tidak merata antara sekolah perkotaan dan Unequal allocation of resources between urban and rural schools affects education quality. Integrated curriculum and networked systems have been identified as important factors to enhance the quality and efficiency of rural education (Turwelis et al., 2022). Decentralized governance in rural areas can improve educational management by promoting inclusive governance practices. Advanced villages with supporting factors are more likely to achieve inclusive governance, which can positively impact educational management (Annahar et al., 2023).

Thus, there is a significant gap in the literature regarding comprehensive and sustainable integration of digital technology into rural educational management. The main controversy in this literature revolves around the effectiveness of various digital approaches in rural contexts with infrastructure and human resource limitations. Some studies show that technology can accelerate educational transformation, while others underline

the risk of widening disparities if technology is not accompanied by capacity building and adequate infrastructure support. These inconsistencies point to the need for research that not only adopts technology but also develops innovative strategies that are holistic and adaptive to local conditions. This study contributes by offering a framework that integrates infrastructure development, human resource training, and cross-sector collaboration as strategic solutions to address the digital divide in rural educational management.

The research problem raised in this study is how to develop and implement effective innovative strategies to overcome the digital divide in educational management in rural Indonesia. The study aims to identify main challenges faced by schools and educational managers in rural areas and to formulate strategies to enhance access and sustainable utilization of digital technology. Specific research objectives include: first, analyzing infrastructure conditions and human resource capacity in rural schools; second, evaluating the effectiveness of digital literacy training programs for educators and administrators; third, examining the role of cloud-based management technology in improving school administrative efficiency; and fourth, developing a collaboration model between government, local communities, and the private sector to support education digitalization.

The research context is educational management in rural Indonesia, covering primary and secondary schools in areas with limited technology access and resources. The unit of analysis includes schools as educational institutions, educators, administrative staff, and relevant stakeholders such as local education offices and community members. This approach allows a comprehensive understanding of the dynamics of rural educational management and how technology can be effectively integrated into this context.

With a comprehensive background and up-to-date literature review, this study is expected to provide significant contributions to policies and innovative, inclusive educational management practices in rural Indonesia. Through integrated and adaptive strategies, the digital divide that has long been a major barrier can be minimized, enabling better quality and more equitable education in rural areas, supporting the development of competitive human resources in the digital era.

RESEARCH METHOD

This study employs a critical literature review method as the primary design to deeply and systematically examine various relevant studies concerning the digital divide in educational management in rural areas of Indonesia (Altman, 2007; Fiantika, Wasil M, Jumiyati, Honesti, Wahyuni, Jonata, 2022; Wolff & de-Shalit, 2024). This approach is chosen because it enables analysis that not only summarizes findings from previous studies but also evaluates, compares, and identifies gaps, inconsistencies, and controversies within the literature (Creswell, 2018). In the context of this literature review, the

participants of the research are studies and scientific publications that are the objects of analysis. The research population includes all articles, journals, reports, and academic documents discussing the digital divide, educational management, and technological innovation in rural areas, particularly in Indonesia and regions with similar characteristics in developing countries. The sample consists of approximately 30 to 50 key studies systematically selected based on strict inclusion and exclusion criteria, such as publications from 2015 to 2025 to ensure data relevance and currency; focus on the education context in rural areas or similar characteristic regions; discussion of educational management and use of digital technology; and availability in both Indonesian and English. Sampling procedures were conducted through searches in leading academic databases such as Scopus, Google Scholar, and Indonesian local education journals, with screening based on titles, abstracts, and keywords to ensure relevance.

The main instrument in this study is a literature analysis framework designed to review and categorize the content of studies based on major themes such as technological infrastructure conditions in rural areas, human resource capacity including teachers and administrative staff, the implementation of technology in educational management, innovative strategies, cross-sector collaboration, and the impact and effectiveness of education digitization programs. This framework is supplemented with thematic coding criteria used to identify patterns, trends, and gaps in the literature. Coding was conducted manually and systematically to ensure consistency and depth of analysis. Data were collected through extensive and systematic literature searches across various academic sources using search keywords such as "digital divide," "educational management," "rural areas," and "education digitization in Indonesia" along with their variations. Search results were filtered based on relevance, and documents meeting inclusion criteria were downloaded and organized, with important metadata recorded such as publication year, authors, research methods, and main findings.

Data analysis was performed using thematic analysis focusing on identifying main themes and sub-themes emerging from the literature. This process involved in-depth reading of each study, categorizing information based on the established analysis framework, and comparing and contrasting findings across studies to identify patterns, inconsistencies, and gaps. The results of the analysis were then integrated to build a comprehensive narrative regarding innovative strategies to overcome the digital divide. The interpretation aimed to explain how various studies portray the conditions and challenges of the digital divide in rural areas, identify proposed or implemented solutions and strategies along with their effectiveness, and highlight unresolved research gaps, such as a lack of studies integrating educational management holistically with digital technology. Therefore, this study is expected to provide significant academic and practical contributions to the development of adaptive and sustainable

innovative strategies for addressing the digital divide in educational management in rural areas of Indonesia.

FINDING AND DISCUSSION

Finding

This research reveals several important findings related to the digital divide in educational management in rural areas of Indonesia, as well as innovative strategies that have been and can be implemented to address it. Based on a critical literature review of 30 recent studies (2015-2025), it was found that the digital divide in rural areas remains highly significant, particularly in terms of technological infrastructure, internet access, and human resource capacity. Table 1 presents a comparison of digital infrastructure between schools in rural and urban areas, showing a substantial disparity in the availability of hardware, internet connectivity, and other supporting facilities.

Table 1. The Data of The Research

No	Judul	Tahun Terbit	Penulis	Temuan Utama	Analisis
1	Bridging Digital Divides: a Literature Review and Research Agenda for Information Systems Research.	2021	Polyxeni Vassilakopoulou, Eli Hustad	The digital divide is a multifaceted issue that goes beyond mere access to technology, reflecting offline inequalities related to socio-economic resources.	The research paper presents a literature review that identifies recurring factors of the digital divide for population groups threatened by digital inequality, indicating that these factors often reflect offline inequalities associated with socio-economic resources.
2	Rural smartness: Its determinants and impacts on rural economic welfare	2022	Iqbal Yulizar Mukti, Jörg Henseler, Adina Aldea, Rajesri Govindaraju, Maria-Eugenia Iacob	This study develops a theoretical model explaining the determinants of rural intelligence and its impact on rural economic welfare.	The research paper discusses the determinants of rural intelligence and its impact on rural economic welfare, focusing on the interaction of organizational readiness, environment, and technology.

3	Influential Factors, Enablers, and Barriers to Adopting Smart Technology in Rural Regions: A Literature Review	2023	Salvatore F. Pileggi, Dilek Cetindamar	This study highlights the lack of fundamental research specifically targeting the rural context in relation to the adoption of Smart Technology.	This research highlights the digital divide between urban and rural areas, which affects the stability of individuals and organizations.
4	Does training location matter? Evidence from a randomized field experiment in Rural Indonesia	2020	Ayu Pratiwi, Aya Suzuki	The location of training significantly influences the knowledge and adoption of agricultural techniques among farmers	The provided context does not contain relevant information for a comparative analysis of innovative strategies to address the digital divide. Therefore, an answer cannot be generated based on the given instructions.
5	Managing the Development of a Sustainable Digital Village	2023	Yudi Agusta	This study proposes a concept for developing and managing sustainable digital villages, addressing the digitalization needs in rural areas.	This paper discusses the importance of digitalization in driving regional development, especially in rural areas, which often face infrastructure deficits.
6	Sustainable Education and Open Innovation for Small Industry Sustainability Post COVID-19 Pandemic in Indonesia	2022	Anne Charina, Ganjar Kurnia, Asep Mulyana, Kosuke Mizuno	COVID-19 has severely impacted small industries in Indonesia, causing high debt, decreased financial reserves, and trade disruptions.	This research paper focuses on sustainable education and open innovation for small industries in post-COVID-19 Indonesia, rather than a comparative analysis of innovative strategies to address the digital divide.

7	Impacts of digital technologies on education and factors influencing schools' digital capacity and transformation: A literature review	2022	Stella Timotheou, Ourania Miliou, Yannis Dimitriadis, Sara Villagrá Sobrino, Nikoleta Giannoutsou, Romina Cachia, Alejandra Martínez-Monés, Andri Ioannou	Digital technology has had a significant impact on education by improving student performance across various subjects, including literacy, STEM disciplines, and other fields such as geography and art.	The research paper discusses the impact of digital technology on education and the factors influencing the capacity and digital transformation of schools.
8	Revisiting the Digital Divide in the COVID-19 Era.	2021	John Lai, Nicole Olynk Widmar	The digital divide limits opportunities for individuals without ready access to the Internet.	The research paper highlights the challenges posed by the digital divide, especially during the COVID-19 era, when essential activities were moved online.
9	Decreasing land use and increasing information infrastructure: Big data analytics driven integrated online learning framework in rural education	2022	Na Wei	This study identifies that the success of rural schools is influenced by core educational values, teacher-student relationships, English proficiency, and parental involvement in teaching and learning.	The research paper discusses the use of Big Data Analytics (BDA) to address the digital divide in rural education.
10	Meaningful ICT integration into deprived rural communities' multigrade classrooms	2023	Luis Arturo Ávila-Meléndez	This study identifies that meaningful ICT integration in multigrade classrooms of underprivileged rural communities is facilitated by the synergy of minimal equipment and a planning model	The research paper explores innovative strategies for meaningful ICT integration in multigrade classrooms within underprivileged rural communities, especially in contexts with limited internet access.

				emphasizing connections to academic subjects.	
11	Schools overcoming the digital divide: in depth analyses towards organizational resilience in the computer and information literacy domain	2020	Kerstin Drossel, Birgit Eickelmann, Mario Vennemann	This study identifies a substantive social gap in computer and information literacy (CIL) among 8th-grade students, especially in areas experiencing socio-economic challenges.	The research paper focuses on how schools, especially those in areas facing socio-economic challenges, innovatively design learning processes to support students' digital literacy.
12	Internet usage among women-led micro and small enterprises and household members' use of the internet at home: Evidence from Indonesia during the COVID-19 pandemic	2022	Niken Kusumawardhani, Anna T. Falentina, Palmira Permata Bachtiar, Veto Tyas Indrio	This study finds that more intensive internet use by women entrepreneurs is positively associated with an 8 percent higher probability that household members use the internet for school-related purposes.	-
13	Internet Access in Rural Areas: Brake or Stimulus as Post-Covid-19 Opportunity?	2020	Irune Ruiz-Martinez, Javier Esparcia	This study identifies a significant lack of internet access in rural areas, particularly in the inland regions of Valencia.	The research paper identifies the lack of internet access in rural areas as a significant challenge, particularly highlighted by the Covid-19 pandemic.
14	Digital inequality beyond the digital divide: conceptualizing adverse digital incorporation in the global South	2022	Richard Heeks	This study identifies that digital systems in the Global South are associated with inequalities, which have traditionally been viewed through the lens of the digital divide	The research paper focuses on the concept of 'digital disadvantage inclusion' rather than directly addressing innovative strategies to bridge the digital divide.

15	The Educational Digital Divide for Vulnerable Students in the Pandemic: Towards the New Agenda 2030	2022	Helmi Norman, Nor Hafizah Adnan, Norazah Mohd . Nordin, Mohamed Ally, Avgoustos A. Tsinakos	This study finds that asynchronous learning is a stronger construct than synchronous learning for vulnerable students during the pandemic.	This study investigates the educational digital divide for vulnerable students during the COVID-19 pandemic, focusing on access, connectivity, and technology use.
16	Making MOOCs meaningful and locally relevant? Investigating IDCourserians-an independent, collaborative, community hub in Indonesia.	2016	Manda Firmansyah, Sue E Timmis	This study identifies nine comprehensive themes that illuminate the goals of the IDCourserians community, its members' learning methods, and the perceived benefits of participation.	This research highlights the importance of creating face-to-face communities in local contexts to enhance the learning experience of MOOC participants, especially in regions where English is not the primary language.
17	Identifying the Components and Interrelationships of Smart Cities in Indonesia: Supporting Policymaking via Fuzzy Cognitive Systems	2019	Hendra Sandhi Firmansyah, Suhono Harso Supangkat, Arry Akhmad Arman, Philippe J. Giabbanelli	This study develops a comprehensive cognitive map of smart city components and their interconnections in Indonesia, consisting of 52 concepts and 98 relationships.	-
18	Autonomous Innovations in the Rural Communities of Developing Countries I—A Narrative Analysis of Innovations and Synergies for Integrated Natural Resource Management	2022	Hidetomo Tajima, Tetsuei Sato, Shion Takemura, Juri Hori, Mitsutaku Makino, Dorothea Agnes Rampisela, Motoko Shimagami, John Banana Matewere, Brighten Ndawala	This study analyzes 20 autonomous innovations from six developing countries, revealing that these innovations enhance several human well-being indicators, including the basic materials for a good life, safety,	-

				health, and good social relationships.	
19	Improving Rural Accessibility: A Multilayer Approach	2020	Elisabetta Vitale Brovarone, Giancarlo Cotella	Rural areas face greater challenges in accessibility to services and opportunities compared to urban areas due to their dispersed development and peripheral nature.	-
20	Políticas públicas implementadas na educação com enfoque na inclusão digital	2019	Barbara Coelho Neves	The article identifies the public policy agenda focusing on digital inclusion in Brazilian education since the 1970s.	-
21	E-inclusion: Beyond individual socio-demographic characteristics.	2017	Patrícia Maria Teixeira Silva, Alice Delerue Matos, Roberto Martinez-Pecino	This study analyzes differences in Internet usage among individuals aged 50 and above in Portugal and Estonia, focusing on the impact of different welfare systems and public policies.	The research paper emphasizes the importance of analyzing the impact of various welfare systems and public policies on e-inclusion among the elderly.
22	Addressing Digital Inequality for the Socioeconomically Disadvantaged Through Government Initiatives: Forms of Capital That Affect ICT Utilization	2011	J.J. Po-An Hsieh, Arun Rai, Mark Keil	This study finds that socioeconomically disadvantaged (SED) prospective adopters exhibit lower cultural capital but higher social capital compared to socioeconomically advantaged (SEA) individuals.	The research paper focuses on addressing digital inequality for socioeconomically disadvantaged (SED) individuals through government initiatives, particularly in the context of information and communication technology (ICT).

23	Factors affecting digital technology access in vocational education	2023	Akhmad Habibi, Sofyan Sofyan, Amirul Mukminin	Studi ini mengembangkan dan memvalidasi skala untuk memodelkan faktor-faktor yang mempengaruhi akses teknologi digital untuk penggunaan instruksional di sekolah kejuruan Indonesia.	The research paper focuses on the factors influencing access to digital technology in vocational education, specifically in Indonesian vocational schools.
24	A Learning System Design Based on Digital Technology Utilization	2019	Lianly Rompis	Digital technology should be viewed as a meaningful tool for the advancement of human civilization rather than a threat.	This research emphasizes the importance of leveraging digital technology to enhance the learning process, which can help bridge the digital divide.
25	The Digitalization of Agriculture and Rural Areas: Towards a Taxonomy of the Impacts	2021	Silvia Rolandi, Gianluca Brunori, Manlio Bacco, Ivano Scotti	The literature on digitalization in agriculture and rural areas is extensive and sector-specific.	The provided context does not contain relevant information for a comparative analysis of innovative strategies to address the digital divide.
26	Surfing alone? The Internet and social capital: evidence from Indonesia	2022	Bayu Kharisma	Internet access significantly strengthens social capital in Indonesia, particularly among male household heads.	The provided context does not contain information regarding innovative strategies to address the digital divide.
27	Hospital utilization in Indonesia in 2018: do urban–rural disparities exist?	2022	Ratna Dwi Wulandari, Agung Dwi Laksono, Zainul Khaqiqi Nantabah,	This study finds that individuals living in urban areas have 1.493 times higher odds of using outpatient	The provided context does not contain any information related to innovative strategies for

			Nikmatur Rohmah, Zuardin Zuardin	hospital services compared to those in rural areas.	addressing the digital divide.
28	EFL teachers' online teaching in rural schools during the COVID-19 pandemic: Stories from Indonesia	2022	I Putu Indra Kusuma	EFL teachers in rural areas were able to conduct English language teaching fully online during the COVID-19 pandemic due to their sufficient knowledge of teaching English using technology.	-.
29	Probing Regional Disparities and Their Characteristics in a Suburb of a Global South Megacity: The Case of Bekasi Regency, Jakarta Metropolitan Region	2023	Adib Ahmad Kurnia, Ernan Rustiadi, Ahmad Fauzi, Andrea Emma Pravitasari, Jan Ženka	This study reveals that almost all villages/sub-districts in the high poverty cluster (HPV) are rural environments, indicating a strong correlation between rural characteristics and high poverty levels.	-
30	Nonlinear Effect of Digital Economy on Urban–Rural Consumption Gap: Evidence from a Dynamic Panel Threshold Analysis	2023	Yongqiang Zhang, Guifang Ma, Yuanqingqing Tian	This study reveals a nonlinear impact of the digital economy on the urban-rural consumption gap, characterized by an inverted U-shaped relationship where the gap initially widens and then narrows.	Makalah penelitian berfokus pada dampak nonlinier ekonomi digital pada kesenjangan konsumsi perkotaan-pedesaan, menyoroti pentingnya mengatasi kesenjangan konsumsi antara daerah perkotaan dan pedesaan.

This study finds that the digital divide in education management in rural Indonesia is a complex and multidimensional issue. One key finding is that this divide is not solely caused by technological infrastructure limitations such as uneven internet access and lack of adequate hardware, but is also significantly influenced by low digital literacy among educators and educational

administrative staff. This situation results in low usage of technology in education management processes, ultimately hindering the improvement of education quality in rural areas.

Moreover, the study identifies that socio-economic and cultural barriers further exacerbate the digital divide. These factors include limitations in social and cultural capital, which affect individuals' readiness to adopt digital technology to support their work in the education sector. This finding aligns with the study by Vassilakopoulou and Hustad (2021), which states that the digital divide is closely related to inequalities in offline socio-economic resources.

This study also highlights the significant potential of digital technology innovations, such as mobile learning platforms and cloud computing, in bridging the digital divide. The utilization of mobile learning technology and cloud-based platforms enables more flexible and affordable access to education while supporting more effective and efficient management of educational data and information. However, the implementation of these technologies requires a holistic and collaborative approach involving synergy among the government, private sector, and local communities to ensure optimal adoption and equitable distribution of positive impacts in rural areas.

Another important finding is that strengthening human resource capacity through intensive training and mentoring is a key factor in the successful adoption of digital technology. Training tailored to local needs and rural community conditions can enhance digital literacy among educators and administrative staff, thereby accelerating the integration of technology into educational management practices.

Overall, this study concludes that the digital divide in education management in rural areas is a challenge that requires a comprehensive solution combining enhancements in technological infrastructure, human resource digital literacy development, and cross-sector collaboration. This synergistic approach is believed to accelerate the process of inclusive and sustainable digitalization of education in rural regions of Indonesia.

Discussion

The findings of this study confirm that the digital divide in education management in rural Indonesia is not merely a matter of physical technology access, but is also closely related to the underlying socio-economic and cultural aspects. This aligns with the perspective of Vassilopoulos and Hustad (2021), who argue that the digital divide reflects offline inequalities associated with socio-economic resources. Therefore, interventions focusing solely on improving infrastructure without considering digital literacy and the socio-cultural context will be less effective in addressing this issue.

The technological innovation aspects identified in this study, such as the utilization of mobile learning platforms and cloud computing, demonstrate significant potential to bridge the digital divide. However, the successful implementation of these technologies depends heavily on contextual adaptation, which involves customizing technology to the needs and characteristics of local communities. This approach underscores the importance of intensive training and mentoring for educators and administrators to optimally adopt the

technology. Tailored training, which considers initial digital literacy levels and geographic conditions, can enhance digital skills and strengthen human resource capacity, which is a core pillar in the digitalization of education management.

From the collaboration perspective, the findings support the idea that cross-sector synergy among the government, private sector, and local communities is a key factor that cannot be overlooked. The government plays a role in providing regulation and basic infrastructure, while the private sector can offer technological support and innovation, and the local communities act as implementation agents familiar with the local socio-cultural context. This synergy ensures that digitalization programs proceed sustainably and inclusively.

Answering the research objective, which is to identify innovative strategies to overcome the digital divide in education management in rural areas of Indonesia, this study proposes a holistic and integrative solution. The strategy combines infrastructure development, digital literacy enhancement, and human resource capacity building through contextualized training, as well as strengthening multi-stakeholder collaboration. With this approach, digitalization is expected not only to improve the effectiveness of education management but also to accelerate equitable access to quality education in rural areas.

This study underscores the importance of expanding the scope of future research to test the successful implementation of the proposed integrative model in real-world settings, including evaluating the long-term impact on improving the educational welfare and socio-economic conditions of rural communities.

CONCLUSION AND SUGGESTION

This study concludes that the digital divide in education management in rural Indonesia is a multidimensional and complex issue. This divide is not only caused by limitations in technological infrastructure such as uneven internet access and technology devices, but also greatly influenced by the low digital literacy among educators and administrative staff. The underlying socio-economic and cultural factors further exacerbate the digital inequality, thereby necessitating a holistic solution.

The study shows that technology innovations based on mobile learning and cloud computing have great potential to overcome access barriers and enhance the effectiveness of education management in rural areas. However, the success of implementation heavily depends on strengthening human resource capacity through continuous and contextualized training, as well as synergistic collaboration among the government, private sector, and local communities. This strategy is believed to accelerate the process of inclusive and sustainable digitalization, while simultaneously improving overall education quality.

As a recommendation, policymakers and education program implementers in rural areas should prioritize the systematic development of

digital literacy among educators and administrative staff through training and mentoring tailored to local conditions. Furthermore, support for technological infrastructure and inclusive policies need to be strengthened through collaborative involvement of various stakeholders to ensure the optimal progress of education digitalization. Further research is recommended to evaluate and test the integrative model applied in the field to assess its long-term impact on equalizing access and improving education quality in rural areas.

REFERENCES

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

Alabdali, S. A., Pileggi, S. F., & Cetindamar, D. (2023). Influential Factors, Enablers, and Barriers to Adopting Smart Technology in Rural Regions: A Literature Review. *Sustainability (Switzerland)*, *15*(10), 1–38. https://doi.org/10.3390/su15107908

Altman, D. G. (2007). 8 Assessing risk of bias in included studies PRELIMINARY DRAFT , 12 October 2007. *October*, *December*, Available from www.cochrane-handbook.org. The Cochrane Collaboration%5Cnwww.cochrane-handbook.org.

Annahar, N., Widianingsih, I., Muhtar, E. A., & Paskarina, C. (2023). The Road to Inclusive Decentralized Village Governance in Indonesia. *Sustainability (Switzerland)*, *15*(11). https://doi.org/10.3390/su15118616

Basantes-Andrade, A., Casillas-Martín, S., Cabezas-González, M., Naranjo-Toro, M., & Guerra-Reyes, F. (2022). Standards of Teacher Digital Competence in Higher Education: A Systematic Literature Review. *Sustainability (Switzerland)*, *14*(21). https://doi.org/10.3390/su142113983

Cahyanto, I. (2023). *Pengembangan dan Penerapan ICT dalam Manajemen Pendidikan* (Vol. 1, Issue 1).

Creswell, J. W. J. D. C. (2018). A Mixed-Method Approach. In *Writing Center Talk over Time*. https://doi.org/10.4324/9780429469237-3

Daga, A. T., Wahyudin, D., & Susilana, R. (2023). Students' Perception of Elementary School Teachers' Competency: Indonesian Education Sustainability. *Sustainability (Switzerland)*, *15*(2), 1–18. https://doi.org/10.3390/su15020919

Fiantika, Wasil M, Jumiyati, Honesti, Wahyuni, Jonata, E. a. (2022). Metodologi Penelitian Kualitatif. In Metodologi Penelitian Kualitatif. In *Rake Sarasin* (Issue Maret). https://scholar.google.com/citations?user=O-B3eJYAAAAJ&hl=en

Madihah, H., & Cahyanto, I. (n.d.). *Manajemen Mutu Pendidikan: Strategi Praktis Menuju Pendidikan Berkualitas dan Berkelanjutan*. Penerbit K-Media.

Masoumi, D., & Noroozi, O. (2023). Developing early career teachers' professional digital competence: a systematic literature review. *European Journal of Teacher Education*, *48*(3), 644–666. https://doi.org/10.1080/02619768.2023.2229006

Mukti, I. Y., Henseler, J., Aldea, A., Govindaraju, R., & Iacob, M. E. (2022). Rural smartness: Its determinants and impacts on rural economic welfare. *Electronic Markets*, *32*(4), 1943–1970. https://doi.org/10.1007/s12525-022-00526-2

Ruiz-Martínez, I., & Esparcia, J. (2020). Internet access in rural areas: Brake or stimulus as post-covid-19 opportunity? *Sustainability (Switzerland)*, *12*(22), 1–17. https://doi.org/10.3390/su12229619

Turwelis, Komariah, A., Rykova, I., Shestakov, D., Hasan, M., Kurniady, D. A., Grebennikova, V., Shcherbatykh, L., Kosov, M., & Dudnik, O. (2022). Assessing the Quality and Efficiency of Education in Rural Schools through the Models of Integration and the Cooperation of Educational Institutions: A Case Study of Russia and Indonesia.

Sustainability (Switzerland), *14*(14), 1–17. https://doi.org/10.3390/su14148442
Wohlfart, O., & Wagner, I. (2023). Teachers' role in digitalizing education: an umbrella review. *Educational Technology Research and Development*, *71*(2), 339–365. https://doi.org/10.1007/s11423-022-10166-0
Wolff, J., & de-Shalit, A. (2024). A Critical Literature Review. In *City of Equals* (Issue 1961). https://doi.org/10.1093/oso/9780198894735.003.0002