



Digital Village: Can it Promote Sustainable Rural Development in Indonesia?

Ni Kadek Sinarwati^{1*}, I Nengah Suarmanayasa², Salut Muhidin³, Luh Gede Elvina Adi Saputri⁴, Pardomuan Robinson Sihombing⁵, Ngurah Eka Utama Putra⁶

^{1,6} Economic and Accounting Department, Economic Faculty, Ganesha Education University, Singaraja, Indonesia

² Management Department, Economic Faculty, Ganesha Education University, Singaraja, Indonesia

³ Faculty of Macquarie Business School, Macquarie University, Sydney, Australia

⁴ International Marketing Management, eLBajo Commodus Polytechnic, Labuan Bajo, Indonesia

⁵ BPS Statistics Indonesia

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ABSTRACT

Sustainable development has been widely discussed since the establishment of the Sustainable Development Goals (SDGs). However, empirical evidence on rural sustainable development remains limited and inconclusive. This study addresses this gap by examining the role of digital villages in promoting sustainable rural development across Indonesia. The novelty of this research lies in its large-scale analysis covering villages nationwide rather than focusing on a single case study. This study employs a quantitative associative approach using secondary data collected through documentation methods. Data were obtained from the Ministry of Villages, Development of Disadvantaged Regions, and Transmigration, as well as the Central Statistics Agency. Digital village indicators include the proportion of villages with 4G internet access and cable telephone subscriptions, while sustainable rural development is measured using the Village Development Index (VDI), which integrates economic, social, and environmental dimensions. The results reveal that digital villages have a significant and positive effect on sustainable rural development. Economically, digitalization enhances the marketing of agricultural products and improves productivity. Socially, it contributes to more accurate and efficient data collection, particularly in identifying poverty levels. Environmentally, digital villages support ecological efficiency in agricultural practices. These findings highlight the strategic role of digital infrastructure in accelerating rural development and achieving sustainability goals in Indonesia.

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1. INTRODUCTION

This research aims to analyze the role of village digital technology in promoting rural sustainable development. The researchers conducted this study because, *first*, sustainability is the main focus of the country's development goals. *Second*, the Indonesian Government, especially the Village's Ministry, Development of Disadvantaged Regions, and Transmigration/ VMDDR, set sustainable development goals until the level village/village SDGs. *Third*, the MCI has a Digital Village or Village Internet Access program, so analyzing whether Village Digital contributes to rural sustainable development is urgent. This research is quantitative associative research that uses multiple regression analysis techniques. The data used is Secondary data were accessed from the websites of the VMDDRT, and the Central Statistics Agency. Research has found that digital villages can promote sustainable rural development.

The theme of sustainable development is widely discussed among academics and has become a research topic since the end of the Millennium Development Goals/MDGs era. This theme has become the focus of studies on global development (B. Liu et al., 2023). Sustainable development is an approach that prepares the needs of future generations while meeting the needs of current generations (Kasztelan, 2017). Sustainable development emphasizes economic, social, and environmental (Armeanu et al., 2018); (Harangozo et al., 2018); (Hejnowicz et al., 2022). Sustainable development integrates economic, social, and environmental improvements (Harangozo et al., 2018); (Mensah, 2019); (Hejnowicz et al., 2022). Research on rural sustainable development from a holistic perspective is still limited (B. Liu et al., 2023); (Lin & Hou, 2023).

Previous research reviewing rural development has only focused on economic aspects (Ioan et al., 2020); (Hussain et al., 2023), while the study of social and environmental aspects is still limited. Although there is a study on sustainable rural development with reviews of non-economic fields, the analysis is only conducted in one village (Ayu Purnamawati et al., 2023). The limitations of previous studies that have only focused on one

village are that the research findings cannot be generalized and only held in that area. This condition was the motivation for this research.

Sustainable rural development is the development of rural areas that synergizes development in the economic, social, and environmental fields. Sustainable rural development strengthens the rural economy, social development, and aspects of the rural environment (He et al., 2020). Determinants of sustainable development include rural tourism (Yanan et al., 2024); village accountability performance (Dhanda et al., 2023), and the implementation of information and communication technology and ICT in villages (Ayu Purnamawati et al., 2023). This study aims to analyze the role of digital villages in sustainable rural development. The findings are useful for policy determination to accelerate the achievement of sustainable rural development and realize the welfare of village communities.

Information and Communication Technology (ICT) is a medium for collecting, analyzing, utilizing, and disseminating information. The use of IT in all areas of life has provided convenience, resulting in time efficiency in completing work. The ICT used in daily activities includes computers, telecommunication facilities, the Internet, hardware, and software. The use of ICT has been found to increase the entrepreneurial orientation of business actors (Gomes & Lopes, 2022) support business sustainability (Asongu et al., 2023), establish sustainable tourism (Gössling & Michael Hall, 2019), ensure income distribution (Herrera et al., 2023) and encourage economic growth in Korea (Tao et al., 2023).

The use of ICT in various areas of life is called digitalization. Digitalization is a strategy for sustainable development (Babkin et al., 2022). The rapid pace of digitalization development in almost all sectors and fields of activities to support people's lives creates prospects for the country's economy while spreading economic security issues (Panshin et al., 2021).

Digitalization, in terms of territoriality, occurs in urban and rural areas. Digitalization in rural areas can be found in the management of government administration, and the inclusion of 4G Internet networks in villages called digital villages. Digital villages are a rural development strategy that improves internet networks in rural areas. This strategy began to emerge in 2018 and has benefits for rural development; therefore, it is expected to reduce the gap between urban and rural development (Ziemba, 2021).

The Government of the Republic of Indonesia is intensively implementing programs to increase internet access in rural areas. This program aimed to increase development in rural areas to reduce the development gap between urban and rural areas. Since the launch of the Nawacita Development Program, building the State of Indonesia from marginalized areas, which is the third program, the focus on rural development has increased (Setiawan, 2019). Digital villages can increase the involvement of various generations in rural development, thus encouraging sustainable rural development (Ayu Purnamawati et al., 2023). This study examined the influence of digital villages on sustainable rural development in all villages in Indonesia. The difference between this study and previous studies that analyzed sustainable rural development lies in two aspects: the unit of analysis and the previous type of research only analyzed one village using primary data (Ayu Purnamawati et al., 2023), whereas this study analyzed all villages in Indonesia using secondary data. The second difference lies in sustainable development indicators, which uses the Village Development Index (VDI), which is a combination of the Social, Economic, and Environmental Resilience Index, while the previous study analyzed sustainable development in the economic field (W. Liu et al., 2022); (Hussaina et al., 2023); (Z. Wang & Jia, 2022); (Ioan et al., 2020).

Development is a continuous change towards a better direction. Development in terms of focus area is divided into economic, social, and environmental development. Judging from territoriality, development comprises urban and rural development. Rural development aims to reduce poverty and improve the welfare of rural communities. Rural development at this time not only emphasizes the economic field, but sustainable development in rural areas also pays attention to social and environmental aspects. Determinants of sustainable development: findings of previous research on rural innovation (B. Liu et al., 2023) and the use of information technology (K. K. Makun & Jayaraman, 2020); (Dabbous & Tarhini, 2021); (Nogueira et al., 2022); (Asongu et al., 2023).

The use of ICT in rural areas is found in web-based village government administration management, digital marketing and sales carried out by rural micro-enterprises, the use of certain applications by farmers in marketing products, the use of mobile-based software in the management of village-owned enterprises and BUMDes, and other forms of ICT use. The use of ICT is an important effort to modernize agriculture and the lives of rural communities (Bakker & Ritts, 2018). The use of ICT in rural areas has been found to promote economic growth (P. Wang, 2023); (Han et al., 2023). The ability to have 4G Internet access in rural areas can support the promotion of tourism. ICT has a positive effect on sustainable tourism development (Gössling, 2019). The introduction of rural cultures and the growth of cultural tourism impact preservation efforts, while the use of ICT in these areas fosters long-term economic growth and poverty reduction. (Huang et al., 2023). The conceptual framework of this research is shown in Figure 1.

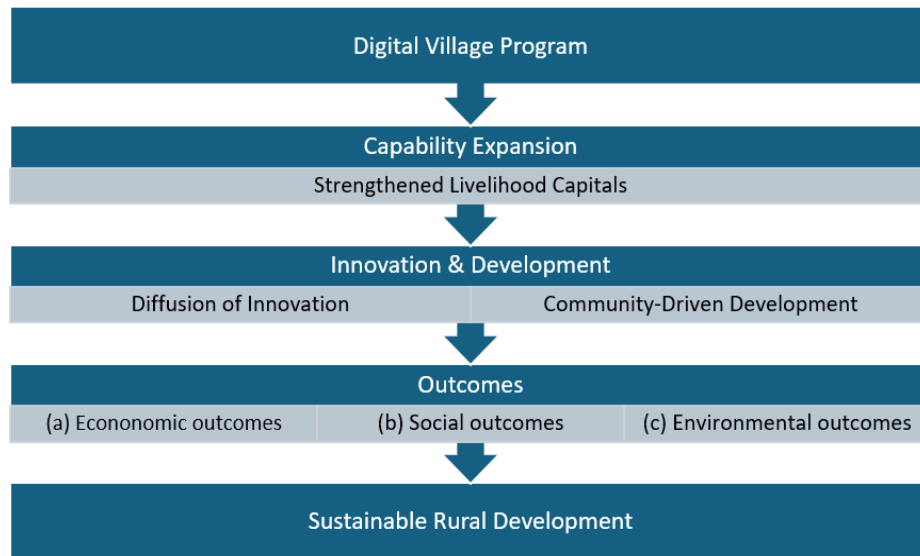


Figure 1. The Conceptual Framework of this research
Source: Author's thoughts, 2026

Hypothesis: The implementation of digital villages has a significantly positive impact on the implementation of sustainable rural development.

2. METHOD

This research is a type of associative quantitative research, which is a study that analyzes the influence of independent variables on dependent variables (Sugiyono, 2010);(N. K. Sinarwati & Sihombing, 2024). The independent variable was digital villages, and the dependent variable was sustainable rural development. Secondary data were used. Secondary data are those that have been completed and collected by other parties. Data were collected using documentation methods.

Digital villages are measured by the proportion of villages that access the 4G Internet and the proportion of villages subscribing to cable phones, according to research (Clinton, 2023). The proportion of villages with Internet access in each province is calculated using the number of villages with 4G Internet access divided by the number of villages in the province. The same method was used to calculate the proportion of villages subscribing to the landlines. The number of samples is 33 provinces in Indonesia, except Jakarta. Data is the value of internet access, the proportion of cable phone use and the Building Village Index which is the aggregate value at the provincial level. These data were collected through the Central Bureau of Statistics website by downloading the Statistical Yearbook of Indonesia 2022. Sustainable rural development is measured by the Village Development Index (VDI), referring to research (Manoby et al., 2021);(N. K. S. Sinarwati & I Nengah Suarmanayasa, 2023). The VDI can be used as a proxy for sustainable rural development because it is a composite index consisting of the Economic Resilience Index (RI), Social RI, and Environmental RI. These data were obtained from the VMDDRT website by searching Google and typing the keywords VDI. The data were analyzed using MLR analysis techniques because this research analyzes the relationship between more than one independent variable and one dependent variable.

3. RESULT AND DISCUSSION

Statistical analysis indicates a positive and significant correlation between the proportion of villages with 4G internet access, cable phone subscriptions, and sustainable rural development. Descriptive statistics of the data are presented in Table 1.

Table 1. Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Dev
The proportion of villages with 4G internet access	33	.17	.95	.7245	.17971
Proportion of villages subscribed to cable phone	33	.001	.13	.0212	.03008
Sustainable rural development	33	.46	.80	.6588	.06707

Source: Results of statistical analysis (2026)

Table 1 data shows from 33 provinces in Indonesia in 2021. The proportion of villages with internet access to a minimum value of 0.17 is found in Papua Province. This means that the number of 4G internet access villages in 2021 is 930 villages divided by the number of villages in Papua Province, as many as 5,555, resulting in 0.17. The percentage of villages with 4G internet access in Papua Province is 17 percent, and this is the lowest number. The highest proportion of internet-accessible villages is in Bangka Belitung Paluan. The number of villages with 4G internet access in Bangka Belitung Islands is 373 out of all 390 villages. Only 20 villages, or five percent of Bangka Belitung Islands, have not accessed 4G internet in 2021. The minimum proportion of villages subscribing to the landlines was 0.001. This occurred in Gorontalo Province. The number of villages subscribing to cable phones in Gorontalo Province was one out of 734. The highest percentage of villages subscribing to landlines was 0.13 in Bali Province. 92 villages have subscribed to cable phones out of 716 existing villages, so the percentage of villages that subscribe to cable phones is the highest in Bali Province, at 13 percent.

The minimum amount of data on sustainable rural development (0.46) is found in Papua Province, and the highest data of 0.80 is in Bali Province. Sustainable rural development This research is measured by the number of VDI, which is a combination of economic, social, and environmental RI. Papua Province, which has the lowest number of developing villages (0.46), shows that villages in Papua Province are still very underdeveloped. The index for developing villages in Bali Province is 0.80, indicating that villages in Bali Province are in the category of developed villages. Table 2 presents the determination coefficient (R^2) test results, which evaluate how effectively the independent variables collectively explain the dependent variables, with higher values indicating a better prediction model.

Table 2. Coefficient of Determination Test

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.824 ^a	.679	.658	.03924

Source: Results of statistical analysis (2026)

Data Table 2. Showing the above coefficient of determination of 0.658, it can be concluded that the proportion of 4G Internet access villages and the proportion of villages subscribing to cable phones as proxies of digital villages can explain the variation in Sustainable Rural Development by 65.8 percent and, the rest by other variables outside the model.

Table 3. Test Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	.486	.030		16.338	.000		
11 The proportion of villages with 4G internet access	.212	.043	.567	4.976	.000	.824	1.214
Proportion of villages subscribed to cable phone	.904	.254	.406	3.559	.001	.824	1.214

Source: Results of statistical analysis (2026)

Data Table 3. shows the proportion of 4G internet access villages has a positive significant impact on sustainable rural development, with an efficiency of 0.212 and t stat value=4.976>t table = 1.96 and prob value = 0.000< alpha = 0.05 so that every increase of 1 point The proportion of 4G internet access villages will increase 0.212 points of sustainable rural development assuming other variables constant. The proportion of villages subscribing to cable phones has a positive significant impact on sustainable rural development with an efficiency of 0.904 and a value of t stat=3,559 > t table=1.96, and a prob value = 0.001< alpha=0.05, so that every increase of 1 point, the proportion of villages subscribing to a cable phone will increase by 0.909 points of sustainable rural.

Table 4. Simultaneous test results

Model	Sum of Squares	df	Mean Square	F	Prob.Sig.
1 Regression	.098	2	.049	31.744	<.001 ^b
Residual	.046	30	.002		
Total	.144	32			

Source: Results of statistical analysis (2026)

Data Table 4. showing the value of $F_{stat}=31.744 > F_{table}=3.12$ and the value of $\text{sign prob}=0.00 < \alpha=0.05$ it can be concluded that the proportion of villages with 4G internet access and the proportion of villages subscribing to cable phones as digital village proxies have a significant and linear effect on sustainable rural development.

The digital village program is considered as a catalyst that strengthens the livelihood assets in rural areas by enabling rural populations to better adapt and thrive. Two concepts can be applied: First: Sustainable Livelihoods Framework (Rugr, 1991) can be used to understand how rural households leverage diverse forms of capital (human, social, financial, physical, and natural) to pursue livelihood strategies that are resilient and sustainable. Second (Sen, 1999) can also be used to extend that first perspective by framing digital access not merely as an infrastructure upgrade, but as a means of expanding individuals' real freedoms, opportunities, and agency to pursue lives they value. According to the Sustainable Livelihood Framework (SLF), the sustainability of community development is determined by the ability of households and communities to access and optimize five types of capital (livelihood assets), namely: human capital, social capital, financial capital, physical capital and natural capital. The five capitals will affect livelihood strategies that ultimately produce livelihood outcomes, such as: improving welfare, reducing poverty, increasing resilience, and ultimately realizing sustainable development (Alifia2023); (Ahmad, 2023); (Marshall, 2024). This research who found that digital village by using the proportion of villages with 4G internet access and Proportion of villages subscribed to cable phone as a proxy, can promote sustainable rural development in line with (K. Makun & Jayaraman, 2020).

The results of statistical analysis show that the proportion of villages with 4G internet access and the proportion of villages subscribing to cable phones as proxies from digital villages have a significant positive effect on sustainable development. 4G internet access to rural areas aims to level development. Before internet access reached rural areas, development was only concentrated in urban areas. The digital gap between villages and cities is one of the causes of the development gap. Digital village is a concept of village development supported by digital technology, such as the internet, telecommunications, and other information technology. The goal of the digital village is to improve the quality of life of the village community by providing access to better information and services, as well as to improve the village economy by increasing productivity and efficiency. Digital villages can also increase community participation in village development and strengthen social networks.

4G internet access in rural areas that give birth to digital villages can be seen in various areas of life in rural areas. In the fields of economics and agriculture, the success of internet access in villages supports the increase in the marketing of agricultural products. The cool young farming community, in Bali Province has implemented digital-based agriculture. Planting crops that begin with a survey of market needs is done in rural areas. This can happen in villages because of 4G internet access in rural areas. The improvement of the economy and the increase in the marketing of agricultural products in the Cool Young Farmers community are the positive impacts of the digital village program, this condition is in line with what happens in China, with the existence of internet access in rural areas encouraging the improvement of the economy of farmers (Yang et al., 2024).

The ability of villages to access 4G internet in the field of government is found in the submission of village government reports, both administrative reports and website-based village fund management reports. The ability to access 4G internet as an indicator of digital villages helps data collection of poor people in rural areas. Filling in Village SDGs data with an application connected to the Ministry of Villages' website produces up-to-date villager data. Proper data collection on poverty levels in rural areas will be used to make poverty alleviation policies. ICT-based data on rural poverty levels is proof of the contribution of digital villages in the social sector (Hu et al., 2022). In law, the existence of digital villages contributes to the speed and ease of dissemination of laws and regulations to all corners of the village, so that villagers are faster to know changes in laws and regulations (Wijaya et al., 2013). In the environmental sector, the presence of digitalization programs in the village is found in the existence of natural disaster mitigation facilities in the village in the form of disaster early warning equipment that works with internet access. Digitalization of agriculture in rural areas has a positive impact on ecological efficiency in agriculture (H. Wang & Li, 2024).

Information technology used in people's lives is one of the resources in the implementation of rural development. Village potential, both natural resource potential and human resources, together with information technology is a rural development resource that can support the achievement of sustainable rural development. Resource Based View Theory states that the resources owned by an entity are internal forces that can drive performance achievement, and resources are the main determinants of performance achievement (Mweru & Maina, 2016). Innovation and Development: The dynamics of digital technology adoption can be explained by using Diffusion of Innovation Theory (Rogers & Everett, 1983), recognizing that the integration of digital tools into village life is a gradual and context-specific process influenced by factors such as leadership, social networks, and infrastructure readiness. Moreover, the Community-Driven Development (CDD) Framework can be used to

provide a perspective that digital village initiatives would empower rural communities to directly shape and govern their own paths toward sustainable development (Issue, n.d.)

4. CONCLUSION

The purpose of this study is to analyze the effect of digital villages with the proportion of the proportion of villages with 4G Internet access and the proportion of villages that subscribe to cable phones on sustainable rural development using the Village Development Index (VDI). VDI is a combination of Environmental, Social, and Economic Resilience Indices. The results of the analysis show that the ability to access 4G Internet and the proportion of village subscribing to cable phones have a positive effect on economic development, social development, and environmental development in rural areas. The findings of this study contribute significant implications for rural development policy and practice in Indonesia. The demonstrated positive impact of digital villages on economic, social, and environmental facets of sustainability suggests that digitalization can be a strategic tool for accelerating progress toward the Sustainable Development Goals (SDGs) at the village level. This research particularly highlights the critical role of expanding digital infrastructure in enhancing agricultural marketing, improving social welfare data collection, and fostering ecological efficiency in rural areas.

For the Ministry of Communication and Informatics, the number of villages that can access 4G Internet should be increased. The limitation of this study is that it uses only one independent variable, namely digital villages, to predict sustainable rural development. Future research can add other variables, such as village governance, conduct surveys, or focus group discussions to gather qualitative data that complements the quantitative analysis.

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6. CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

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BIOGRAPHIES OF AUTHORS



Ni Kadek Sinarwati   is a lecture in Economic and Accounting Department in Economic Faculty of Ganesha Education University/ Universitas Pendidikan Ganesha. She can be contacted via WhatsApp number 081337207627 or email: nikadeksinarwati@undiksha.ac.id



I Nengah Suarmanayasa   He is a lecture in Management Department, in Economic Faculty of Ganesha Education University/ Universitas Pendidikan Ganesha. He can be contacted at email: nengah.suarmanayasa@undiksha.ac.id



Salut Muhidin   He is a lecture in Macquarie Business School-Macquarie University, Sydney, Australia. He can be contacted at email: salut.muhidin@mq.edu.au



Luh Gede Elvina Adi Saputri   She is a Lecture in Polteknik Elbajo. She can be contacted at email: luhgedeelvina@gmail.com



Pardomuan Robinson Sihombing   He is a staf in Central Bureau of Statistics. He can be contacted at email: robinson@bps.go.id



Ngurah Eka Utama Putra   is a student in the Department of Accounting at Universitas Pendidikan Ganesha, Bali. He is currently pursuing his bachelor's degree in accounting with a focus on financial accounting and rural development. His academic interests include village financial management, digitalization in rural areas, and sustainable development accounting. He has been actively involved in academic research related to digital villages and their impact on rural economic, social, and environmental sustainability. He has participated in collaborative research with lecturers and contributed to academic publications. He can be contacted via email at eka.utama@student.undiksha.ac.id