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DOES DIGITAL ACCESS INFLUENCE POVERTY ALLEVIATION IN RURAL AREAS? A VILLAGE-LEVEL STUDY IN CENTRAL JAVA, INDONESIA

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ABSTRACT

This study aims to determine the effect of digital access, including internet facilities, internet signals, telephone signals, television, and radio, on poverty at the village level in Central Java Province, Indonesia. The novelty of this study lies in the fact that no previous study has measured the effect of digital infrastructure on poverty at the village level. The uniqueness of this study lies in its unit of analysis at the village level in Central Java. This study uses panel data analysis with a fixed effect model. The data used is the Central Java Province Village Potential data released by the Central Statistics Agency (BPS) in 2018, 2021, and 2024 in 8,562 villages and a total of 25.684 observations. The results of this study indicate that digital access, consisting of the variables of Internet café, phone signal, and internet signal, has a negative and significant effect on poverty at the village level. In contrast, the variables of government television and private television have a positive and significant effect on poverty at the village level. Radio broadcasts have no significant effect on poverty at the village level in Central Java Province, Indonesia. This research recommends that the government provide facilities and training/education programs based on an equitable digital access infrastructure. Regarding internet infrastructure, 64.3% of villages in Central Java Province do not have internet access, and 12% do not have a phone signal. Government policy interventions should focus on individual device ownership and providing inclusive shared infrastructure so the entire community can access digital infrastructure.

Keywords: Digital Access; Poverty; Rural Area; Indonesia

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1. INTRODUCTION

Governments worldwide are increasingly prioritizing poverty alleviation through welfare-oriented programs aligned with the Sustainable Development Goals (SDGs) (Ruja et al. 2024; Jung et al., 2015). As a country committed to SDG implementation (Hudaefi, 2020), , Indonesia has introduced various poverty reduction initiatives, particularly targeting Goal 1 (ending poverty in all its forms) and Goal 9 (promoting inclusive and sustainable industrialization and innovation) (Kuswantoro et al., 2023; United Nations, 2022). Central Java Province, one of the most populous regions on Java Island, continues to record a relatively high number of poor residents, making it a key focus of national poverty alleviation policies (Al-Khalil & Rochmatullah, 2024: Solikhin, 2021). According to BPS (2021b), between September 2020 and March 2021, urban poverty increased slightly from 10.57% to 10.58%, while rural poverty declined from 13.20% to 13.07%. Although poverty remains more prevalent in rural areas, the rate of increase in the urban poor population has been relatively higher.

Digital access has become a crucial instrument for poverty alleviation in the era of information technology transformation, particularly in rural areas with limited access to information. The availability of digital infrastructure enhances information and communication access while creating new economic opportunities by integrating rural communities into broader market networks. Digitalization enables farmers and small and medium-sized enterprises to access real-time market information, market products online, and reduce reliance on inefficient traditional distribution channels. Moreover, digital education platforms and technology-based public services expand access to knowledge, skills, health services, and financial inclusion. Thus, the digital divide represents not merely an infrastructure gap but a structural challenge that exacerbates socio-economic inequality, making equitable digital access a key strategy for sustainable development and rural poverty reduction. SDGs Goal 9 highlights the importance of inclusive and sustainable infrastructure development, particularly digital-based infrastructure that can be accessed by both urban and rural communities to enhance welfare and innovation (Brodny & Tutak, 2023). Poverty in certain regions is closely associated with disparities in human resource capacity to adopt innovation, technology, and digitalization in daily life (BPS, 2023). While community readiness is essential, the government plays a crucial role in fostering technological advancement by providing digital infrastructure and facilities that support everyday technological use (Xu et al., 2024). Digital infrastructure and access have been identified as key determinants of human capital improvement and poverty reduction, especially among poor households (Bachtiar et al., 2023). Digital infrastructure and access have been identified as key determinants of human capital improvement and poverty reduction, especially among poor households (Azzasyofiaa, 2022). Therefore, examining the effectiveness of digital infrastructure access in reducing poverty remains a critical issue.

Empirical evidence on the role of digital access in poverty reduction in Central Java Province remains inconclusive. Wijayanti (2025) found that information technology access does not significantly reduce poverty across six provinces in Java, including Central Java, whereas Krismono & Nasikh (2022) demonstrated that digital technology supports poverty alleviation in highland agriculture by reducing production costs and improving farmers' financial management. Mulyaningsih et al. (2020) further identified a persistent digital divide within urban areas, particularly among low-income households, with digital diffusion concentrated among younger populations and women. Despite high digital access penetration in Central Java (89%), exceeding

the national average of 73.6% (Bachtiar et al., 2023), urban poverty has continued to rise. This paradox indicates two critical research gaps: the coexistence of expanding digital access and increasing urban poverty, and the reliance of prior studies on aggregate digital access indicators that fail to capture the heterogeneity of digital infrastructure and facilities relevant to poverty dynamics. The limited effectiveness of poverty reduction in Central Java is primarily driven by structural digital inequality between urban and rural areas. Insufficient internet and telecommunications coverage in rural regions restrict poor households' ability to utilize digital technologies for productivity enhancement, information access, and market expansion. These constraints are exacerbated by low digital literacy and limited access to digital services, resulting in the continued marginalization of rural communities from the benefits of digital transformation. Furthermore, public broadcasting institutions such as RRI and TVRI remain underutilized as channels for disseminating educational and development-oriented information. This evidence suggests that existing government strategies are fragmented and predominantly infrastructure-oriented, lacking adequate emphasis on affordability, equity, and community capacity building, thereby undermining their effectiveness in reducing rural poverty in Central Java.

Empirical studies show that digital access and infrastructure play a crucial role in poverty reduction through improved accessibility, efficiency, and economic participation. Digital infrastructure enhances resilience and environmental sustainability (Stjernborg & Lopez Svensson, 2024), while the digital economy significantly reduces energy poverty (Xinxin et al., 2024), and overall poverty levels. However, rural entrepreneurs often face barriers in actively utilizing digital technologies due to poverty constraints, resulting in passive internet use (Rosman & Yussof, 2022). Moreover, unequal digital access widens the gap between the "digitally wealthy" and the "digitally poor," increasing the risk of digital exclusion despite the expansion of e-commerce and e-government services (Susanto, 2016). Nevertheless, e-commerce adoption has been shown to reduce poverty vulnerability among rural households (Tang et al., 2024). although high-speed internet access may unintentionally increase household energy poverty by weakening social capital Ackermann et al. (2023). Access to digital technology also contributes to income equality, employment transformation, and rural revitalization. Digital access reduces income inequality in rural areas by promoting entrepreneurship, lowering credit costs, improving labor mobility, and enhancing skill development (Zhang & Li, 2024; Zhang et al., 2024; Yu et al., 2024). Digital infrastructure and finance further support rural revitalization by strengthening industrial development, marketing efficiency, and non-agricultural employment, ultimately improving household economic conditions (Bi, 2024; Han et al., 2023). However, the impact of digital economic development varies regionally, with more developed areas generating positive spillover effects for less developed regions (Tao et al., 2024; Lyu et al., 2024; Zhou et al., 2024). Digital access fosters rural revitalization and spatial spillovers by stimulating innovation, entrepreneurship, human capital accumulation, and financial inclusion, thereby reducing household financial vulnerability and expanding income opportunities (Deng et al., 2024; Xu et al., 2024; Liu et al., 2024).

Digital infrastructure access relevant to poverty reduction can be categorized into six channels: internet cafés or public internet facilities, telephone signal availability, internet signals, government and private television signals, and government radio signals. Existing studies consistently show that digital access improves information transparency, educational opportunities, and economic welfare, while unequal access may intensify social exclusion. Nevertheless, most empirical evidence is derived from macro-level analyses at national or regional scales, which are limited in capturing local heterogeneity. Villages exhibit substantial variation in socio-economic

conditions, infrastructure availability, and digital readiness, making village-level analysis essential for understanding the actual mechanisms through which digital access affects poverty. Addressing this gap, this study examines the impact of digital access on the number of poor households using villages as the unit of analysis in Central Java, Indonesia, thereby providing a more context-specific contribution to the digital poverty alleviation literature.

This study emphasizes the role of village-level digital infrastructure, including internet facilities, telecommunications, television, and radio, in supporting poverty reduction. Internet cafés function as local information hubs, while internet signal availability reflects the broader digital ecosystem that enables access to education, public services, and digital economic opportunities. Improved connectivity allows poor households to acquire skills, participate in digital markets, and access government programs. In Central Java, where urban–rural development disparities remain pronounced, internet signal quality is a critical factor in narrowing opportunity gaps. In addition, telephone, RRI, and TVRI signals are included as key determinants, as they facilitate communication, disseminate development and social assistance information, and reduce information isolation, particularly in remote and underserved villages.

Based on the explanation above, this study aims to examine the impact of digital access including internet facilities, internet signals, telephone signals, television, and radio on poverty alleviation at the village level in Central Java Province. Referring to the research objectives, the research question is: Does digital access, including internet facilities, internet signals, telephone signals, television, and radio, reduce the number of poor people at the village level in Central Java Province. This study contributes to the literature on digital access transformation and poverty by confirming that variations in digital access at the village level have different impacts on the number of poor families, thereby enriching the theoretical understanding of the importance of the village-level context in the effectiveness of digital access. In practical terms, these findings also provide an empirical basis for the Indonesian government in designing more targeted digital inclusion policies, whether through improving signal infrastructure, providing public internet facilities, or digital literacy programs through mass media (television and radio) tailored to rural socio-economic conditions, thereby aligning with the national agenda to accelerate poverty alleviation through technological transformation.

The novelty of this research lies in the fact that no prior studies have examined digital products as a basic necessity in today's era specifically, internet facilities, internet signals, telephone signals, television, and radio, along with their impact on poverty at the village level in Central Java Province. Referring to Díaz-bonilla & Constenla-villoslada (2021) emphasize the importance of a micro approach in poverty alleviation through policy evaluation that directly impacts individuals, while Pu & Chang (2022) highlight the need for a specific understanding of social life to address structural issues such as inequality and vulnerability. In line with this view, village-level data provides rich information for examining the role of digital access infrastructure in poverty alleviation.

2. LITERATURE REVIEW

2.1. Theoretical Analysis

From the perspective of Sen (1999) capability approach, poverty should be understood as a multidimensional condition that extends beyond income deprivation to include limitations in individuals' capabilities and freedom of choice. Socio-cultural and infrastructure dimensions, including digital access, play a crucial role in shaping poverty outcomes (Affandi et al., 2025). Digital access expands the capabilities of poor communities by enabling access to education, e-commerce, health services, and information, thereby enhancing individuals' capacity to make informed life choices. However, unequal digital access may generate new forms of deprivation by excluding digitally marginalized groups. Therefore, poverty alleviation through digital infrastructure requires not only technological availability but also equitable access to strengthen community capabilities and freedoms (Gigler, 2014; Kleine, 2010; Sen, 1987).

Human capital theory further explains this relationship by emphasizing the role of information access in enhancing productivity and income (Becker, 1993). Beyond formal education and training, widely accessible information enables individuals to make more efficient economic decisions, such as choosing better employment opportunities and accessing competitive markets. Public service media including the internet, television, and radio reduce information asymmetry by disseminating critical knowledge related to government assistance, health, agriculture, and education, which is particularly relevant for poor communities (Stiglitz, 2015). Improved access to information thus strengthens human capital formation and workforce productivity. The digital economy represents a shift from a knowledge-based economy toward an internet-driven economic system that enhances societal and national economic performance (Kong et al., 2024; Javaid et al., 2024). Digital transformation processes enabled by technologies such as mobile connectivity, cloud computing, the Internet of Things, and artificial intelligence facilitate new business models and personalized digital services (Sledziewska & Włoch, 2021). These developments create new economic opportunities by increasing efficiency, connectivity, and data-driven decision-making, thereby supporting inclusive economic growth.

Finally, Cáceres (2007), highlights digital exclusion as a key constraint for low-income communities, arising from limitations in access, skills, and perceived need for ICT. Digitally disadvantaged groups include individuals facing supply-side barriers, capability constraints, demand-side limitations, or generational skill gaps. These forms of digital poverty demonstrate that digital access alone is insufficient; effective poverty alleviation requires policies that simultaneously address infrastructure provision, digital literacy, and awareness to ensure inclusive participation in the digital economy.

2.2. The Causal Relationship Between Digital Access Variables and Poverty

The relationship between digital access variables and poverty. The relationship between digital access variables can be described as having a direct and indirect influence on poverty levels. The direct influence of digital access products, such as internet facilities or Internet cafè, internet signals, television, and radio, on poverty levels is that they facilitate direct access to various information in real time without restrictions. Information that can be received directly and

disseminated widely to other communities includes job vacancies, access to online education, digital skills that increase labor productivity and competitiveness, and the promotion and marketing of every entrepreneur in rural areas. The indirect impact of this digital infrastructure can be observed in the formation of communities that have a basic understanding of information technology, extensive knowledge gained through knowledge transfer, and communities that demonstrate resilience and adaptability to economic shocks due to their ability to adapt to an increasingly challenging environment. Experts describe the types of products within the digital economy as including internet facilities, internet networks, telephone signals, and information channels such as television, radio, and digital news platforms (Leroch & Sirries, 2023; Sledziewska & Włoch, 2021; Cáceres, 2007; Carey, 2005). Several studies have shown that internet access and technology positively impact income and public welfare (Zhang & Li, 2024; Tang et al., 2024; Lyu et al., 2024; Liu et al., 2024). Digital economy products can have a positive impact on public information and knowledge, thereby improving overall well-being (Zhang et al., 2024). Digital infrastructure and digital finance positively influence rural revitalization and income levels (Deng et al., 2024; Bi, 2024; Xu et al., 2024; Han et al., 2023). On the other hand, the study by Tao et al. (2024) indicates that the digital economy index has not yet significantly influenced rural income, as spatial factors cause digital economy products to elicit different responses depending on the characteristics of each region (Zhou et al., 2024).

2.3. Hypothesis

Based on the theory and empirical evidence described above, it is concluded that the research hypotheses are as follows:
Hypothesis 1 (H1). The existence of internet facilities such as Internet cafè negatively affects the number of poor people at the village level. This is because individuals with limited personal internet access can still easily access information through these public spaces.

Hypothesis 2 (H2). Telephone signals are suspected to negatively affect the number of poor people at the village level, based on the premise that every individual has access to communication with other members of the community without geographical restrictions.

Hypothesis 3 (H3). The existence of internet signals is suspected to have a negative effect on the number of poor people at the village level. This is based on the premise that individuals have easy access to information via the internet, regardless of geographical location, because internet access is available in all villages.

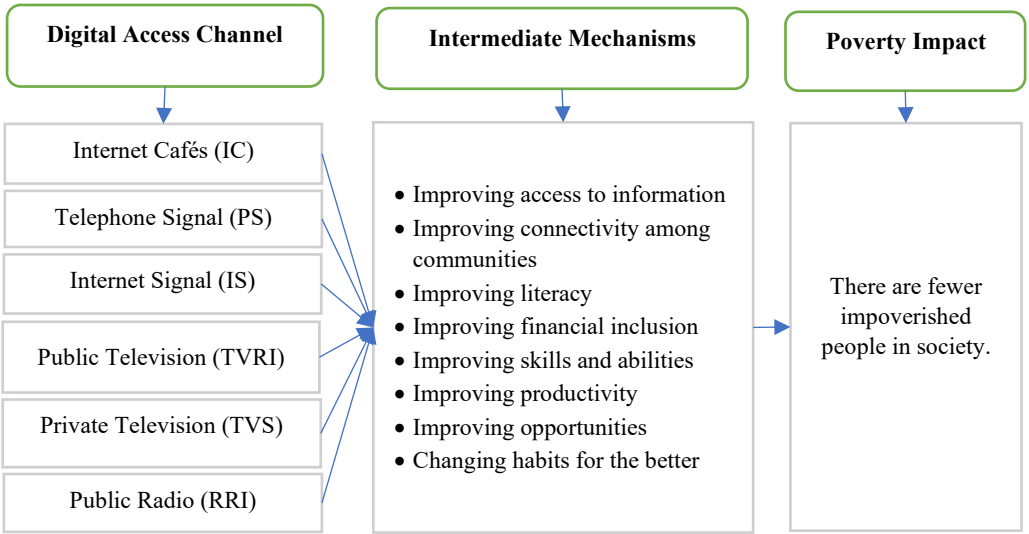
Hypothesis 4 (H4). The availability of state television signals hurts the number of poor people at the village level, because people can easily access information conveyed through state television to the public. People are aware of the programs provided by the government so that they can welcome these programs.

Hypothesis 5 (H5). The existence of private television signals is thought to have a negative effect on the number of poor people at the village level, because people can easily access the information conveyed through private television to the community. People are aware of the programs provided by digital media companies, so they can increase their knowledge and skills.

Hypothesis 6 (H6). The existence of state-owned radio signals is suspected to have a negative effect on the number of poor people at the village level, because the community can easily access information conveyed through state-owned radio to the community. The community is aware of the programs provided by the government, so that the community can welcome these programs.

The conceptual framework of this study can be seen in Figure 1. The conceptual framework is as follows:

Figure 1: Conceptual Framework



3. METHODOLOGY

3.1. Models

This study employs a panel data econometric approach using the Fixed Effects model to examine the impact of digital access on poverty reduction at the village level in Central Java Province, Indonesia. Digital access is represented by internet cafés, internet signals, telephone signals, public television, private television, and public radio. Following the panel regression framework of Gujarati & Porter (2009) and Baltagi (2005), the model specification is expressed as:

$$LogP_{ij} = \beta o_{ij} + \beta 1\ IC_{1ij} + \beta 2\ PS_{2j} + \beta 3\ IS_{3ij} + \beta 4\ TVRI_{4ij} + \beta 5\ TVS_{5ij} + \beta_6\ RRI_{6ij} + \varepsilon \qquad (1)$$

where i denotes villages and j denotes years. LogP represents the number of poor people, while the remaining variables capture different forms of digital infrastructure. Panel data regression combines cross-sectional and time-series dimensions, increasing degrees of freedom and mitigating omitted variable bias. Model selection is determined using the F-test, Hausman test, and Lagrange Multiplier test.

3.2. Data and Variables Definition

This study utilizes village-level raw data from the Village Potential Survey (PODES) of Central Java Province published by Statistics Indonesia (BPS) for the years 2018, 2021, and 2024. The sample comprises 8,562 villages, yielding a total of 25,684 observations. Operational definitions and measurements of the variables are presented in Table 1.

Table 1: Operational Definitions of Variables

Variable	Description	Measurement Unit	Source
Log Y	Poor population	Number of Families	(Hakim & Hakim, 2024); BPS, 2021a)
IC_1	Internet cafè	present =1 absent =0	(Cáceres, 2007; BPS, 2021a)
PS_2	Phone Signal	present =1 absent =0	(Cáceres, 2007; BPS, 2021a)
IS_3	Internet Signal	present =1 absent =0	(Cáceres, 2007; BPS, 2021a)
$TVRI_4$	TVRI	present =1 absent =0	(Cáceres, 2007; BPS, 2021a)
TVS_5	TV Privat	present =1 absent =0	(Cáceres, 2007; BPS, 2021a)
RRI_6	RRI	present =1 absent =0	(Cáceres, 2007; BPS, 2021a)

The dependent variable, the number of poor families, undergoes a logarithmic transformation. This procedure addresses data skewness, stabilizes variance, and facilitates more meaningful percentage-form interpretation. This transformation also helps address data imbalance, especially when there are large differences in values, so the data distribution approaches normal and the estimation results become more reliable. Conversely, the independent variable is a dummy variable that does not undergo a logarithmic transformation due to its categorical nature (0/1). As a result, the logarithmic transformation becomes irrelevant and eliminates the substantial meaning of the differences between categories.

4. RESULTS AND DISCUSSION

4.1. Selection testing of the best model between CEM, FEM, and REM

The process of determining the best model in panel data regression is carried out through a series of statistical tests. The following is a summary of the CEM, FEM, and REM regression results presented in Table 2 below.

Table 2: Estimation results between CEM, FEM, and REM.

No	Variable	CEM	FEM	REM
1	IC_1	0,248***	-0,075***	0,121***
2	PS_2	0,170***	-0,110***	0,071***
3	IS_3	-0,038	-0,251***	-0,144***
4	$TVRI_4$	0,097	0,334***	0,211***
5	TVS_5	0,033	0,410**	0,228**
6	RRI_6	-0,168***	-0,004	-0,099
7	_constan	3,517***	3,340***	3,387***

Source: Results output Stata 17 (2025).
Notes.***p < 0.01; **p < 0.05; and *p < 0.10

To determine the best panel data regression model among the CEM and FEM models, a Chow test was conducted, as presented in Table 3 below:

Table 3: Chow Test Result

Chow Test	Test Statistic	df (between, within)	Prob > F	Decision
F test that all $u_i = 0$	2,55	(8561, 17106)	0,000	FEM is preferred over CEM

Source: Results output Stata 17 (2025).

The Chow test results in Table 3 show that the probability value of 0.000 is smaller than the significance level of 5% (0.05), so FEM is more appropriate than CEM for the estimated panel data results analyzed. Next, we select the regression model between FEM and REM using the Hausman test. The Hausman test results are as follows:

Table 4: Hausman Test Result

Test of H0: Difference in coefficients not systematic	
chi2(7	= (b-B)'[(V_b-V_B)^(-1)](b-B)
	= 461,31
Prob > chi2	= **0.0000**

Source: Results output Stata 17 (2025).

The Hausman test results show that FEM is better than REM, because the Prob> chi2 = 0.0000 value is smaller than the significance level of 5% (0.05). FEM is considered the most appropriate analytical approach in this study, as evidenced by the results of the Chow test and the Hausman test. With the consistency of the results of both tests, Lagrange Multiplier testing is no longer relevant because it has been identified that FEM is the preferred choice over CEM and REM. Therefore, FEM is established as the basis for analysis in this study.

4.2. Descriptive Analysis

This study conducts a classical assumption test, specifically a multicollinearity test, by examining the correlation values between independent variables. The results of the multicollinearity test, based on the correlation values among independent variables, are presented in Table 5 below.

Table 5: Multicollinearity Test

Variable	VIF	1/VIF
Phone Signal	1,16	0,86
Internet Signal	1,15	0,87
TVRI	1,05	0,96
TV Privat	1,04	0,96
Internet cafè	1,02	0,98
RRI	1,01	0,99
Mean VIF	1,07	

Source: Results output Stata 17 (2025).

Based on Table 5, the correlation values among the independent variables indicate that none have a correlation value greater than 0.7. Therefore, the variables included in the model do not exhibit

multicollinearity. Next, a descriptive analysis provides an overview of the research data, as presented in Table 6 below.

Table 6: Descriptive Analysis

Variable	Mean	Standard Deviation	Minimum	Maximum
Poor Population	84	189	0	17.923
Internet cafè	0,393	0,488	0	1
Phone Signal	0,902	0,297	0	1
Internet Signal	0,979	0,143	0	1
TVRI	0,996	0,067	0	1
TV Swasta	0,999	0,036	0	1
RRI	0,920	0,272	0	1

Source: Results output Stata 17 (2025).

According to Table 6, the average number of poor individuals per village in Central Java Province is 91, while the highest number of poor individuals in a single village reaches 17,923 people. The descriptive data also reveal that 39.3% of villages have an internet café. Additionally, 90,2% of villages have mobile signal coverage, while 97,9% have internet signal access. The data further indicate that 99.6% of villages have access to TVRI broadcasts, 99.9% have access to private TV broadcasts, and 92% have access to RRI radio broadcasts. Furthermore, 60.7% of villages lack internet access, and 9,7% of villages do not have mobile signal coverage in Central Java Province.

4.2. Regression Results

After determining that the Fixed Effect Model (FEM) is the best-fit model, a hypothesis test was conducted. The hypothesis testing is performed using t-tests and F-tests based on the equation obtained from the data analysis presented in Table 7. The regression results on the impact of digital access on poverty in Central Java Province are as follows:

Table 7: Regression Results of Digital Access on Poverty in Central Java Province

Dependent: Poor Population	Coefficient	t-statistic
Internet Cafés	-0,075***	-3,700
Phone Signal	-0,110***	-3,100
Internet Signal	-0,251***	-4,010
TVRI	0,334***	2,540
TV Privat	0,410*	1,790
RRI	-0,004	-0,120
Constant	3,340	13,260

Source: Results output Stata 17 (2025).
Notes.***p < 0.01; **p < 0.05; and *p < 0.10

Based on Table 7, the Fixed Effect Model estimation shows that several digital access variables significantly influence village-level poverty in Central Java Province. The t-test results indicate that internet cafés, phone signal availability, and internet signal coverage have a negative and significant effect on the number of poor residents. In contrast, access to TVRI and private television is positively and significantly associated with poverty levels, while radio access (RRI) shows no significant effect. Furthermore, the F-test results confirm that all digital access variables jointly have a significant effect on poverty in Central Java Province.

4.3. Regression Results

Based on Table 7, internet cafés have a statistically significant negative effect on the number of poor residents, with a coefficient of −0.075. This indicates that a 1% increase in villages with internet cafés is associated with a 7.5% reduction in village-level poverty. The presence of internet cafés facilitates access to information and knowledge, thereby enhancing community capabilities and competitiveness, particularly in rural areas. Public internet facilities enable communities to adopt IT-based activities and reduce disparities with more developed regions. This finding is consistent with Nguyen et al. (2022), who show that internet use among rural households is positively associated with human capital and productive assets, and with Furuholt et al. (2008) , who emphasize that frequent internet use improves individual competence and well-being.

Phone signal availability also exhibits a significant negative effect on poverty, with a coefficient of −0.110, indicating that a 1% increase in villages with phone signals reduces the number of poor residents by 11%. This result highlights the importance of basic telecommunications infrastructure in rural areas, as phone connectivity facilitates access to socio-economic information, strengthens social networks, and improves household welfare through enhanced information flows.

The availability of mobile phone signals in rural areas reduces dependence on local markets and expands access to broader market opportunities. Mobile connectivity also strengthens social ties by facilitating information exchange on employment and education opportunities beyond the village, thereby reducing social isolation, enhancing social capital, and improving socio-economic well-being. These findings align with Zang et al. (2023), who show that mobile phone usage significantly reduces energy poverty through increased household income and consumption outside the agricultural sector, as well as through strengthened social capital. Similarly, Balgobin & Dubus (2022) find that basic mobile phone adoption positively influences employment and job quality, contributing to community well-being in Uganda.

Internet signal availability has a negative and significant effect on village-level poverty, with a coefficient of −0.251, indicating that a 1% increase in villages with internet access reduces the number of poor residents by 25.1%. Internet access improves rural welfare by expanding access to education, information, employment, and entrepreneurial opportunities, particularly in geographically isolated areas. Online platforms enable villagers to seek jobs, start businesses, and access healthcare services remotely, ensuring productivity is not hindered by health constraints. These results are consistent with Nguyen et al. (2022), who argue that productive internet use increases household income, supports non-agricultural development, and reduces reliance on natural resources. Likewise Bergantino et al. (2024) and Ackermann et al. (2023) highlight that reducing digital inequality and expanding high-speed internet access are effective strategies for alleviating rural poverty.

Overall, the findings underscore the critical role of digital infrastructure in reducing socioeconomic inequality. Limited access to ICT remains a key driver of rural poverty, as emphasized by Jayanthi & Dinaseviani (2022). Improving digital infrastructure lowers information barriers and expands participation in knowledge-based economic activities. Internet cafés, as informal institutions, play an important role in providing inclusive digital access for households unable to afford personal devices or internet services. From the perspective of media dependency theory, greater reliance on

digital media for information, social orientation, and economic decision-making enhances individuals' capacity to escape poverty traps (Nurlina et al., 2024; Lindell et al., 2022).

Internet signal quality plays a crucial role in enabling rural communities' participation in the knowledge economy, where information production and utilization drive economic activities. Adequate internet access transforms rural populations from passive information consumers into active contributors through e-commerce, digital creative services, and platform-based micro-enterprises, thereby increasing income and reducing structural poverty. Similarly, the availability of telephone signals facilitates market integration by lowering transaction costs and mitigating information asymmetry, which often increases economic risks. Improved telephone access supports goods distribution, market price monitoring, and digital financial services, including mobile banking and fintech, expanding financial inclusion for low-income households. These findings indicate that digital infrastructure development extends beyond technical provision and involves social and behavioral dimensions. Without sufficient digital literacy, unequal access may persist in the form of a digital divide that limits productive technology use. Therefore, digital infrastructure, media access, and behavioral transformation should be integrated into poverty reduction strategies, as investment in digital connectivity constitutes a key element of inclusive and sustainable development.

The TVRI variable has a positive and significant effect on the number of poor residents, with a coefficient of 0.334, indicating that a 1% increase in the number of villages with access to TVRI is associated with a 33.4% increase in the poor population. Similarly, private television access shows a positive coefficient of 0.410, indicating a 41.0% increase in poverty rates after a 1% increase in the number of villages with access to private television. These results indicate that both public and private television broadcasts have not effectively contributed to improving human capital or reducing poverty in rural areas. Although television broadcasts are accessible in approximately 99.5% of villages in Central Java Province, poverty levels remain high, implying a positive correlation between television availability and rural poverty.

Television is theoretically expected to enhance human capital by disseminating information and knowledge, particularly in remote areas. However, the findings suggest that television content has limited developmental value and does not support community productivity or welfare. This result is consistent with La Ferrara (2016) who found that television consumption may reduce welfare due to non-productive content. Similar evidence from Australia shows that high installation and subscription costs for digital television disproportionately burden low-income households, reducing welfare and access to information (Brown & Cave, 1992; Pantazis & Gordon, 1997). Excessive exposure to low educational value television content has also been shown to lower productivity and reinforce hedonistic consumption patterns, further constraining welfare improvements (Pertierra, 2018; Artero et al., 2015).

One key limitation is the lack of educational and sector-specific programming, particularly for rural livelihoods. Ogola et al. (2023) report that while farmers rely on television for information, the absence of agricultural extension content limits productivity and food security. Television remains largely a passive medium, dominated by entertainment rather than content that builds skills, financial literacy, or market access. Strengthening educational, interactive, and development-oriented programming could transform television into an effective tool for community empowerment, particularly for unemployed and low-income populations (Lybbert & Wydick,

2018). state that development economists have the opportunity to build a more complete understanding of poverty and the dynamics of poverty by adopting the concepts of hope and enlightenment that they can provide regarding poverty and development. Poverty is closely related to the psychology of low-income communities and/or governments that cause communities to become poor. The way to improve people's understanding of poverty is through media accessible to the wider community, namely television, so that it can provide hope and experiences about life, to continue to rise from every failure. Interactive programs such as job information, business development, and access to public services for the community can potentially have a transformative effect on welfare.

Improving internet infrastructure and strengthening television content regulation are therefore critical for achieving the Sustainable Development Goals (SDGs). Expanded internet access enables poor communities to access education, health services, and digital economic opportunities, supporting SDG 1 (No Poverty) and SDG 4 (Quality Education). At the same time, television content regulation can promote productive and educational programming aligned with SDG 8 (Decent Work and Economic Growth) and SDG 12 (Responsible Consumption and Production). Together, these policies position digital infrastructure and media regulation as integral components of inclusive and sustainable development strategies.

The RRI variable does not have a significant effect on the number of poor residents, indicating that the presence of RRI in rural areas has not effectively disseminated information or knowledge to local communities. This finding suggests a declining relevance of radio as a development medium, driven by rapid advances in information technology and the widespread adoption of smartphones and digital platforms. Younger rural populations increasingly rely on internet-based media, reducing radio's role in the rural communication landscape. In addition, competition from social media and online information sources offering faster and more diverse content has further diminished radio's influence. Another contributing factor is the mismatch between RRI program content and the specific needs of rural communities. Nationally oriented and formal programming often fails to address practical local concerns such as agricultural innovation, commodity prices, and economic empowerment opportunities. As a result, radio becomes less effective as a tool for poverty alleviation. These findings indicate that the sustainability of RRI's role in rural development depends on its capacity to adapt to changing media consumption patterns, produce context-specific content, and integrate with digital platforms to enhance reach and relevance. As emphasized by James (2006), radio and internet-based media can strengthen community capabilities only when they are optimized to meet public needs.

5. CONCLUSION

This study concludes that digital access at the village level plays a significant role in poverty alleviation in Central Java, Indonesia, with varying impacts across types of media infrastructure. Access to internet cafés, telephone signals, and internet signals shows a negative and significant effect on the number of poor residents, indicating that productive digital connectivity contributes to improved economic welfare. In contrast, the presence of government and private television is positively associated with poverty levels, suggesting that passive media consumption does not necessarily enhance productive capacity, while radio access shows no significant effect. These findings highlight that not all forms of digital infrastructure contribute equally to poverty reduction.

The policy implications emphasize the importance of inclusive and shared digital infrastructure in achieving the Sustainable Development Goals (SDGs), particularly SDG 1 (No Poverty), SDG 9 (Industry, Innovation, and Infrastructure), and SDG 10 (Reduced Inequalities). Expanding affordable internet access through public facilities such as internet cafés and improving telephone and internet signal coverage in underserved rural areas are crucial for reducing regional disparities. Given that a substantial proportion of villages still lack adequate internet and telephone access, investment in rural telecommunications infrastructure can generate a dual impact by enhancing both individual capabilities and collective socio-economic inclusion. The results also call for caution in prioritizing investments in conventional media, especially television, which may not support poverty reduction without complementary strategies to improve educational content and media literacy. Therefore, digital development policies should shift from merely expanding access toward enhancing the relevance and economic value of digital media for rural communities. Strengthening digital literacy programs and integrating them with rural economic empowerment initiatives align with Indonesia's Digital Transformation Plan and Smart Village policies, reinforcing the role of digitalization as a strategic instrument for inclusive and sustainable development (Hombone, 2025).

The weakness of this study lies in the low R-square value in both the within dimension (variation in the dependent variable explained by variation in the independent variable within village units over time is 0.38%) between (variation in the dependent variable between village units in a given year (cross-section) explained by independent variables of 5%), and overall (a combination of within and between variation, describing the model's overall ability to explain panel data variation), which indicates that the independent variables in the model are only able to explain a small portion of the variation in the dependent variable. This may be due to important unobserved variables, data quality and coverage limitations, and the possibility of weak relationships between variables in the context under review. Therefore, the results of this study should still be interpreted with caution, and further studies are recommended to expand the variables, improve data quality, and consider alternative model specifications.

Future research should include additional control variables, combine individual and structural level data, and explore the spatial dimensions of digital adoption. Further evaluation of media content, particularly television and digital platforms, is also necessary to understand their role in supporting poverty eradication, sustainable economic development, and the achievement of the Sustainable Development Goals (SDGs).

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