Internet, Media Usage, and Poverty: Quadrant Mapping of ICT Trend and Poverty Level in Indonesia

Sri Hastjarjo[1], Rutiana Dwi Wahyunengseh[2]
[1]ORCID iD: 0000-0002-0306-9594, Universitas Sebelas Maret, Jl. Ir. Sutami No. 36, Surakarta, Central Java 57126, Indonesia
[2]ORCID iD: 0000-0002-8806-7132, Universitas Sebelas Maret, Jl. Ir. Sutami No. 36, Surakarta, Central Java 57126, Indonesia
*Corresponding author, e-mail: sri.hastjarjo@staff.uns.ac.id

Abstract

Introduction: This article addressed the research problem: 'how the information and communication technology usage related to the poverty rate in Indonesia in 2020-2021, compared between provinces and rural-urban segmentation.' This study contributed evidences for the development of digital literacy policies to answer previous research debates on the extent to which information and communication technology is a useful tool for reducing poverty, which is one of the Sustainable Development Goals.
Methods: Using a quantitative approach, this study used the data from the Indonesian Central Bureau of Statistics. Data is analyzed using product moment correlation to determine the relationship between information and communication technology penetration and the poverty rate, the results then are displayed using quadrant mapping.
Findings: This study found variations in relations between provinces and rural-urban segmentations. High internet penetration and media use are not always accompanied by a low poverty index. In conclusion, the expansion of internet needs to be complemented by massive and systematic digital literacy education in order to effectively accelerate poverty reduction.
Originality: This study meets the need for novelty as the issue discussed is related to poverty and information and communication technology penetration using spatial analysis. The novelty can be seen from the result of bibliometric analysis.
Keywords: Poverty Reduction, Internet Penetration, Media Literacy, Quadrant Analysis, Indonesia.

Introduction

This study departs from empirical condition and theoretical gap. The underlying empirical condition is the need for information related to poverty phenomenon becoming global issues. Poverty is a global issue targeted to be subjugated by the whole world. It can be seen from Sustainable Development Goals making 'to end poverty in all its forms everywhere' the main objective. The number of poor populations in Indonesia is 26.50 million people or 9.71 percent in September 2021. The national target is to lower poverty to 7-6.5% or 18.34 million–19.75 million people in late 2024, as the commitment of Republic of Indonesia's President, Joko Widodo, as mentioned in the document of National Medium-Term Development Plan in 2020-2024.

Viewed from the aspect of theoretical gap, this study meets the need for novelty as the issue discussed is related to poverty and internet penetration using spatial analysis. The novelty can be seen from the result of bibliometric analysis. The poverty research issue in Indonesia in the period of 2020–2022 is identified using co-occurrence Vosviewer analysis. The parameter used is Minim number of occurrence of keyword 2, finding 34 co-occurrences out of 315 keywords, divided into 3 clusters. When overlay is made based on publication year, as shown in Figure 1, 6 (six) new issues are found in

2021: (i) child poverty, (ii) poverty line, (iii) panel vector error correction, (iv) decentralization, (v) empowerment', and (vi) chronic poverty.
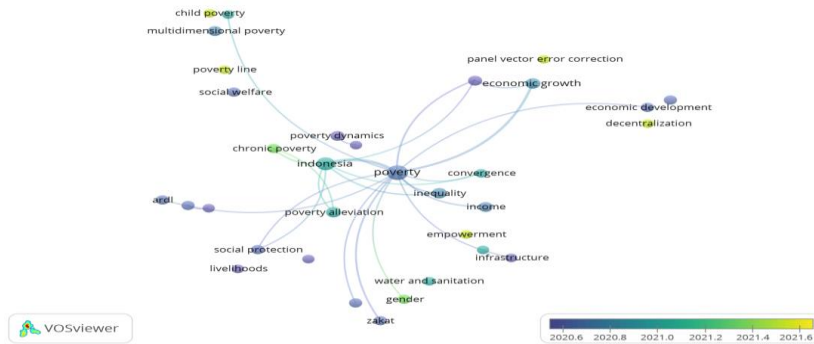

Figure 1. Cluster of Scopus-indexed poverty research in Indonesia in 2020-2021
(source: Primary Data Analysis using Vosviewer version 1.6)

Figure 1 indicates that internet topic has not appeared yet in the map of poverty research in Indonesia documented by Scopus database. Meanwhile, the position of internet and poverty issues in the researches conducted out of Indonesia is shown in Figure 2.
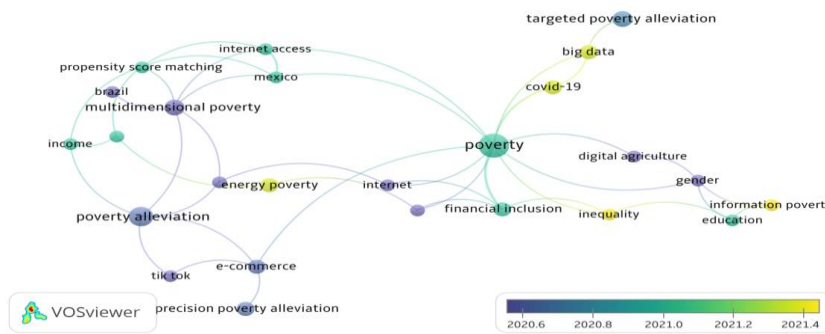

Figure 2. Cluster of Scopus-indexed international poverty researches in 2020-2021
(source: Primary Data Analysis using Vosviewer version 1.6)

Figure 2 shows that the international-scale poverty research has raised internet and poverty topics in 2020. The issue still potential to be developed in 2021 is poverty information, inequality, big data, energy poverty, and Covid-19. Considering this mapping, this study is designed to develop a research on internet penetration and poverty to yield a spatial-based map of poverty information in 33 (thirty three) provinces in Indonesia.

Problem statement studied is how is the relation of internet penetration to poverty rate in Indonesia? The analysis used is quadrant analysis to find the region still having low internet penetration and low poverty rate. In addition, this study also identified the region on anomaly, high internet penetration and high poverty rate. Meanwhile, the urgency of current study is to meet the need for spatial-based poverty information, particularly the correlation between internet penetration and poverty. Poverty information yielded can be utilized to make an inclusive social policy related to, among others: (i) the region needing to be prioritized for internet access expansion as one of supporting conditions to lower poverty rate, and (2) how to educate the citizens to utilize internet more productively and thereby contribute to lowering poverty.

A relevant literature study on internet support in lowering poverty rate can be found in some researches. The result of research shows that internet accessibility affects significantly the decrease of poverty rate in Java Island, Indonesia (Hidayat et al., 2021)

and in Mexico (García-Mora & Mora-Rivera, 2021). Study in Columbia (Cuberos et al., 2019) found that internet underlies the use of information and communication technology to bridge digital gap and to encourage empowerment in Bolívar and Villa del Rosariocities in Columbia-Venezuela border in Columbia. Improved access improvement and penetration rate of cellular phone and internet can increase financial inclusion, as the main factor supporting economic development and growth and poverty reduction (Bayar et al., 2021).

Studies conducted in Ghana (Siaw et al., 2020) and in Nigeria (Akindele et al., 2020) found that internet use increases agricultural and household incomes. Rural internet encourages the growth of rural e-commerce, and thereby affects rural income positively and significantly (Peng et al., 2021). Internet access at home helps job seekers find job opportunities more quickly, and thereby increases the potential unemployment reduction, and in turn contributes to poverty reduction (Denzer et al., 2021; Gürtzgen et al., 2021). Internet gap resulting in digital gap reflecting poverty in certain city/region/group in Mexico has been studied (Mecinas Montiel, 2016).

The digital divide and the role of internet access in alleviating poverty have become focal points in understanding socioeconomic disparities. Researchers have examined how internet connectivity affects various dimensions of poverty, including economic development, educational access, health outcomes, and social inclusion. This review synthesizes findings from recent studies, highlighting the complexities and varied impacts of digital connectivity.

Simionescu & Cifuentes-Faura (2024) explored the link between the digital economy and energy poverty, showing that digital infrastructure investment could alleviate energy poverty but often excludes low-income households. Lamberti et al., (2024) examined cyclic effects in digital divides, underscoring the importance of digital literacy in breaking poverty cycles. Oyebamiji & Khan (2023) demonstrated that internet access is critical in reducing multidimensional poverty in Nigeria, particularly among women. Cleofas (2023) highlighted the essential role of internet access in maintaining mental health among youth during COVID-19, showing that lack of access exacerbated mental health challenges.

Anrijs et al. (2023) argued that digital exclusion in welfare societies like Belgium leads to socioeconomic isolation, calling for policies to reduce this divide. Lahr (2020) addressed broad structural disparities in rural digital access, arguing for federal interventions. Ma et al. (2023) emphasized digitalization's potential in agricultural development, noting that rural areas lag due to limited internet access. Mora-Rivera & García-Mora (2021) found that internet access significantly reduced poverty in Mexican households, primarily by improving access to education and financial services. Friedline et al. (2020) introduced the concept of 'digital redlining,' highlighting how poor rural communities face barriers to financial services due to limited internet access. Mora-Rivera et al. (2024) explored poverty among Indigenous populations, finding that connectivity deficits worsen economic and social outcomes.

Internet penetration relates to the development of new media use. The result of research on new media use and poverty shows that social media can help build narration on poverty and thereby can be used to get support (Dutta & Elers, 2020; Lugo-Ocando, 2020). Social media contribute directly to women empowerment in many countries to pursue business through social media platform (Arefin et al., 2020; Zhu et al., 2022). Forati & Ghose (2022) used social media as platform to disseminate information or direct grant to those vulnerable.

Nevertheless, Lugo-Ocando (2019) found a paradox in which news media report poverty unfairly. News coverage on poverty in media tends to concentrate more on the manifestation of poverty than on the structural cause. The news media's coverage on poverty prefer imposing individual responsibility to those in the poverty rather to seeing the structural reason of poverty phenomenon. News media also pays inadequate attention to the issue and in fact dedicates very limited space and time to poverty in its news agenda.

From the literature review, it can be seen that internet correlates to poverty reduction through a variety of mediating variables. The important determinant of Information and Communication Technology use in poor families in Argentina, as studied by Alderete (2019), is the adequate access to Information and Communication Technology. In addition, there are other aspects such as technology complementarity and infomediary presence.

The factors found inhibiting the contribution of internet to the attempt of reducing poverty are, among others: access, skill, and motivation. Even, when access is available, some digital inequalities arise because citizens often have poor skill and motivation to pursue internet use for their best benefit, and thereby affect the contribution of internet to productivity improvement (Balgobin & Dubus, 2022; Laeeq Khan et al., 2020; Ofori et al., 2021; van Deursen & Mossberger, 2018; Zheng et al., 2022). Lechman & Popowska (2022) study found that internet affects the poverty reduction through various variables, including people's education level, job market, trading activity, and other ICT using activities contributing to community income.

In addition to positive impact, internet penetration also increases poverty, through the presence of other negative-valuing variables. It is because the emergence of internet is followed with the development of information technology, having impact on the reduction job opportunities, in which the less skillful human laborers are replaced with the ones who master technology-based devices (McClure, 2018; Postuła et al., 2021).

Nguyen et al. (2022) finding showed that the effect of internet use on productive purpose is that it can widen the income gap among the people having no internet access. Internet also can have an impact on widening the gap of society's social network (Mendonça et al., 2015). Internet-based information technology rarely becomes the singular cause of gap but it interacts with others such as technology use power, economic structure, and politics (Adams & Akobeng, 2021; Bauer, 2018; Palvia et al., 2018).

Having mapped previous studies in the scope of internet, ICT, Media, and Poverty themes, this study contributes to increasing the information on poverty based on the correlation between internet penetration and poverty rate in all provinces in Indonesia. The novelty of current study lies on the use of quadrant analytical method based on provincial area. The development of previous studies' finding is used as the qualitative analysis framework to sharpen the finding of quadrant analysis. The components considered to be the factors affecting the quadrant result are: information and communication technology media accessibility and use.

Methods

This study employed a quantitative approach with statistic descriptive analysis to explain the correlation between internet penetration and poverty rate. Data source was obtained from the result of National Economic Social Survey (Indonesian: Survey Social Economic Survey, thereafter called Susenas) of 2021 published by Republic of Indonesia's Central Bureau of Statistics (Biro Pusat Statistik, 2022). The data analyzed were: (i) proportion of people aged 10 years and older having ever accessed internet in

the last three months by province and type of main activity in 2020, and (ii) proportion of poor populations by province in Indonesia in 2020 (Biro Pusat Statistik, 2021). These two data were processed using SPSS Statistic 20 software, with mean-based quadrant analysis (Wallace, 2016), with X-axis is internet penetration or internet use rate And Y-axis is poverty rate.

To determine the raltionship between variables, this study used product moment correlation analysis. The product moment correlation is used widely to measure interval-scale or ration data correlation. The result of product moment correlation will yield coefficient of correlation (r) furthermore used to find out the strength of relation (correlation) that will be consulted with the following categories. The interpretation of correlational coefficient, (Sugiyono, 2018) is as follows: (i) 0-0.199 meaning very weak; (ii) 0.40-0.599 meaning moderately strong; (iii) 0.60-0.799 meaning strong; (iv) 0.80-1.0 meaning very strong. In product moment correlational model, there are 3 (three) characteristics of relation potentially appearing: (i) positive relation, meaning the increase in independent variable will be followed with the increase in dependent one; (ii) there is no correlation, meaning that dependent variable will not change despite the change in independent one; (iii) negative correlation, meaning the increase in independent variables will be followed with the decrease in dependent variables.

Results

The primary data in this study derived from Central Bureau of Statistics: (i) proportion of people aged 10 and older having ever accessed Internet in the last 3 years by Province and type of main activities in 2020; and (ii) proportion of Poor Population (P0) by Province and Region in 2020. The first data analysis was conducted on internet access data used to work with poverty rate data in 33 provinces in Indonesia with SPSS help, to be presented later in the form of quadrant. In addition to yielding quadrant, the processing of data pair was also employed to see the correlation using Pearson's product moment correlation (PPMC) test.

Quadrant analysis is the processing of simple turbulence data that is fairly useful in investigating the turbulence shift flow (Wallace, 2016). Quadrant analysis is the one using the comparison of 2 (two) indicators. Quadrant analysis can divide the plot area into 4 (four) based on the specified mean value. Overall, the four parts are: quadrants 1, 2, 3, and 4. The positions of data plot or factor located in a certain quadrant have similar (homogeneous) characteristics and thereby facilitate action taking, policy making, and activity planning in the future based on the characteristics of quadrants. The characteristics of individual quadrants are similar in each of cases. Quadrant analysis puts the intersection of quadrants on to the mean value of observation result in each of axes, aiming to find out specifically each of factors located on the quadrant.

In this study, X-axis is internet penetration or internet use rate. Meanwhile, Y-axis is poverty rate. Generally, based on the characteristics of each quadrant, quadrant 1 has low value of x-axis indicator, but high value of y-axis indicator. Quadrant 2 has high values of x- and y-axis indicators. Quadrant 3 has low values of x- and y-axe indicators, while quadrant 4 has high value of x-axis indicator but low value of y-axis indicator. The interpretation of quadrant analysis is varying for each of quadrants in each of cases, dependent on the interpretation of indicators to be compared. Previous studies found that the presence of internet has a positive impact on economic and social improvement if other intervening variables are positive. Considering the finding, this study determines the criteria of quadrant. Quadrant I is intended to the plot showing high internet

penetration and low poverty rate. Quadrant II is intended to the condition with low internet penetration and low poverty. Quadrant III is intended to an area with low internet penetration and high poverty rate. Meanwhile, quadrant IV is intended to the plot with high internet penetration and high poverty rate. This study also used Pearson's product moment correlation to find out the close relationship between internet variable and poverty rate. PPMC analysis is particularly conducted on the variables confirmed to be internet variable for the relation between internet and poverty in previous studies, including media use for working, study purposes, and other categories, non-working or non-school. The first result of the quadrant mapping of the correlation between internet use for working purpose and poverty rate is presented in Figure 3.
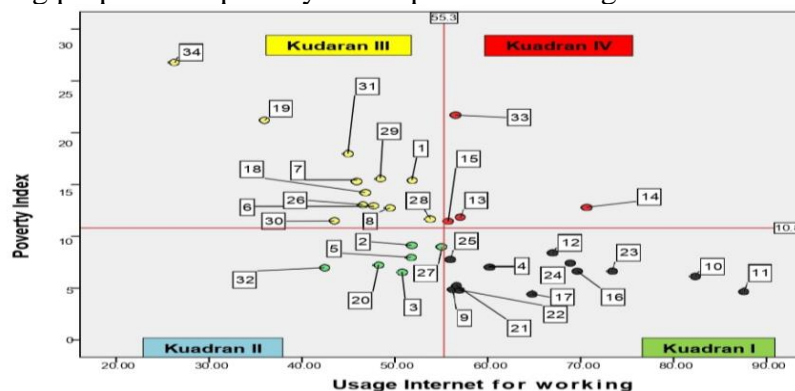

Figure 3. Internet Use for working and poverty rate in Indonesia by Province in 2020
(source: Primary Data Analysis using SPSS Statistic 20)

Correlational test on internet penetration for working purpose and poverty rate in 34 provinces in Indonesia yields very significant results of 0.000 and correlational coefficient of–0.629 (strong category). Figure 2 indicates the mean value of internet usage for working at 55.3%, and mean value of poverty rate at 10.8%. The provinces located in quadrant I have the following characteristics: internet penetration for working belongs to higher-than-the average category and poverty rate belongs to low category consisting of 12 provinces (35%), i.e. numbers 4, 9, 10, 11, 12, 16, 17, 21, 22, 23, 24, and 25. The provinces located in quadrant II have internet penetration for working below average and low poverty rate, consisting of 6 provinces (18%), i.e. numbers 2, 3, 5, 20, 27, and 32. The provinces located in quadrant III are those with internet usage for working below average but high poverty rate, consisting of 12 provinces (35%), i.e. numbers 1, 6, 7, 8, 18, 19, 26, 28, 29,30, 31, and 34. The provinces with high access to internet for working purpose and high poverty rate are located in quadrant IV, consisting of 4 provinces (12%), i.e. numbers 13, 14, 15, and 33. This data reveals that the presence of high internet access for working does not help control the poverty too well.

The highest percentage is found equally in quadrant I and III, 35% respectively. This finding confirms the previous studies conducted in many countries revealing that internet penetration contributes to poverty rate phenomenon. The presence of plot in quadrant III indicates that internet access is not an absolute variable to control poverty. Quadrants II and IV have lower percentage. The data in quadrant II means that divide poverty occurs, implying that there is an internet access gap in the provinces with high poverty rate. The data in quadrant IV means that the presence of internet needs the complement of non-technology variable.

Observation is also conducted on the data of internet usage for domestic or household affairs. The Republic of Indonesia's Central Bureau of Statistics defines doing

house chores as an individual activities of doing daily chores without getting wage. This data identification aims to find out the percentage of regions with high poverty rate and high internet usage for household affairs.
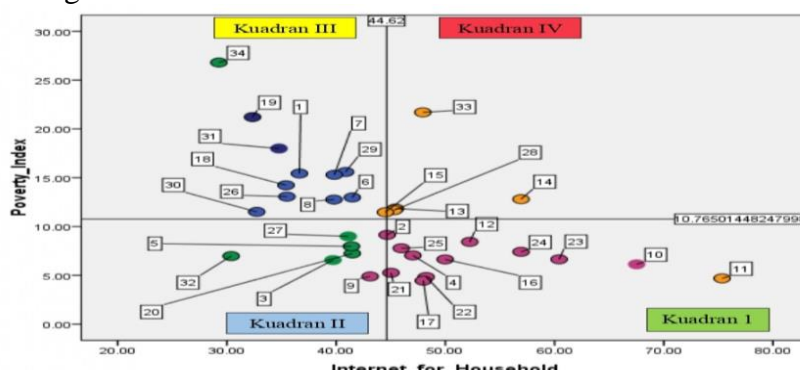

Figure 4. Internet usage for doing household chores and poverty rate in Indonesia by Province in 2020 (source: Primary Data Analysis using SPSS Statistic 20)

The result of Pearson's product moment correlational (PPMC) test shows that the internet usage for doing household chores correlates to poverty rate at medium level (-0.515). The distribution of provinces by the correlation between internet usage for doing house chores and poverty rate is presented in Figure 4 above. Figure 3 shows national mean poverty rate of 10.7% and internet usage for household of 44.65%. Internet usage for household tends to be the one not yielding cash directly, but it facilitates the fulfillment of other needs, such as shopping, searching for information, and fulfilling the needs for other public services. The result of data processing shows 12 provinces (35%) in quadrant I: 2, 4, 10, 11, 12, 16, 17, 21, 22, 23, 24, and 25. It means that generally in these 12 provinces the internet usage for household is high or above the national average, and the poverty rate is below the national average.

There are 6 provinces (18%) in quadrant II: 3, 5, 9, 20, 27, and 32, meaning that internet use for household and poverty rate are low. In quadrant III, there are 11 provinces (32%): 1, 6, 7, 8, 18, 19, 26, 29, 30, 31, and 34, indicating that internet usage for household is low and poverty rate is high. In quadrant IV, there are 5 provinces (15%): 13, 14, 15, 28, and 33, meaning that internet usage for household is high and poverty rate is also high. The data display in the first and the second segments indicate similarity in the province groups occupying the quadrants. The comparative result is presented in Table 1.

Table 1. The comparative correlation of internet penetration to poverty rate in Indonesia

No	Correlation	Quadrant I	Quadrant II	Quadrant III	Quadrant IV
1	Internet usage for working and poverty rate	(i) Riau, (ii) Kep. Bangka Belitung (Bangka Belitung Islands), (iii) Kep. Riau (Riau Islands), (iv) Jakarta, (v) Jawa Barat (West Java),	(i) Sumatera Utara (North Sumatera), (ii) Sumatra Barat (West Sumatera), (iii) Jambi, (iv) Kalimantan Barat (West Kalimantan); (v) Sulawesi	(i) Aceh, (ii) Sumatra Selatan (South Sumatera), (iii) Bengkulu, (iv) Lampung, (v) Nusa Tenggara Barat (West	Jawa Tengah (Central Java), Daerah Istimewa Yogyakarta (Yogyakarta Special Region), Jawa Timur (East Java), Papua Barat

175 ■ P-ISSN: 2086-1559, E-ISSN: 2527-2810

No	Variable				
		(vi) Banten, (vii) Bali, (viii) Kalimantan Tengah (Central Kalimantan), (ix) Kalimantan Selatan (South Kalimantan), (x) Kalimantan Timur (East Kalimantan), (xi) Kalimantan Utara (North Kalimantan), (xii) Sulawesi Utara (North Sulawesi).	Selatan (South Sulawesi), (vi) Maluku Utara (North Moluccas).	Nusa Tenggara), (vi) Nusa Tenggara Timur (East Nusa Tenggara), (vii) Sulawesi Tengah (Central Sulawesi), (viii) Sulawesi Tenggara (South East Sulawesi), (ix) Gorontalo, (x) Sulawesi Barat (West Sulawesi); (xi) Maluku (Moluccas), (xii) Papua.	(West Papua).
2	Internet Usage for Doing Household Chores and Poverty Rate	(i) Sumatra Utara (North Sumatera), (ii) Riau, (iii) Kepulauan Riau (Riau Islands), (iv) DKI Jakarta (Jakarta Capital Special Region), (v) Jawa Barat (West Java), (vi) Banten, (vii) Bali, (viii) Kalimantan Tengah (Central Kalimantan), (ix) Kalimantan	(i) Sumatra Utara (North Sumatera), (ii) Jambi,(iii) Kepulauan Bangka Belitung (Bangka Belitung Islands), (iv) Kalimantan Barat (West Kalimantan), (v) Sulawesi Selatan (South Kalimantan), (vi) Maluku Utara (North Moluccas).	(i) Aceh, (ii) Sumatra Selatan (South Sumatera), (iii) Bengkulu, (iv) Lampung, (v) Nusa Tenggara Barat (West Nusa Tenggara), (vi) Nusa Tenggara Timur (East Nusa Tenggara), (vii) Sulawesi Tengah (Central	(i) Jawa Tengah (Central Java), (ii) Daerah Istimewa Yogyakarta (Yogyakarta Special Region),(iii) Jawa Timur (East Java), (iv) Sulawesi Tenggara (South East Sulawesi), (v) Papua Barat (West Papua).

Selatan (South Kalimantan), (x) Kalimantan Utara (North Kalimantan), (xi) Sulawesi Utara (North Sulawesi).	Sulawesi), (viii) Gorontalo, (ix) Sulawesi Barat (West Sulawesi), (x) Maluku (Moluccas), (xi) Papua.

Note: Quadrant I = provinces with high internet penetration and low poverty rate; Quadrant II = provinces with low internet penetration and low poverty; Quadrant III = provinces with low internet penetration and high poverty rate; Quadrant IV = provinces with high internet penetration and high poverty rate.

The finding of research as presented in the quadrant map and the PPMC results aforementioned answer the problem statements in this study, there is a moderate-to-strong relation between internet penetration and poverty rate. Data display in quadrants II and III answer the research question *"Which regions do need priority for the expansion of internet access as one of conditions to support the poverty rate reduction?"*

The research conducted on 34 provinces in Indonesia found internet gap or digital poverty or digital divide in those in quadrant III. The parameters are percentage internet usage below national average and poverty rate above national average. There are 12 provinces in Indonesia fulfilling these parameters in 2020: i) Aceh, (ii) Sumatera Selatan (South Sumatera), (iii) Bengkulu, (iv) Lampung, (v) Nusa Tenggara Barat (West Nusa Tenggara), (vi) Nusa Tenggara Timur (East Nusa Tenggara), (vii) Sulawesi Tengah (Central Sulawesi), (viii) Sulawesi Tenggara (South East Sulawesi), (ix) Gorontalo, (x) Sulawesi Barat (West Sulawesi); (xi) Maluku (Moluccas), (xii) Papua. Digital divide or digital gap condition is also found in the different regions in quadrant II, low internet penetration. There are 5 provinces appearing consistently in the first and the second segment analyses: (i) Sumatra Utara (North Sumatera), (ii) Jambi, (iii) Kalimantan Barat (West Sumatera), (v) Sulawesi Selatan (South Sulawesi), and (vi) Maluku Utara (North Moluccas).

The display of data analysis result shown in table 1 also answers the research question related to the regions located in anomaly area, high internet penetration and high poverty rate. This finding leads to a discussion on how to build the citizens' literacy to utilize internet more productively in order to contribute to reducing poverty. In this area, the author refers to the findings of previous studies positioning the media variable to mainstream the inclusive and sustainable development communication, to optimize its contribution to poverty reduction. The following discussion will focus on the quadrant IV as the challenge of previous studies' proposition, in which internet is claimed to have positive relation in supporting poverty reduction and to become an instrument to improve productivity to alleviate poverty.

Discussion

The results of this study provide a nuanced view of the relationship between internet penetration and poverty rates across Indonesian provinces, emphasizing the diverse impacts of ICT across rural and urban areas. The findings challenge the assumption that internet access alone can significantly reduce poverty, as evidenced by the variations

observed in Quadrant analysis, particularly in Quadrants III and IV, where internet penetration does not correlate neatly with poverty reduction. This section explores these complexities by addressing the unique socio-economic, structural, and demographic factors that may mediate the relationship between ICT access and poverty reduction. Moreover, comparisons are drawn to other studies to understand these dynamics more broadly, providing insight into why high internet penetration does not consistently align with low poverty rates.

1. The Digital Divide and Socio-Economic Inequality

The digital divide remains a significant challenge across various Indonesian provinces, especially those in Quadrants III and IV. The provinces in Quadrant III, such as Aceh, Sumatera Selatan, and Nusa Tenggara Timur, exhibit low internet usage rates coupled with high poverty rates, illustrating a form of digital poverty. This finding aligns with previous research highlighting the persistence of digital inequality in socio-economically disadvantaged regions, where limited internet access exacerbates existing disparities (Cleofas, 2023; Simionescu & Cifuentes-Faura, 2024). For these provinces, the digital divide serves as both a symptom and a contributor to poverty, hindering opportunities for education, economic growth, and social integration. The lack of internet access, compounded by inadequate digital literacy, restricts residents' ability to leverage online resources for income generation, educational advancement, and essential services, thus entrenching poverty.

For instance, Cleofas (2023) emphasizes the crucial role of internet access in supporting mental health and educational outcomes, particularly during crises like the Covid-19 pandemic. In regions with limited digital infrastructure, the absence of such access can have wide-reaching effects on social and economic well-being. Therefore, expanding internet access in these areas is critical but must be accompanied by tailored interventions, such as digital literacy programs and local support initiatives, to address the specific challenges faced by these communities.

2. High Internet Penetration and High Poverty Rates: The Anomaly of Quadrant IV

Provinces in Quadrant IV, such as Central Java, East Java, and Yogyakarta, present a unique paradox where high internet penetration coexists with high poverty rates. This phenomenon raises questions about the factors inhibiting the effectiveness of internet access in poverty alleviation in these areas. The data suggest that merely providing internet access is insufficient to overcome structural barriers to economic advancement. Factors such as population density, rural predominance, and limited human capital development may explain why internet access does not translate directly into poverty reduction in these regions.

Population size and density are critical components of this discussion. Both Central and East Java rank highly in terms of population numbers, which creates unique economic pressures and demands on available resources. The larger the population living near or below the poverty line, the greater the challenge of leveraging ICT for broad-based poverty reduction (Biro Pusat Statistik, 2021). This finding aligns with studies suggesting that internet access alone cannot bridge socio-economic gaps without supportive social and economic policies that address broader structural issues, such as employment opportunities, education quality, and income inequality (Lugo-Ocando, 2020; Mora-Rivera & García-Mora, 2021).

3. Rural-Urban Divide and Economic Opportunities

The role of the rural-urban divide is also significant, as highlighted in the findings. The majority of impoverished populations in Central and East Java reside in rural areas,

where the economy is primarily based on the primary sector. In rural contexts, the utility of the internet is often constrained by limited job markets and fewer income-generating opportunities. As Peng et al. (2021) note, the expansion of e-commerce and digital economies in rural areas requires an integrated infrastructure that includes internet access, economic diversification, and skill development.

Furthermore, the primary sector often lacks the value-added benefits that ICTs provide in more diversified economies. For instance, while internet access may facilitate market access or online learning, these benefits remain limited in areas where basic infrastructure and educational opportunities are scarce. In contrast, urban areas with diverse economies can leverage ICT to improve productivity and foster innovation, which is less feasible in regions dependent on traditional agriculture or small-scale industries. Thus, targeted policies are essential to address these economic disparities by supporting rural digital economies through training, funding, and infrastructure.

4.   Human Capital and Digital Literacy as Catalysts for Economic Growth

Another critical factor limiting the impact of internet access on poverty reduction in Quadrant IV is human capital. Central and East Java rank low in terms of average years of schooling, with both provinces positioned toward the lower end of national rankings (Biro Pusat Statistik, 2022). Low levels of education can hinder the ability of residents to effectively utilize ICT for economic benefit, as they may lack the necessary skills to engage with digital platforms productively. Studies by Balgobin & Dubus (2022) and Zheng et al. (2022) support this, indicating that digital skills and motivation are essential for realizing the potential benefits of ICT. In regions where educational attainment is limited, investments in internet infrastructure must be complemented by digital literacy programs to enable the effective use of digital resources. Moreover, previous research highlights that digital literacy, innovation, and skill development are essential in transforming internet access into economic value (Laeeq Khan et al., 2020; Lechman & Popowska, 2022). Without these elements, internet access remains underutilized, and the potential of ICT for poverty alleviation remains unrealized. In the context of Indonesia, policies aimed at reducing poverty through ICT must prioritize education and digital literacy as integral components of any intervention strategy, particularly in regions with high internet penetration but high poverty rates.

5.   Media Utilization and Economic Inclusion

The study also reveals variations in media utilization across provinces. In Central and East Java, the use of media for commercial activities, such as online selling, remains low compared to other provinces. This limited use of digital platforms for income-generating activities may explain why high internet penetration has not translated into economic growth or poverty reduction in these areas. Research by Dutta & Elers (2020) and Lugo-Ocando (2019) suggests that media narratives and access to commercial platforms can play a significant role in empowering individuals economically, especially among marginalized groups. Encouraging the productive use of media, particularly social media and e-commerce, could facilitate broader economic participation in these provinces. However, this requires not only digital skills but also the infrastructure to support digital transactions, including secure payment systems, logistics, and delivery services. By investing in these areas, policymakers can support local entrepreneurs and small businesses, enabling them to reach wider markets and contribute to regional economic growth.

6.   The Role of Inclusive and Sustainable Development Communication

Previous   studies   indicate   that   inclusive   and   sustainable   development

communication can play a crucial role in addressing poverty by promoting policies that support social and economic inclusion. Media can act as a catalyst for poverty alleviation by framing internet access as an essential public good and advocating for policies that address digital exclusion (Anrijs et al., 2023; Simionescu & Cifuentes-Faura, 2024). Effective communication strategies can raise public awareness of the importance of digital inclusion, encourage community participation, and garner support for government interventions.

In the Indonesian context, inclusive media narratives could foster support for digital literacy initiatives and broader internet access policies. For example, communicating the benefits of internet access for rural economic development might encourage investment in digital infrastructure in underserved areas. Additionally, such narratives can empower marginalized communities by providing them with a platform to voice their needs and aspirations, thereby facilitating more responsive and targeted policy-making.

7.   Implications for Policy and Practice

This study's findings highlight the need for a holistic approach to poverty reduction through ICT. While internet access is a valuable tool for economic development, it must be integrated into a broader socio-economic strategy that addresses educational disparities, rural economic development, and digital literacy. Policies that prioritize digital literacy and skill development, particularly in regions with high internet access but limited economic outcomes, could maximize the poverty-reduction potential of ICT (Mora-Rivera & García-Mora, 2021; Oyebamiji & Khan, 2023). Furthermore, targeted interventions in Quadrants II and III, which exhibit low internet penetration and high poverty rates, are essential to bridging the digital divide and fostering inclusive growth. For these regions, investments in infrastructure, combined with training and community support programs, can create the conditions necessary for ICT to drive poverty alleviation. In particular, rural regions would benefit from digital initiatives focused on agricultural productivity, access to markets, and e-commerce, all of which could leverage local economic strengths.

Conclusion

This research found digital divide and digital poverty phenomena and thus recommends Indonesian government to prioritize the expansion of internet access into the regions in quadrant III, followed those in quadrant II. Considering the result of case analysis on Central Java and East Java Provinces, this research recommends Indonesian government to prioritize digital economic development in rural areas. Further researches are recommended to be conducted related the analysis of policy communication media for digital literacy in rural areas. The research methods needing to be developed are social network analysis and discourse network for rural digital economic issue.

Conflict of Interest

We certify that there is no conflict of interest with any financial, personal, or other relationships with other people or organization related to the material discussed in the manuscript.

Acknowledgements

References

Adams, S., & Akobeng, E. (2021). ICT, governance and inequality in Africa. *Telecommunications Policy*, *45*(10), 102198. https://doi.org/10.1016/j.telpol.2021.102198

Akindele, F. A., Adepoju, K. O., Omole, S. M., Adebayo, T. T., & Adeojo, M. B. (2020). The effect of Internet Technology on Employment towards a Jobless Society. *International Journal of Academic Library and Information Science*, *8*(6), 204–208. https://doi.org/10.14662/IJALIS2020.205

Alderete, M. V. (2019). Examining the drivers of internet use among the poor: The case of Bahía Blanca city in Argentina. *Technology in Society*, *59*, 101179. https://doi.org/10.1016/J.TECHSOC.2019.101179

Anrijs, S., Mariën, I., De Marez, L., & Ponnet, K. (2023). Excluded from essential internet services: Examining associations between digital exclusion, socio-economic resources and internet resources. *Technology in Society*, *73*, 102211. https://doi.org/10.1016/J.TECHSOC.2023.102211

Arefin, S., Hoque, R., & Rasul, T. (2020). Social media for web communities of female entrepreneurs: A prisma-compliant exploration. *International Journal of Web Based Communities*, *16*(4), 1. https://doi.org/10.1504/IJWBC.2020.10032584

Balgobin, Y., & Dubus, A. (2022). Mobile phones, mobile Internet, and employment in Uganda. *Telecommunications Policy*, *46*(5), 102348. https://doi.org/10.1016/j.telpol.2022.102348

Bauer, J. M. (2018). The Internet and income inequality: Socio-economic challenges in a hyperconnected society. *Telecommunications Policy*, *42*(4), 333–343. https://doi.org/10.1016/j.telpol.2017.05.009

Bayar, Y., Gavriletea, M. D., & Păun, D. (2021). Impact of mobile phones and internet use on financial inclusion: Empirical evidence from the EU post-communist countires. *Technological and Economic Development of Economy*, *27*(3), 722–741. https://doi.org/10.3846/tede.2021.14508

Biro Pusat Statistik. (2021). *Jumlah Desa/Kelurahan Menurut Provinsi, 2021*. https://www.bps.go.id/indikator/indikator/view_data_pub/0000/api_pub/bEVXU2 52SU9hTjBxWEU3Z2NpS1ZPQT09/da_02/1

Biro Pusat Statistik. (2022). *Statistik Kesejahteraan Sosial tahun 2021*.

Cleofas, J. V. (2023). Internet access as a moderator of mental health and satisfaction with life during the COVID-19 pandemic: Evidence from young Filipino undergraduates from income-poor households. *Children and Youth Services Review*, *155*, 107255. https://doi.org/10.1016/J.CHILDYOUTH.2023.107255

Cuberos, M.-A., Vivas-García, M., & Mazuera-Arias, R. (2019). Las Tecnologías de Información y Comunicación como mediadoras de políticas públicas para la reducción de la pobreza en dos municipios fronterizos colombo-venezolanos. *Comunicación y Sociedad*, *2019*, 1–30. https://doi.org/10.32870/cys.v2019i0.6374

Denzer, M., Schank, T., & Upward, R. (2021). Does the internet increase the job finding rate? Evidence from a period of expansion in internet use. *Information Economics and Policy*, *55*, 100900. https://doi.org/10.1016/j.infoecopol.2020.100900

Dutta, M., & Elers, P. (2020). Media narratives of kindness − a critique. *Media International Australia*, *177*(1), 108–112. https://doi.org/10.1177/1329878X20953278

Forati, A. M., & Ghose, R. (2022). Examining Community Vulnerabilities through multi-scale geospatial analysis of social media activity during Hurricane Irma.

International Journal of Disaster Risk Reduction, *68*, 102701. https://doi.org/10.1016/j.ijdrr.2021.102701

Friedline, T., Naraharisetti, S., & Weaver, A. (2020). Digital Redlining: Poor Rural Communities' Access to Fintech and Implications for Financial Inclusion. *Journal of Poverty*, *24*(5–6), 517–541. https://doi.org/10.1080/10875549.2019.1695162

García-Mora, F., & Mora-Rivera, J. (2021). Exploring the impacts of Internet access on poverty: A regional analysis of rural Mexico. *New Media & Society*. https://doi.org/10.1177/14614448211000650

Gürtzgen, N., (né Nolte), A. D., Pohlan, L., & van den Berg, G. J. (2021). Do digital information technologies help unemployed job seekers find a job? Evidence from the broadband internet expansion in Germany. *European Economic Review*, *132*, 103657. https://doi.org/10.1016/j.euroecorev.2021.103657

Hidayat, A., Prasetyia, F., & Pangestuty, F. (2021). Role of Internet Accessibility in Reducing the Poverty rates in Java; a Spatial Approach. *Journal of Indonesian Applied Economics*, *9*(1), 21–31.

Laeeq Khan, M., Welser, H. T., Cisneros, C., Manatong, G., & Idris, I. K. (2020). Digital inequality in the Appalachian Ohio: Understanding how demographics, internet access, and skills can shape vital information use (VIU). *Telematics and Informatics*, *50*, 101380. https://doi.org/10.1016/j.tele.2020.101380

Lahr, M. L. (2020). Poverty, the U.S. South, and the SRSA. *Review of Regional Studies*, *50*(2). https://doi.org/10.52324/001c.14142

Lamberti, G., Lopez-Sintas, J., & Pandolfo, G. (2024). Tackling Cyclicity in Causal Models with Cross-Sectional Data Using a Partial Least Squares Approach: Implications for the Sequential Model of Internet Appropriation. *Social Indicators Research*, *172*(3), 879–900. https://doi.org/10.1007/s11205-024-03320-z

Lechman, E., & Popowska, M. (2022). Harnessing digital technologies for poverty reduction. Evidence for low-income and lower-middle income countries. *Telecommunications Policy*, *46*(6), 102313. https://doi.org/10.1016/j.telpol.2022.102313

Lugo-Ocando, J. (2020). The 'changing' face of media discourses on poverty in the age of populism and anti-globalisation: The political appeal of anti-modernity and certainty in Brazil. *International Communication Gazette*, *82*(1), 101–116. https://doi.org/10.1177/1748048519880749

Lugo-Ocando, J. (2019). Poverty in the news media: Continuities, ruptures, and change in the reporting socioeconomic inequality. *Sociology Compass*, *13*(7). https://doi.org/10.1111/soc4.12719

Ma, W., McKay, A., Rahut, D. B., & Sonobe, T. (2023). An introduction to rural and agricultural development in the digital age. *Review of Development Economics*, *27*(3), 1273–1286. https://doi.org/10.1111/rode.13025

McClure, P. K. (2018). "You're Fired," Says the Robot. *Social Science Computer Review*, *36*(2), 139–156. https://doi.org/10.1177/0894439317698637

Mecinas Montiel, J. M. (2016). The Digital Divide in Mexico: A mirror of poverty. *Mexican Law Review*, *9*(1), 93–102. https://doi.org/10.1016/j.mexlaw.2016.09.005

Mendonça, S., Crespo, N., & Simões, N. (2015). Inequality in the network society: An integrated approach to ICT access, basic skills, and complex capabilities. *Telecommunications Policy*, *39*(3–4), 192–207. https://doi.org/10.1016/j.telpol.2014.12.010

Mora-Rivera, J., & García-Mora, F. (2021). Internet access and poverty reduction:

Evidence from rural and urban Mexico. *Telecommunications Policy*, *45*(2), 102076. https://doi.org/10.1016/j.telpol.2020.102076

Mora-Rivera, J., Fierros-González, I., & García-Mora, F. (2024). Determinants of poverty among Indigenous people in Mexico's Guerrero Mountain Region. *Development Policy Review*, *42*(1). https://doi.org/10.1111/dpr.12733

Nguyen, T. T., Nguyen, T.-T., & Grote, U. (2022). Internet use, natural resource extraction and poverty reduction in rural Thailand. *Ecological Economics*, *196*, 107417. https://doi.org/10.1016/j.ecolecon.2022.107417

Ofori, I. K., Armah, M. K., Taale, F., & Ofori, P. E. (2021). Addressing the severity and intensity of poverty in Sub-Saharan Africa: how relevant is the ICT and financial development pathway? *Heliyon*, *7*(10), e08156. https://doi.org/10.1016/j.heliyon.2021.e08156

Oyebamiji, O. A., & Khan, M. (2023). Multidimensional poverty in South-West Nigeria: Empirical insights from a household survey in Osun State. *Poverty & Public Policy*, *15*(2), 227–250. https://doi.org/10.1002/pop4.365

Palvia, P., Baqir, N., & Nemati, H. (2018). ICT for socio-economic development: A citizens' perspective. *Information & Management*, *55*(2), 160–176. https://doi.org/10.1016/j.im.2017.05.003

Peng, C., Ma, B., & Zhang, C. (2021). Poverty alleviation through e-commerce: Village involvement and demonstration policies in rural China. *Journal of Integrative Agriculture*, *20*(4), 998–1011. https://doi.org/10.1016/S2095-3119(20)63422-0

Postuła, M., Chmielewski, W., Puczyński, P., & Cieślik, R. (2021). The Impact of Information and Communication Technologies (ICT) on Energy Poverty and Unemployment in Selected European Union Countries. *Energies*, *14*(19), 6110. https://doi.org/10.3390/en14196110

Siaw, A., Jiang, Y., Twumasi, M. A., & Agbenyo, W. (2020). The Impact of Internet Use on Income: The Case of Rural Ghana. *Sustainability*, *12*(8), 3255. https://doi.org/10.3390/su12083255

Simionescu, M., & Cifuentes-Faura, J. (2024). The digital economy and energy poverty in Central and Eastern Europe. *Utilities Policy*, *91*, 101841. https://doi.org/10.1016/j.jup.2024.101841

Sugiyono. (2018). *Metode Penelitian Kuantitatif*. Alfabeta.

van Deursen, A. J. A. M., & Mossberger, K. (2018). Any Thing for Anyone? A New Digital Divide in Internet-of-Things Skills. *Policy & Internet*, *10*(2), 122–140. https://doi.org/10.1002/poi3.171

Wallace, J. M. (2016). Quadrant Analysis in Turbulence Research: History and Evolution. *Annual Review of Fluid Mechanics*, *48*(1), 131–158. https://doi.org/10.1146/annurev-fluid-122414-034550

Zheng, Y., Zhu, T., & JIia, W. (2022). Does Internet use promote the adoption of agricultural technology? Evidence from 1 449 farm households in 14 Chinese provinces. *Journal of Integrative Agriculture*, *21*(1), 282–292. https://doi.org/10.1016/S2095-3119(21)63750-4

Zhu, X., Li, X., Gong, J., & Jinghong Xu. (2022). Technology empowerment: A path to poverty alleviation for Chinese women from the perspective of development communication. *Telecommunications Policy*, *46*(6), 102328. https://doi.org/10.1016/j.telpol.2022.102328