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Meaningful Community-Centered Connectivity as an Alternative/Peripheral Practice of Rural Digital Development in Indonesia

Subekti Priyadharma and Rudi Hartanto

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Overview of the digital divide and connectivity challenges in the Asia-Pacific region.

(From Yoonee Jeong, "Bridging the digital divide," Hinrich Foundation, July 26, 2022, https://www.hinrichfoundation.com/research/article/tech-digital-trade/bridging-digital-divide-asia-eafq-v14)

Table of Contents

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POLICY BRIEF 2026-16
ISSN 2619-7278 (Print)
ISSN 2619-7286 (Online)

PROGRAM ON ALTERNATIVE DEVELOPMENT

Towards a Feminist Policy Analysis Framework

Assessing Gender Policies in the Philippines

Maria Dulce F. Natividad, PhD

Introduction

The Philippines is recognized as one of the most gender-equal countries globally, ranking 20th out of 148 countries in the World Economic Forum's Global Gender Gap Report in 2025. Ranked third in the Asia Pacific, it is a consistent leader in gender equality in the region (PCW 2025). This is attributed mostly to the enactment of policies that defend and promote women's rights beginning in the 1990s. In general, these policies can be categorized into legislation that a) provide frameworks for gender equality, b) address gender-based violence, c) affirm reproductive health rights, d) recognize women's economic rights, and e) challenge cultural and family practices. Most notable among these are: [1]

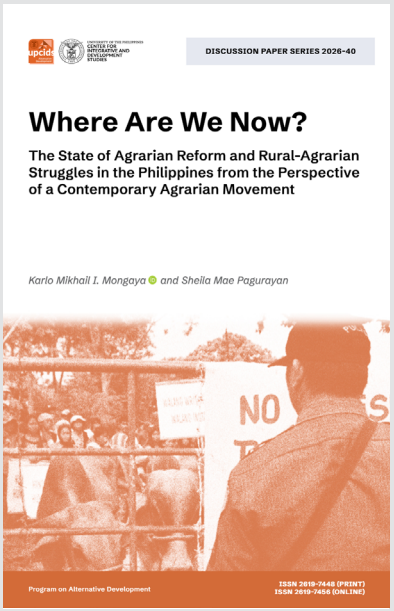
- Republic Act 7192: Women in Development and Nation-Building Act (1992)
- Republic Act 7322: Increasing Maternity Benefits in Favor of Women Workers in the Private Sectors
- Republic Act 7877: Anti-Sexual Harassment Act of 1995
- Republic Act 8353: The Anti-Rape Law of 1997
- Republic Act 9208: Anti-Trafficking in Persons Act of 2003 (expanded 2022)
- Republic Act 9262: Anti-Violence Against Women and their Children Act of 2004
- Republic Act 9710: The Magna Carta of Women (2009)
- Republic Act 9775: Anti-Child Pornography Act of 2009
- Republic Act 10354: The Responsible Parenthood and Reproductive Health Act of 2012
- Republic Act No. 10361: Domestic Workers Act or Batas Kasambahay (2013)
- Republic Act 11313: Safe Spaces Act (2019)
- Republic Act 11596: An Act Prohibiting the Practice of Child Marriage and Imposing Penalties for Violations Thereof (2022)

The successful reshaping of the Philippine policy landscape on women and gender can be attributed to two factors. The first was the presence of a dynamic women's and feminist movement that initiated, drove, and ensured many of these policy reforms. In reframing issues of women

1 For a more complete list of policies on women and gender in the Philippines, please visit https://pcw.gov.ph/republic-acts-2/

POLICY BRIEF

Towards a Feminist Policy Analysis Framework: Assessing Gender Policies in the Philippines



DISCUSSION PAPER SERIES 2026-40

Where Are We Now?

The State of Agrarian Reform and Rural-Agrarian Struggles in the Philippines from the Perspective of a Contemporary Agrarian Movement

Karlo Mikhail I. Mongaya and Sheila Mae Pagurayan

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DISCUSSION PAPER

Where Are We Now? The State of Agrarian Reform and Rural-Agrarian Struggles in the Philippines from the Perspective of a Contemporary Agrarian Movement

Meaningful Community-Centered Connectivity as an Alternative/Peripheral Practice of Rural Digital Development in Indonesia

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Key Highlights

- This paper advances *meaningful Community-Centered Connectivity (CCC)* as an explicitly peripheral and structural alternative to mainstream rural digital development in Indonesia, contending that connectivity becomes meaningful not through access alone, but when digital infrastructure is aligned with the social, cultural, and economic aspirations that communities define for themselves; it reframes the "periphery" from a passive recipient of technology into a legitimate center of innovation and decision-making. Indonesian digital development remains dominated by center-centric, infrastructure-led paradigms, from the Palapa Ring backbone and USO/BAKTI financing to the *Digital Indonesia Vision 2045* and successive "building from the periphery" slogans (Jokowi's *Nawacita*, Prabowo's *Asta Cita*) that privilege universal access and market expansion, even as persistent urban–rural divides (for instance, roughly 85 percent connectivity in Jakarta against some 26 percent in Papua) expose the limits of top-down, KPI-driven rollout.

- The study draws on two APC-funded research projects on the School of Community Networks (SCN): *Connecting the Unconnected* (2022–2023) and *Developing a National Strategy for Meaningful Community-Centered Connectivity in Indonesia* (2024), in which the lead author served as research coordinator, combining field observation and interviews with 57 informants across SCN sites with expert interviews, participatory discussion, and involvement in national events, analyzed through APC's *Theory of Change* and a periphery-centric framework

- Across sites such as Ciptagelar (now Gelaralam), Ciracap, Sukadana, Pulo Aceh, and Ngata Toro, SCN initiatives deploy low-cost, locally maintainable infrastructure—bamboo towers, VSAT, solar power, voucher systems, and IoT sensors—guided by the "5L" principles to generate meaningful use across five sectors (health, governance, disaster and climate resilience, education and culture, and the productive economy), while strengthening community capacity, cultural preservation, and local agency; levels of advancement vary widely, and challenges persist around unreliable electricity, equipment standardization, financial sustainability, and competition from profit-driven providers (such as Starlink resale in Ngata Toro).

- Meaningful CCC is conceived not as a technological endpoint but as a process of expanding freedom and agency, consistent with Sen's (1999) conception of *development as freedom*; the periphery is thereby reimagined as a center, not in geography, but in epistemology and power, with the meaningfulness of connectivity defined by communities themselves rather than imposed by market standards or government KPIs.

- Rural digital policy should pivot from universal to meaningful access by recognizing community ownership and autonomy, providing technical standardization and reliable power infrastructure, embedding multistakeholder collaboration with village and *adat* (customary) leaders, ensuring affordable access points and locally relevant content, and treating CCC not as a supplement but as a structural component of national connectivity strategy.

Introduction

The longstanding issue of the digital divide between developed and developing nations, as well as among rich and poor countries, is a well-documented concern. This gap not only persists at the international level but also within individual countries, spanning various socioeconomic factors such as income disparity, gender, educational attainment, ethnicity, and the divide between urban and rural areas (Woodhouse 2022; World Bank 2021). The Indonesian government has made a commitment to addressing this digital disparity by implementing various initiatives. For instance, the Ministry of Communication and Digital Affairs, or Komdigi (formerly the Ministry of Communication and Information), has initiated the "Inclusive Digital Transformation" program, aimed at bolstering digital infrastructure in underserved regions, fostering digital literacy and skills development (digital talent), and enacting supplementary legislation to complement existing regulatory frameworks (Setu 2021). These efforts are integral to the broader digital transformation agenda, which includes initiatives such as the promotion of the Universal Service Obligation (USO) program.

Komdigi plays a strategic role in expanding broadband access through Regulation No. 7/2018, which targets the 3T areas (*terdepan*, *terluar*, *tertinggal*, or frontier, outermost, underdeveloped). Regulations such as No. 25/2015 on USO provide community funding for ICT infrastructure and capacity-building initiatives. While Komdigi leads national ICT policy, the Digital Village Initiative from the Ministry of Villages and Development of Disadvantaged Regions (*Kementerian Desa dan Pembangunan Daerah Tertinggal*, Kemendes PDT) introduces regional overlap, complicating coordination among ministries in areas like Central Sulawesi.

The primary document serving as a reference for realizing the "Golden Indonesia" 2045 Vision in the digital sector is the *Digital Indonesia Vision 2045* (*DIV2045*), released by Komdigi in December 2023. This document outlines Indonesia's national digital strategy and roadmap, guiding future policy direction leading up to 2045. In its implementation, *DIV2045* emphasizes three core principles: inclusivity, empowerment, and sustainability. The inclusivity principle stresses the importance of equal digital access and the creation of safe digital spaces for all segments of society. The empowerment principle encourages communities to utilize digital technology productively and to generate added value from its use. Meanwhile, the sustainability principle places the Sustainable Development Goals (SDGs) as its primary reference.

Within the country, the principle of inclusivity has been articulated by President Prabowo, as outlined in *Asta Cita* (the eight-point presidential vision and mission), specifically point six, in which the government commits to "building from the village and from the bottom-up to promote economic equity and eradicate poverty." This development principle aligns with the earlier concept of "building from the periphery" advanced by former President Joko Widodo (Jokowi) through his *Nawacita* program.

It remains to be critically assessed whether these principles will genuinely translate into practice or they will be reduced to little more than aesthetically pleasing development slogans, lacking the substantive capacity to effect meaningful change within the communities where this digital vision is pursued.

The experience during Jokowi's administration demonstrates that his development paradigm amounted to little more than a façade, concealing a vision of development that was overly focused on infrastructure expansion financed through debt, an approach reminiscent of the New Order era under President Suharto. Eve Warburton characterizes this as a form of "new developmentalism," which she defines as "a narrow form of economic progress in infrastructure, deregulation, and de-bureaucratization," driven by a strong "statist-nationalist ideology" (Patria and Heriyanto 2016).

The current administration under President Prabowo, which, at the time of writing, is only seven months into its term, has not escaped criticism, particularly with regard to its flagship Free Nutritious Meals Program (*Makan Bergizi Gratis*), which absorbs a massive budget of Rp171 trillion. This figure marks a substantial increase from the initially allocated Rp71 trillion and has come at the expense of budget cuts across various ministries and agencies (Agnes Theodora 2025) . Other programs have drawn similar critiques for their top-down nature, including the *food estate* initiative, introduced during Jokowi's presidency, which has raised environmental concerns and demonstrated a high risk of crop failure (Dian Rahma Fika Alnina 2025). Additional concerns have been raised about the passage of the revised Law on the Indonesian National Armed Forces (TNI), which potentially expands military authority into civilian domains and risks a resurgence of New Order–style militarism. Likewise, the *Koperasi Desa Merah Putih* (Red-and-White Village Cooperative) policy has been criticized for reducing the autonomy of villages in allocating their own development funds, contradicting Law No. 6/2014 on Villages, which outlines mechanisms for village autonomy, governance, and sustainable development (Yulita Putri 2025).

Conceptually, the "building from the periphery" approach stands in sharp contrast to Indonesia's previous development visions, particularly during the 32-year New Order regime under Suharto, when development was heavily centralized in Java and Jakarta. At that time, most major development projects were concentrated in the urban core of Java, especially in the Greater Jakarta Metropolitan Area, resulting in a significant developmental gap between the center and the periphery, broadly referring to areas outside Jakarta or, more generally, outside Java.

In practice, however, national development policies continue to be decided by the central government in Jakarta, effectively reducing peripheral regions to mere implementers of centrally formulated programs. This phenomenon, known as center-centric development, constrains the ability of regional governments and rural communities to formulate their own development visions, ones that address local challenges and elevate local resources, without being restricted by rigid metrics such as economic growth or investment rates. This centralized approach also applies to the vision for digital development.

Viewing digital development from a peripheral perspective becomes highly important because currently, many initiatives are undertaken in regions as a logical reaction to top-down development that lacks context-sensitivity and misses the target. This is why periphery research becomes necessary to be conducted as an effort to capture various initiatives from these regional contexts.

The persistent digital divide between central and peripheral regions highlights the inadequacy of top-down digital development approaches that prioritize universal access without addressing local contexts and capacities. State-led rural digitalization initiatives often prove inconsistent, while corporate-driven connectivity efforts, shaped by profit imperatives, tend to position rural populations as passive consumers rather than as agents of socioeconomic and cultural transformation. In response, community-centered connectivity (CCC) offers a critical alternative—an approach grounded in the specific needs, resources, and aspirations of peripheral communities. By emphasizing local participation, contextual relevance, and community empowerment, CCC reorients digital development away from centralized, one-size-fits-all strategies toward more inclusive and transformative models capable of addressing structural digital inequality.

One of the key models of CCC developed in Indonesia is the *School of Community Networks* (SCN), initiated by the Common Room Networks Foundation (Common Room). This initiative aims to shift the digital development paradigm from a center-centric model focused on universal access toward a periphery-centric approach that emphasizes the development of meaningful access. Since its launch in 2021, the SCN has operated in 11 villages across Indonesia, ranging from Breueh Island in Aceh (the country's westernmost point) to Jayapura Regency in Papua (its easternmost). In collaboration with local communities, governments, universities, and donor agencies, the SCN continues to evolve.

Government-led rural digitalization programs in Indonesia are often unsustainable and risk generating new forms of digital inequality (Priyadharma 2023, 2024). In contrast, the SCN's peripheral practice of rural digital development seeks to directly address these inequities through active community participation in the use and management of digital connectivity. By doing so, these communities empower themselves to solve local challenges and drive their own development agendas.

This paper aims to examine the practices of CCC initiatives and how their approaches present a viable alternative to mainstream development models. Specifically, it explores, through case studies of SCN villages, how rural and marginalized communities in Indonesia strategically build internet infrastructure and utilize it meaningfully to address their specific needs and local challenges. These efforts are intended to establish connectivity that is safe, secure, affordable, sustainable, and contextually meaningful (Social Development Direct, n.d.).

The conceptual framework developed in this study adopts a meaningful CCC, which relates to the "periphery-centric" approach developed by Priyadharma (2024). CCC initiatives align with the user-centric approach, as they examine, from the perspective of marginalized communities, how they perceive, understand, and utilize digital technology by generating new forms of innovation that have real impacts on their community, such as tailored applications for public services in the health and governance sector, expanding the market for rural agricultural products, and local internet infrastructure for mitigating climate change and disaster preparedness. Meanwhile, within the periphery-centric framework, rural communities in the periphery are situated in their relationships not only with urban communities but also with the government, particularly the central and local governments representing the center in the context of digital development planning and implementation.

State-of-the-Art

1. The Global South

Zooming out to the Global South[2] (encompassing developing regions in Asia, Africa, Latin America, and the Middle East), one finds that internet connectivity, while steadily improving, remains far from universal. Globally, 5.5 billion people (about 68 percent of the world's population) were online by 2024, leaving 2.6 billion people still offline. The vast majority of those offline reside in the Global South. In high-income countries, internet use is above 90 percent of the population, nearing saturation, whereas in low-income countries only about 27 percent of people use the internet. In Africa, the least connected continent, only 38 percent of the population is online. This digital divide between richer and poorer nations underscores the development challenges: access to information and digital services has become a prerequisite for full participation in the modern economy and society, and countries across the Global South risk falling further behind without urgent improvements in connectivity. A key characteristic of the global digital divide is the urban–rural gap, which is even more pronounced in developing regions. Worldwide, 83 percent of urban dwellers are internet users, compared to just 48 percent of rural dwellers. Put differently, approximately 1.8 billion of those offline live in rural areas. In low-income countries, the gap is extreme: only 16 percent of rural residents are online, roughly one-third the rate of urban residents in those countries. These figures highlight that the challenge of connecting the unconnected is largely a challenge of reaching rural, remote, and marginalized communities in the Global South. The reasons are multifaceted—lack of infrastructure (many villages remain out of range of fiber or even cell towers), high costs relative to income, low literacy and digital skills, and in some cases, social or gender barriers (such as restrictions on women's access to

2 We recognize that the term "Global South" is complex and can be misleading, as it risks oversimplifying global inequalities and reinforcing postcolonial divisions. In this paper, we follow APC's interpretation, which views the Global South as a political and flexible concept. Drawing on Anne Garland Mahler's definition, the term refers to communities and regions that are disadvantaged by global capitalist systems—regardless of their geographic location. This means that "economic Souths" can exist within the geographic North, and vice versa (APC 2024a). See also Ruiz, Gallagher, and Najjuma (2025), who propose the concept of "the Majority World" as an alternative to terms such as the Global South, the Third World, or Developing and Least Developed Countries, in order to address the conceptual ambiguities and contested meanings these categories often carry.

technology). The gender digital divide is indeed another layer: globally and especially in developing countries, women are less likely than men to be online, compounding the exclusion of rural women in particular (International Telecommunication Union [ITU] 2024).

Affordability remains one of the toughest hurdles in the Global South. Although the cost of mobile data has been decreasing in many countries, it often remains high relative to local incomes. The Alliance for Affordable Internet (A4AI) long championed the "1 for 2" affordability target (one gigabyte of mobile data for no more than 2 percent of monthly income) as a baseline for affordable internet. Many countries in the Global South have not met this threshold for all segments of their population, especially for those living in poverty. In response to increasing data needs, A4AI (2025) updated its target to five gigabytes for 2 percent of income by 2026—reflecting that meaningful internet use (for education, work, video, etc.) requires several gigabytes per month, not just one. Under this more ambitious metric, the affordability gap is even starker. For example, while countries like India or Nigeria have some of the world's cheapest data plans in US dollars, the poorest residents in those countries still find even small data packages expensive when weighed against their sparse incomes. Additionally, the cost of an entry-level smartphone and the cost of electricity (to charge devices) are often overlooked factors affecting affordability and uptake in rural areas of the Global South (Diga et al. 2022). The consequence is a phenomenon often called "connectivity poverty"—people might technically live in areas with network coverage but cannot afford sufficient access or devices to make use of it. Indeed, the usage gap (people covered by a signal but not using the internet) is larger than the coverage gap (people with no signal at all) in most regions now, which indicates that issues such as affordability, skills, and relevance have become the primary barriers (GSMA 2023). Without targeted interventions, market forces alone may not resolve these, since the poorest and most remote offer little commercial incentive.

Across the Global South, governments and international organizations have introduced a plethora of policy initiatives to boost connectivity—from universal service funds to rural telecenter programs, national broadband plans, and public–private partnerships for infrastructure. However, the orientation of these policies has often been top-down. Many national broadband plans emphasize large-scale infrastructure (fiber optic backbones, 4G/5G spectrum auctions, satellite systems) implemented through partnerships with major telecom operators or global tech companies. While these are important, they

tend to reflect the visions of states and corporations: expanding networks, capturing new markets, and sometimes increasing governmental control over communications. Local communities, civil society, and end-users have had relatively little say in what connectivity is built and how it is used. As a result, there is frequently a mismatch between policy and people's needs on the ground. For instance, a government might invest heavily in an urban tech park or in boosting nationwide download speeds, even as basic connectivity or digital literacy in poor rural districts remain unaddressed. A recent analysis noted that many states in the Global South have been distracted by fashionable tech topics (like AI or smart cities) and diverted attention away from basic connectivity in rural areas, under the mistaken belief that leapfrogging to advanced technologies can solve development issues. In reality, without universal, high-speed, and reliable connectivity, such leapfrogging efforts fail to reach those who need them most (Jensen and Labardini 2024).

Despite these positive steps, the mainstream approach in the Global South still skews toward large-scale, centralized solutions. State and corporate actors often frame connectivity as a delivered service or a commodity, rather than a community resource. The needs and agendas of people, especially those in rural and marginalized communities, struggle to be heard in policy discourses. This issue is particularly significant for communities that continue to uphold their traditional customs, as they often face a dilemma when confronted with pressures to adopt new technologies such as internet connectivity. Such adoption is frequently accompanied by concerns that it may negatively affect the preservation of their cultural heritage. For instance, this was evident in the case of the Baduy Indigenous community in Indonesia, which formally requested the government to remove internet signal coverage from their territory, a request that was ultimately granted (Nazmudin and Arief 2023). A similar case can be observed among the Marubo community in the Amazon, which has actively sought to protect its cultural identity from the encroachment of modernity (Esteve 2025).

A community-centered approach to connectivity calls for involving these communities in planning and decision-making, recognizing their unique needs (for example, interfaces in local languages, content relevant to local livelihoods, training for first-time users, etc.), and sometimes devolving ownership of infrastructure to the community level. Research has shown that when communities are given a chance and the right support, they can develop and maintain their own networks effectively, fostering local empowerment and skills (Diga et al. 2022). Furthermore, local ownership can ensure that the network serves community development goals (education, health, and cultural

preservation) rather than purely profit goals. As the economic historian Fernand Braudel observed, local cooperatives or entrepreneurs are often better positioned to serve community needs than distant corporations driven by external profit motives (Jensen and Labardini 2024). This is especially true in rural Global South contexts, where trust, local knowledge, and social cohesion are critical for projects to succeed.

2. Southeast Asia

In the Asia-Pacific region (which includes Southeast Asia), about 83 percent of urban residents are online but only 49 percent of rural residents—a gap that has barely narrowed in recent years (ITU 2024). This suggests that even as overall internet use grows, rural communities are not catching up proportionately. Many rural Southeast Asians remain offline or under-connected, due to factors such as difficult terrain (e.g., mountainous or island communities), lower incomes, and lower digital literacy. For example, while Vietnam and Thailand report over 70 percent internet use nationally, large rural provinces in those countries have much lower rates; similarly, the Philippines reports around 74 percent penetration overall, but connectivity is concentrated around urban Luzon and Cebu, with more isolated islands trailing behind.

Southeast Asia's mobile-first internet model has generally kept data costs relatively affordable by global standards, but not uniformly so. Countries like Malaysia, Vietnam, and Indonesia benefit from competitive mobile markets that drive data prices down (often around $0.30 per gigabyte) (bestbroadbanddeals [2023]). In contrast, places with telecom monopolies or challenging geographies—for instance, Laos or remote parts of the Philippines—see higher costs or poorer value for service. Affordability is not just about pricing; it is also about incomes. Even "affordable" data can be out of reach for the millions of Southeast Asians living in poverty or just above the poverty line. Rural villagers may prioritize basic needs over data top-ups, and the cost of an internet-capable device is a significant barrier for low-income households. The digital exclusion in Southeast Asia therefore often correlates with socioeconomic status: poorer, rural, less-educated communities are the least connected. This has raised concerns that the rapid digitalization of Southeast Asian economies could widen inequality. Indeed, as one analysis pointed out, the faster the digital transformation, the wider the gap can become if specific inclusion measures are not in place (Nazara and Markus 2024). Many people in the region remain "under-connected"—they have some access (e.g., a basic smartphone with a prepaid SIM card) but do not enjoy reliable, high-quality connectivity or cannot afford enough data to use the

internet for more than basic messaging. The GSMA reports that the mobile internet "usage gap"—the share of the population who lives under a mobile broadband signal but are not using the internet—is around 41 percent (global average) and is particularly pronounced in South Asia and parts of Southeast Asia (GSMA 2023). This gap is attributed to issues such as cost, digital skills, and lack of relevant content in local languages.

Governments in Southeast Asia have universally recognized the importance of bridging the digital divide, and many have national broadband plans or digital master plans as part of their policy frameworks. Thailand's Net Pracharat Project, launched to bridge the rural connectivity gap, established broadband infrastructure in around 24,700 rural communities (Adipat et al. 2019). The Philippines' Konektadong Pinoy Bill (Senate Bill No. 2699) seeks to enhance rural connectivity through streamlined regulatory processes, infrastructure sharing, and spectrum accessibility. Malaysia's Jalinan Digital Negara (JENDELA) initiative adopts a structured phased approach, first expanding 4G coverage and subsequently incorporating multiple technologies, including 5G and satellite broadband to achieve nationwide digital inclusion (MCMC 2020).

Despite various critiques, such as for being overly top-down, focusing predominantly on infrastructure provision without adequately addressing crucial complementary factors such as digital literacy, affordability of devices, and localized content development (Bernama.com 2024), the aforementioned centrally led efforts have shown some progress in providing universal access, but not so much in meaningful access where internet connection is seen as part of the extension of the communities rather than a new add on.

Complementing these centrally driven policies, community-led connectivity initiatives have emerged to better align connectivity solutions with local contexts and needs. For example, in the Philippines, community networks such as those supported by Internet Society Philippines and ISEA offer low-cost community-managed Wi-Fi and mesh network solutions tailored specifically for geographically isolated areas. Similarly, Malaysia's community-based programs, such as those facilitated by a coalition of civil society groups and government like Malaysian Communications and Multimedia Commission (MCMC) PEDi (Pusat Ekonomi Digital Keluarga Malaysia) initiative, promote local content and digital skill-building, supporting rural communities through public internet centers (MCMC 2021). The sustainability for PEDi has been helped by Universal Service Provision (USP) Fund and has become one of the pieces of evidence of multistakeholder approach to provide meaningful connectivity rather than just access.

3. Indonesia

Indonesian digital connectivity indicates significant growth in recent years. The central government, through the Telecommunications and Information Accessibility Agency (*Badan Aksesibilitas Telekomunikasi dan Informasi*, BAKTI), a non-echelon body under the Ministry of Communication and Information Technology (*Kementerian Komunikasi dan Informatika*, Kemenkominfo) tasked with managing Universal Service Obligation (USO) financing and providing telecommunications and information infrastructure and services, has successfully enhanced digital connectivity through the Palapa Ring project. This project involves the construction of submarine and terrestrial fiber optic cable networks, as well as wireless networks spanning over 12,000 kilometers, completed in 2019. The Palapa Ring project is part of the "sky toll" infrastructure and is divided into three packages: west, central, and east. It connects all 514 cities/regencies in Indonesia and adopts both public-private partnership and availability payment (PPP AP) as well as non-PPP models. The availability payment scheme is funded by the USO Contribution Fund amounting to 1.25 percent of telecommunication service providers' revenue in Indonesia, managed by BAKTI. This scheme is chosen as a manifestation of the government's affirmative policy for rural and remote areas to provide fast internet and reduce digital disparities, especially in 3T areas that are commercially less viable for private telecommunication providers to develop (Bidwell and Jensen 2019; Dinas Komunikasi dan Informatika Kabupaten Sleman 2019).

Official statistics in Indonesia present an optimistic picture. For instance, the Indonesian Internet Service Providers Association (APJII) reported 221.6 million internet users in 2024, with a penetration rate of 79.5 percent. The national statistics agency (BPS) previously stated that 82 percent of households had internet access as early as 2021 (Freedom House 2023). However, this aggregate data masks stark regional disparities across the archipelago. While over 85 percent of Jakarta residents are online, in Papua the figure is only around 26 percent (Nababan 2024). In effect, national averages obscure the deep connectivity divide: approximately four out of five internet users are concentrated in Java and Sumatra (Western Indonesia), whereas residents of Maluku, Nusa Tenggara, and Papua (Eastern Indonesia) often contend with limited or nonexistent internet access.

Government efforts, such as Kominfo's Palapa Ring backbone project, subsidized broadband access points, and digital village programs, have extended some coverage. Since 2018, Kominfo has reported the installation of

8,463 fixed broadband access points across 164 villages in nine of Indonesia's 34 provinces, with an additional 2,606 points added in 2024 (DJPPI 2024). Yet these measures only begin to address the scale of the need. Moreover, connectivity in many of these areas remains unreliable, with users frequently reporting unstable or intermittent service (Nababan 2024).

Digital development in Indonesia continues to face significant challenges, particularly concerning the complex and persistent digital disparities in rural areas. According to the World Bank (2021), the digital connectivity gap between urban and rural populations in Indonesia remains significant and may be increasing. While internet usage among adults rose sharply from 13 percent in 2011 to 51 percent in 2019, the majority of these users, approximately 62 percent, reside in urban areas, whereas only 36 percent of rural adults are online. Moreover, digital inequality is not limited to geography but also intersects with factors such as income level, gender, educational attainment, age, and other social indicators. A key obstacle is the lack of comparable, disaggregated data across regions, especially related to gender, youth, marginalized communities, and overlapping issues in indicator definitions, which hampers the formulation of effective strategies to close the digital divide. While access to the internet is a crucial factor in enabling connectivity, it is insufficient on its own to address the broader issues of digital development, particularly in realizing meaningful CCC.

The digital divide is commonly understood to manifest across three levels: disparities in access, differences in skills, knowledge, motivation, and purpose, and finally, inequalities in outcomes or benefits derived from technology use (Ragnedda and Ruiu 2017). Within this framework, "connectivity gaps" specifically refer to "gaps in access and uptake of high-quality broadband services at affordable prices in areas with low population densities and for disadvantaged groups compared to the population as a whole" (González Fanfalone et al. 2021, 5). This concept aligns with the first level of the digital divide.

Crucially, meaningful internet access extends beyond infrastructure. It plays a vital role in strengthening social relationships and providing solutions to local problems, while fostering civic participation, both online and offline, thereby addressing the second and third levels of the digital divide. Accordingly, the nonmeaningful adoption of the internet by structurally marginalized communities, such as rural populations, women and children, and persons with disabilities, can in fact generate new problems and deepen existing digital inequalities, as highlighted by Nazmudin and Arief (2023), Esteve (2025), and Priyadharma (2023). Heeks (2022) refers to this phenomenon as "adverse digital incorporation," which may lead to a widening "digital inclusion gap"

(Featherstone 2024), highlighting how technology can exacerbate or amplify existing social inequalities. The following section will explore how digital inequality manifests in Indonesia across several key sectors and issues, including education, the economy, gender, health, climate resilience, and governance.

3.1. Remote Learning After COVID-19

The COVID-19 pandemic starkly revealed the extent of educational digital inequality in Indonesia. At the height of the pandemic in 2020, approximately 530,000 schools across the country were closed, and teaching shifted to online platforms (Yarrow and Bhardwaj 2020). However, many students and educators in rural and remote areas were unable to keep pace. Teachers in isolated villages frequently reported the absence of reliable internet access, both at school and at home. As noted by the World Bank (2020), educational technology (EdTech) remains inaccessible for many learners, particularly those in rural areas who face poor connectivity, and for students from low-income households who often lack access to digital devices.

Similarly, UNICEF (2020) found that internet connectivity for students varies significantly by geography, with four out of five internet users concentrated on the islands of Java and Sumatra. While alternatives such as educational television, radio broadcasts, and printed learning materials were offered, these measures only partially mitigated the learning disruption and often exacerbated existing gaps. For example, while 95 percent of urban students had access to television, the figure drops to 92 percent in rural areas. Moreover, students with special needs and those from Indigenous communities received little to no targeted support during the digital shift.

In many 3T (*tertinggal*, *terdepan*, and *terluar*—disadvantaged, frontier, and outermost) regions, teachers resorted to visiting students' homes in person, as online learning was simply not feasible.

The lack of digital literacy further intensified these challenges. Even when devices were available, many users, especially those in marginalized regions, lacked the necessary skills to use them effectively. Both UNICEF (2020) and the World Bank (Yarrow and Bhardwaj 2020) emphasize that without foundational digital training and access to locally relevant content, technological investments tend to benefit only a privileged minority. In some Papuan villages, for instance, students preferred platforms like WhatsApp and Facebook over official EdTech tools due to familiarity and ease of use.

In summary, the COVID-19 crisis transformed preexisting digital divides into profound educational disparities. Students from rural, low-income, and Indigenous backgrounds experienced significantly fewer learning hours, faced a greater risk of dropping out, and often received minimal parental support.

3.2. Unequal Opportunities as Unintended Consequences of the Digital Economy

Indonesia's rapidly expanding digital economy, encompassing e-commerce, fintech, and start-ups, is often celebrated as a driver of national development. Indeed, the country has witnessed a 414 percent increase in digital economic activity in recent years (Napitupulu 2024). However, this growth has been predominantly urban-centric. Most technology investment, digital infrastructure, and skill development are concentrated in Jakarta and other major cities, where young people have greater access to online employment and entrepreneurial opportunities. In contrast, rural youth face limited prospects, hindered by poor connectivity and a lack of localized support.

National digital strategies tend to prioritize ICT hubs and the urban educated elite, often neglecting subsistence farmers, fishers, and informal workers. Consequently, rural engagement with the digital economy may exacerbate income inequality, as wealthier households are better positioned to seize emerging opportunities (Nugraha 2024). The absence of rural e-commerce hubs and affordable broadband reinforces this divide. Despite national survey data suggesting broad improvements, provinces such as Papua continue to experience serious infrastructure deficits. In practice, tens of millions of people in Indonesia's eastern and peripheral regions remain excluded from digital services such as online banking, remote learning, and e-marketplaces. This exclusion perpetuates longstanding socioeconomic disparities, even as national GDP figures present an image of inclusive growth.

3.3. Gender and Youth Disparities in the Digital Divide

At the national level, internet usage rates between men and women appear nearly equal (APJII 2024). However, this aggregated data conceals significant gender disparities in rural areas. For example, mobile phone ownership remains more common among men than women, revealing a first-level digital divide in access to devices (Jeffrie et al. 2023). UNICEF (2023) further reports that by 2022, fewer than 38 percent of rural Indonesian women used the internet.

Girls and women from the poorest households face particularly severe barriers; they are significantly less likely to own digital devices, access the Internet, or possess digital literacy skills.

Household dynamics and gender norms frequently constrain women's digital engagement. In many rural communities, women, particularly mothers or daughters, may only use digital tools with permission from male family members. These restrictions hinder their ability to access crucial information, such as digital resources related to health, education, or livelihoods. During the COVID-19 pandemic, these constraints had tangible negative consequences. For instance, as reproductive health services shifted online, the number of rural women accessing online family planning information declined significantly.

Civil society organizations emphasize that mere internet access is insufficient to ensure women's meaningful digital inclusion. Evaluations of ICT initiatives in Indonesia reveal that many programs operate on the assumption that providing access alone guarantees benefit, often overlooking local social and cultural contexts. As a result, such initiatives frequently serve only a narrow demographic, typically urban males.

Women's organizations advocate for more inclusive and context-sensitive approaches, including digital literacy training for mothers, community-led technology groups, and digital content delivered in local languages. One illustrative case is a women's fisherfolk association in Maluku, which successfully used smartphone apps to compare fish prices and bypass exploitative middlemen, but only after sustained training and peer support. Without such intentional and inclusive design, digital development risks reproducing existing patriarchal structures and further marginalizing low-income women (Bahagijo et al. 2022).

3.4. The "Price" of Disconnection for Health and Climate Resilience

Digital health innovations, such as telemedicine, e-pharmacies, and mobile health applications, have expanded rapidly in Jakarta and other major urban centers. However, in Indonesia's remote and rural regions, limited internet connectivity means that many patients are unable to access even basic tele-consultation services. National statistics show that internet access in Jakarta reaches 85 percent, compared to just 26 percent in Papua (Nababan 2024). Similarly, connectivity rates in Kalimantan and Nusa Tenggara remain

significantly lower than in Java. A recent public health study highlights that disparities in access to digital infrastructure may exacerbate existing inequalities in healthcare access. A survey conducted by the Ministry of Communication and Informatics indicates that people frequently experience unstable connections, rendering video consultations with healthcare providers nearly impossible (Nababan 2024).

A similar pattern emerges in the context of climate resilience. Digital tools, such as weather forecast applications, IoT-based drought monitoring, and SMS alerts for market prices, have the potential to support vulnerable farming communities. However, without adequate digital infrastructure, these technologies are accessible only to those living near urban centers. In response, certain local initiatives have emerged. For instance, the Indonesian NGO Common Room is piloting community-owned internet networks in disaster-prone villages to collect localized climate data through sensors (Diani 2025). In Pulo Aceh, residents are being trained to operate solar-powered relay stations that feed microclimate and fishery data into adaptive early warning systems. While such efforts demonstrate potential, they remain limited in scope. Most rural farmers still rely on traditional methods such as word-of-mouth or radio broadcasts for weather information. Consequently, national climate adaptation strategies that assume universal connectivity risk excluding the most vulnerable populations unless they prioritize local ownership and integrate offline solutions.

3.5. Persistent Barriers in E-government Application Services

Indonesia has actively promoted e-government initiatives, including digital identity (e-KTP), online tax systems, social assistance distribution, and smart-city applications. In principle, these digital platforms are intended to streamline public service delivery. Komdigi reports over 27,000 government applications developed across various ministries (Yarrow and Bhardwaj 2020). However, implementation and uptake in rural areas remain inconsistent. During the COVID-19 pandemic, for instance, many rural residents were unable to register for or access relief due to poor internet connectivity or challenges with digital ID systems. Older adults and individuals who speak minority languages often lack the digital and linguistic literacy required to navigate online forms. In some cases, local officials had to revert to door-to-door verification.

Acknowledging these challenges, the World Bank has recommended the development of a unified digital ID system and comprehensive GovTech reform. Indonesia has taken preliminary steps by piloting such systems and passing a data protection law in 2022. Nonetheless, top-down policy frameworks will only be effective if local equity considerations are integrated. For example, shifting essential services, such as driver's license renewal or health insurance registration, to online platforms could further marginalize communities like the Papuans or Dayaks who lack basic digital access. This represents a clear case of adverse digital incorporation (Heeks 2022) and underscores the importance of a whole-of-government approach that ensures affordable digital access points and community participation. Multistakeholder platforms involving government agencies, telecommunications companies, civil society organizations (CSOs), and communities could help ensure that digital public services are equitably extended to underserved regions.

Furthermore, the drivers of Indonesia's digital transformation are often private technology firms and start-ups, whose commercial focus tends to prioritize urban markets. Such top-down initiatives risk neglecting local contexts, needs, and cultural norms. Civil society actors in Indonesia argue that bridging the digital divide requires meaningful partnerships with local communities. Studies of ICT programs reveal that many initiatives equate access with inclusion, overlooking the importance of outreach, training, and context-specific content. Without these components, infrastructure investments may disproportionately benefit urban or male populations while excluding vulnerable groups. For example, Common Room provides training to help rural communities build and manage their own internet infrastructure, thereby fostering digital self-sufficiency.

Accountability is also a critical issue. Policymakers and civil society organizations increasingly advocate for digital service providers to work with village councils and *adat* (customary) leaders to codesign inclusive and contextually appropriate services. As Williams (2019) argues, effective regulation should not merely impose restrictions but also enable stakeholders to embrace socially responsible roles and adapt dynamically to changing conditions. In Indonesia, where corporate-led digital expansion often neglects structurally marginalized communities, regulation must enforce clear, shared commitments among government, private sector, and community actors. Rather than focusing solely on punitive measures, regulatory frameworks should encourage collaboration, embrace the inevitability of disputes and adaptation, and foster an inclusive ecosystem for digital service delivery.

Ultimately, the evidence points to a clear imperative: expanding broadband infrastructure and access to devices must be prioritized in underserved areas. However, this must be accompanied by public education, culturally sensitive implementation, and alignment with broader social development agendas, particularly in health, climate resilience, economic inclusion, and gender equality.

Theoretical Frameworks

1. Meaningful CCC Initiatives: The Theory of Change

Community-centered connectivity (CCC) is a concept emerging from the Local Networks (LocNet) initiative, established in 2017 by the Association for Progressive Communications (APC) in collaboration with Rhizomatica. While initially adopting the broader term "community networks," LocNet has refined its approach over time to emphasize CCC as a more deliberate, community-led alternative for addressing the digital divide in underserved areas. The initiative responds to a fundamental gap: rural and remote communities are often overlooked by national telecommunications providers, whose commercial logic tends to prioritize urban centers with higher profit potential. CCC thus proposes a different model, one that is bottom-up, grounded in community agency, and responsive to local conditions.

CCC emphasizes the design and governance of internet connectivity that aligns with the unique needs, aspirations, and contexts of the communities it serves. Although levels of participation may differ across initiatives, CCC consistently promotes collaborative processes between communities and external allies to improve collective well-being. This approach prioritizes connectivity not as an end in itself, but as a means for communities to direct and define their own development. As defined in this paper, CCC "refers to the use of the internet connectivity being focused on the needs of the community [. . .] initiatives that provide 'meaningful internet communications infrastructure or services to communities [. . .] that respond to the diverse needs and interests of communities so that they can be empowered to participate in their own development'" (Rey-Moreno 2024, 10).

To guide and support the expansion of CCC efforts across priority countries, APC and the LocNet team developed a Theory of Change. This framework functions as a planning and learning tool while also supporting implementation and stakeholder communication: a "methodology that supports planning,

implementation, learning [...] internal and external project communications" (APC 2023, 1). Designed to steer activities for the 2024–2027 period, the Theory of Change articulates a long-term goal.

Rural, remote and marginalized communities have the opportunities, capacities and resources to achieve and shape meaningful community-centered connectivity that contributes to the strengthening of local well-being, economies and cultures (APC 2023, 2).

This vision is anchored in twelve foundational assumptions concerning the systemic barriers that obstruct equitable connectivity. These include persistent digital inequalities, inadequate policy and investment environments, and a lack of incentives for commercial providers to serve marginalized populations. Critically, the assumptions also acknowledge the limited agency often afforded to communities in conventional connectivity models. In response, CCC—when inclusive and community-led—presents a more context-sensitive and empowering pathway. It offers a foundation for fostering digital inclusion that is not only sustainable, but also embedded in local realities, values, and economic practices.

Importantly, this framework positions CCC as more than just a corrective mechanism for digital exclusion. It is conceptualized as a strategic shift from the narrow goal of universal access to a more comprehensive vision of meaningful access. As noted by Diga, Brock, and Zanolli (2024, 64), "meaningful community-centered connectivity can be defined by the need to strengthen local interests, social ties and relevant activities of respective communities."

APC further identifies four key principles, among the 13 core principles of CCC, that set it apart from other forms of community networking. These are:

> being focused on the community's needs and interests, being participatory in approach, [. . .] working with supportive external stakeholders, and focusing on strengthening the well-being of the community (an initiative [with] . . . a "social mission"). (2024b, 3)

Accordingly, this paper examines how these four foundational principles are reflected in the practices of the *School of Community Networks* (SCN), an initiative that explicitly adopts the CCC framework in its community-building efforts.

2. Periphery-Centric Approach

To understand a *periphery-centric* approach in development, it is essential to begin with the structurally unequal relationship between the center and the periphery. In conventional *center-centric* development models, planning and decision-making are concentrated in central institutions, often in urban capitals, with policies then imposed on peripheral regions. This model assumes that development must originate from the center and radiate outward, making the periphery highly dependent and rarely autonomous.

Center-centricity entails not only central control over policy but also political dynamics that prevent peripheral communities from organizing, asserting agency, or engaging in meaningful collaboration. As Priyadharma (2021) notes, peripheral areas such as villages often lack the authority to formulate development agendas tailored to local conditions. This situation is compounded by the depoliticization of villages and their exclusion from communication infrastructures, resulting in both political and communicative isolation.

Under such centralization, peripheral regions are discouraged from initiating context-specific innovations. As Servaes (1999, 50) observes, the notion of *multiplicity* or *another development,* which highlights "cultural identity, empowerment and multidimensionality," remains largely absent. Instead, the periphery is expected to mimic the center, even in digital strategies. A common example is the replication of urban "smart city" models in rural areas, resulting in "smart villages" that prioritize digital devices and platforms over human-centered solutions. These often involve using overlapping digital applications mandated by multiple central agencies, many of which are unsuited to local needs and lack interoperability. As a result, thousands of redundant and unsustainable applications are abandoned (Fika Nurul Urya and Ihsanuddin 2024).

In contrast, the *periphery-centric* approach, as proposed by Priyadharma (2021, 2024), advocates for the autonomy of peripheral communities to define their own development trajectories. It aligns with Servaes's (1999) concept of multiplicity and rejects one-size-fits-all models. This approach empowers marginalized groups to design and implement locally relevant digital solutions, enhancing meaningful access and technological ownership without reinforcing existing inequalities.

A periphery-centric lens also offers a critique of Galtung's (1971) classic center-periphery framework, which views centrality and peripherality as fixed, feudal, and hierarchical. Instead, it recognizes that peripheries can serve as centers for

others, and that these roles are relational and dynamic. This shift opens space for reimagining development from below, enabling peripheral communities to shape their futures through active citizenship and localized innovation. Crucially, it liberates rural areas from constantly measuring themselves against urban norms and allows them to define progress on their own terms.

3. Theoretical Matrix: Relevance to Alternative Development (AltDev) and Alternative Regionalism

We argue that there are key principles that reflect a shared perspective between the vision of *alternative regionalism* as articulated by Tadem et al. (2020), and the frameworks CCC and the periphery-centric approach, particularly in their conceptualization of development.

First, all three frameworks place people at the center, emphasizing the needs, interests, challenges, goals, and resources of communities and civil society, particularly those embedded in vibrant and empowered social systems. Civil society, in this case referring to rural communities, plays an active and concrete role in organizing and empowering itself as the subject of development. These communities resist being confined by elite-driven development paradigms that often reduce citizens to mere statistical indicators used to validate state-led development achievements.

Alternative regionalism, particularly through the ASEAN Civil Society Conference/ASEAN Peoples' Forum (ACSC/APF), has been critical of development practices within ASEAN that exclude citizen participation, especially those from marginalized groups across Southeast Asia (beyond formal ASEAN member states), from both the planning and implementation of development processes. Similarly, CCC initiatives promote meaningful community participation in local development, especially in digital contexts. As outlined in its strategic plan, the Association for Progressive Communications (APC)—the organization behind LocNet and the CCC umbrella—articulates a vision "for all people, particularly the marginalized, to use and shape the internet and digital technologies to create a just and sustainable world," and a mission "to strengthen collective organizing towards building a transformative movement to ensure that the internet and digital technologies enable social, gender and environmental justice for all people" (2024a, 32).

Meanwhile, the periphery-centric approach emphasizes the importance of bottom-up development ideologies that emerge from within communities themselves, rather than relying on development "prescriptions" imposed by central governments. This perspective aligns with the ACSC/APF's critique of ASEAN's development agenda, which it argues to "breed greater inequalities, accelerate marginalization and exploitation, and inhibit peace, democracy, development, and social progress in the region" (2015, 1).

Second, the development focus promoted by these frameworks is not necessarily aligned with market interests or elite government agendas. CCC initiatives do not necessarily reject collaboration with governments outright, recognizing that policy advocacy is a critical component of their strategy. CCC initiatives acknowledge that the provision of community-based connectivity and services can help address digital inequality and, in doing so, complement national connectivity programs. However, in contrast to commercial service providers that prioritize profitability, CCC is driven by social transformation and guided by a Theory of Change that focuses "on the community's needs and interests, being participatory in approach [. . .] working with supportive external stakeholders, and focusing on strengthening the well-being of the community (an initiative [with] . . . a 'social mission')" (APC 2024b, 3).

Consequently, CCC does not focus on urban, high-density populations, as commercial ISPs typically do. Instead, it prioritizes remote and underserved regions, driven by the recognition that without active civil society involvement in service provision, rural communities will remain excluded from both national and global digital systems, not only in terms of socio-cultural participation but also in political-economic engagement. This objective aligns with the periphery-centric approach, which seeks to liberate communities from total dependence on centralized development policies.

In sum, *meaningful CCC initiatives* can be understood as an alternative and peripheral form of rural digital development that challenges dominant market-centered and profit-oriented models of connectivity

Methodology

Efforts to reduce the digital divide in Indonesia's marginalized communities require development models that are responsive to local contexts. For this monograph, the authors draw on data from two research projects on the *School of Community Networks* (SCN), in which the lead author was involved as the research coordinator.

The first project, *Connecting the Unconnected: Supporting Community-led Approaches to Addressing the Digital Divide* (2022–2023), and the second, *Developing a National Strategy for Meaningful Community-Centered Connectivity in Indonesia* (2024), were both funded by the APC.

In the first project, field observations and interviews were conducted with 57 informants across ten SCN locations: Pulo Aceh (Lapeng Village), Ketemenggungan Tae, Polewali Mandar, Maluku Tengah, Jayapura Regency, Mata Redi, North Lombok, Bali, Ciracap, and Ciptagelar. The second project expanded the research to include four additional sites: Meulingge Village in Pulo Aceh, Ngata Toro in Central Sulawesi, and two villages in Blitar Regency. However, as the two villages in Blitar are not part of the SCN network, they will not be discussed in this monograph. These field activities were further enriched through expert interviews, participatory discussions, and involvement in key national events, including the 2024 Rural ICT Camp, the Pre-event Discussion with the National Advisory Committee, and the National Convening held on 19 November 2024 in Jakarta.

Methodologically, the study presented significant challenges due to its field-based nature. These included the need to engage diverse stakeholders—each with distinct agenda—potential conflicts of interest, inconsistencies across policy and regulatory frameworks, wide geographical distribution, linguistic diversity, variations in local customs and cultural practices, as well as limitations in time and funding.

For the analytical framework, the study combines the *meaningful Community-Centered Connectivity* (CCC) model developed by APC with the *periphery-centric* approach described in the previous chapter. The CCC framework provides practical guidance for the design and analysis of connectivity initiatives, emphasizing community ownership, participatory engagement, and culturally relevant content. The integration of this framework with a periphery-centric perspective enables a deeper understanding of how grassroots

connectivity efforts not only function operationally but also contribute to broader social transformation. The following case study of the School of Community Networks illustrates how these models can offer alternative pathways toward more inclusive and context-sensitive digital development.

The School of Community Networks (SCN)

Currently, the *School of Community Networks* (SCN) includes 11 villages as part of its network. At the time of data collection, Lapeng Village in Aceh, Polewali Mandar Regency in West Sulawesi, and Hitu Messing Village in Central Maluku were still participating in the SCN. However, due to the limited availability of committed local human resources to sustain the initiatives, activities in these locations had to be temporarily discontinued. Hence, due to space limitations, their participation is not described in this monograph.

Descriptions of Sukadana Village (North Lombok), Nimboran District (Jayapura Regency), Tembok Village (Bali), and the Ciptagelar Indigenous Community have been discussed in Priyadharma (2024) and will be briefly revisited here.

Subsequently, four additional locations joined the SCN network: Meulingge Village, Ngata Toro Village, Bobong Village (Taliabu), and Marannu Village (Maros). In addition, one location in Southwest Sumba is not linked to a specific village but rather collaborates with the Don Bosco Vocational Training Center (VTC) located in Weepangali Village. However, since the addition of Bobong and Marannu, as well as the SCN activities at the Don Bosco VTC, occurred outside the research period, we were unable to collect significant data from these sites. Therefore, we will not report on them specifically in this section.

In addition to the four core principles of CCC outlined in Section 3.1, Common Room (2020) also adopts the "5L" principles for the development of SCN, which include:

1. *Low Tech:* The use of simple and accessible technologies to develop community-based internet infrastructure tailored to the needs of rural and remote communities.
2. *Low Energy:* The implementation of energy-efficient infrastructure, prioritizing renewable energy sources where possible to ensure long-term sustainability.

3. *Low Maintenance:* The design of internet infrastructure that can be easily maintained by residents, even in contexts with limited tools and technical expertise.
4. *Low Learning Curve:* The development of user-friendly systems that are easy to learn and can be adopted across diverse community settings.
5. *Local Support:* The establishment of infrastructure supported by local stakeholders, including village leaders, residents, and relevant institutions.

These principles serve as the foundation for the SCN model and explain how each site presents distinctive characteristics, setting them apart from digital infrastructure projects typically led by the government or commercial providers.

1. Ciracap District, Sukabumi Regency

Despite facing initial challenges in its developmental phase (Priyadharma 2023), the SCN training in Ciracap is currently assessed to have reached an advanced stage. Collaborating with the local Vocational High School, SMK Eka Nusa Putra, the development of the community internet in Ciracap engages the school, its teachers, and students as crucial agents in the training process and in shaping a suitable model of community network within the area. SCN activities are integrated with the school's program specializing in Computer and Network Engineering, thereby mutually reinforcing each other in practice. Moreover, Common Room and partners in Ciracap strive to develop a sustainable business model for the community internet, adopting a business model previously developed in Ciptagelar (see below).

D, a teacher at SMK Eka Nusa Putra who is both an SCN participant and a key partner of Common Room, instructs in System Computer and VSAT Network and has previously developed a low-cost Wi-Fi internet voucher system at four hotspot locations: Rp2,000 for two hours of internet access or Rp4,000 (US$0.25) for 24 hours. This approach greatly benefits customers who would otherwise have to pay significantly higher prices for data from cellular operators (ranging from Rp50,000 to Rp100,000 for an average of five gigabytes of data), which may not always be accessible due to numerous blank spots. Common Room supports the development of such business services through cooperation with ISPs, legal aspects, technical assistance, and business management. Another form of support for this location was the organization of the Fifth Rural ICT Camp, held from 7 to 11 October 2024 in Ujung Genteng, Ciracap, which also marked the inauguration of the fifth bamboo internet tower in Indonesia.

2. Meulingge Village, Pulo Aceh

Located on a remote island far from the main islands—specifically the southern tip of Sumatra, where the provincial capital Banda Aceh is situated—it takes no less than two hours to reach the village by wooden boat, the most commonly used means of transportation by residents. Alternative transportation options include a ferry, which also accommodates motor vehicles such as cars and trucks, or a faster boat, though at significantly higher costs. According to the 2020 Census, Pulo Aceh has a population of approximately 4,463 residents, distributed across small villages. The local economy largely depends on fishing, small-scale agriculture, and trade with Banda Aceh. The limited opportunities for diverse employment have resulted in an aging population in the villages.

In Meulingge Village, Pulo Aceh, the implementation of enabling technologies for CCC has advanced considerably. A local team, comprising a coordinator, two technicians (one certified), and a treasurer, has undergone multiple rounds of both technical and non-technical training, covering network management, administration, digital literacy, and content creation.

The village network currently relies on two VSAT units (with one inactive) and two access points, forming the foundation of internet connectivity. A voucher-based system for internet access, supported by Common Room, has been introduced, although local residents have expressed concerns over pricing. Price adjustments are still under review to ensure sustainability. However, recurring power outages, despite the presence of backup systems, remain a major obstacle. The lack of reliable electricity continues to affect service quality, underscoring the need for improved power infrastructure and better internet speed and stability.

3. Ketemenggungan Tae Indigenous Village, West Kalimantan

Ketemenggungan Tae Indigenous Village is one of three indigenous communities participating in the SCN, alongside Kasepuhan Ciptagelar and Ngata Toro. It is also one of five SCN locations, along with Kasepuhan Ciptagelar, Tembok Village, Ciracap, and the Don Bosco vocational training center in Southwest Sumba, where bamboo signal transmission towers have been installed. These towers are used to amplify GSM telecommunication signals, as the existing GSM infrastructure is unable to adequately cover the vast and mountainous customary lands due to challenging geographical conditions.

This limitation makes communication with the outside world difficult, particularly for village governments that are now "obliged" by the central government to operate in a digital environment. The impact of this situation was described by R, a facilitator from Pandu Budaya, a local youth empowerment and cultural preservation initiative, during an interview session:

Out of eight villages in Tae without internet signals (i.e., mobile signal, data connection), six are especially difficult. We have to climb a hill to get a signal, then go back down. It's really unfortunate, particularly in this village area—when the village government needs to send letters, documents, or reports, they have to go uphill first. And if there's still no signal, they must leave the district entirely to find one. (authors' translation).

Bamboo, rather than metal, was chosen as the material for these towers to reflect local cultural values. The use and stewardship of bamboo forests are an integral part of the customary community's social and ecological practices. Bamboo is also more readily available than iron and aligns with the community's existing knowledge and skills in bamboo management. The village collaborates with partners such as the Bamboo Sustainable Foundation (Yayasan Bambu Lestari) in utilizing bamboo-based technologies. Involving the indigenous community in this process ensures that SCN training materials are culturally responsive, leveraging local strengths and traditions rather than imposing externally derived modern values.

4. Sukadana Village, North Lombok Regency

Sukadana Village is recognized as the poorest village in North Lombok, where women, both young and elderly, face heightened vulnerability and frequent discrimination. This group is often affected by serious social issues, including domestic violence, sexual abuse, harassment, early or child marriages, and mental health disorders. Despite their significant role in household management post-marriage, cultural norms exclude women from participating in customary decision-making processes.

In 2018, three successive major earthquakes (6.4 M_w in July and two 6.9 M_w in August) struck Lombok, severely impacting North Lombok and resulting in hundreds of casualties. Many residents, particularly men, lost their livelihoods. The situation in displacement camps, compounded by the later effects of the COVID-19 pandemic, further intensified the already-prevalent social

issues, especially those disproportionately affecting women. These conditions contributed to worsening economic hardships and psychological distress among women in vulnerable positions.

Ms. S, the head of the Women's School community, observed that increased smartphone use among teenage children has contributed to a rise in child marriages. She explained that economic pressures and digital interactions are key factors. Teenagers often meet online, begin relationships, and are influenced by peer curiosity and social pressure. Additionally, many of these cases involve deception by adult perpetrators, who misrepresent their marital status to lure underage girls—only for the truth to be revealed after the girl arrives at the man's home.

Established in 2013, the Women's School aims to support victims of such cases and advocates publicly for the empowerment of women within society. It focuses on building the capacity of poor and vulnerable women to help them achieve financial independence.

Common Room collaborated with the Women's School through the SCN program, with the objective of improving the productivity and efficiency of the *vannamei* shrimp farms— introduced by the Department of Food Security and Fisheries (DKPP) and now totaling 40 ponds—by introducing digital technologies. Over the past year, SCN has focused on developing IoT sensor prototypes that update data every 15 minutes and track the survival rate of shrimp seedlings in each pond. The sensors enable real-time monitoring, reducing the need for manual checks, but require stable internet connectivity and electricity. The primary challenge in implementing this technology in Sukadana is the unreliable power supply provided by the national electricity company PT Perusahaan Listrik Negara (Persero) (PLN).

Unlike in some locations, the SCN program in Sukadana was not imposed top-down. Instead, it was codesigned with local stakeholders—namely the Women's School—and IoT specialists, based on assessments of community needs, in order to directly address specific problems and develop relevant solutions.

5. Mata Redi Village, Central Sumba Regency

How can SCN be organized in a location where even basic electricity is unavailable? This is precisely the situation in Mata Redi Village, Central Sumba. The state electricity company, PLN, once attempted to supply power

using portable solar panels installed in individual households, but the initiative was short-lived. At present, the community relies on solar-powered generators or vehicle batteries for electricity. When SCN held its training activities in May 2022 to develop GSM-based community network infrastructure, electricity was sourced from generators.

In addition to limited electricity, Mata Redi also scores poorly in areas such as information and communication infrastructure, sanitation, and access to education. The local elementary school, for example, struggles to regularly submit reports to the national Basic Education Data System *(Data Pokok Pendidikan*, *Dapodik*) because there is no internet signal—despite having computers available. Dapodik is Indonesia's centralized education data system that requires early childhood, primary, and secondary education institutions nationwide to upload data through an application developed by the Ministry of Education, Culture, Research, and Technology as part of the country's digital education transformation.

Due to the absence of internet connectivity, teachers must go to extreme lengths to access a signal. Sometimes this involves climbing trees or sending someone to the district capital, where telecommunication infrastructure is better (V, Headmaster of the Elementary School, interview). This situation is deeply ironic: while schools are mandated by the government to submit digital data, the necessary digital and electrical infrastructure has yet to be developed.

At the time of data collection, a large-scale solar panel construction project was underway, intended to provide reliable electricity to two adjacent villages—Mata Redi and Mata Woga. This initiative is part of the MENTARI Program (*Menuju Transisi Energi Rendah Karbon Indonesia/Towards Low Carbon Energy Transition in Indonesia*), a bilateral cooperation between the British Embassy and the Indonesian Ministry of Energy and Mineral Resources. The program is implemented by a consortium of Palladium International, HIVOS, Castlerock Consulting, and Economic Consulting Associates (ECA).

In Mata Redi, SCN activities are carried out in partnership with MENTARI to enhance program effectiveness. Common Room also works with the Don Bosco Training Center Sumba, which has been offering various vocational training programs since 2002, especially for poor and marginalized youth facing structural injustices. Their current programs include training in computer skills, electrical systems, installation, air conditioning, machining, and furniture making.

Through such multi-stakeholder collaborations, Common Room seeks to maximize existing local resources and align them toward shared development goals.

6. Nimboran District, Jayapura Regency, Papua

Ex oriente lux, meaning "light rising from the east," served as Common Room's motto during the launch of the SCN program in Jayapura Regency, Indonesia's easternmost region. Rather than referencing spiritual or philosophical traditions, the phrase here symbolizes efforts to bring internet access to remote, mountainous villages scattered across the region.

To address these challenges, Common Room collaborated with PT Pasifik Satelit Nusantara (PSN), a private satellite internet provider. PSN technicians trained Pemantik, a local group of ICT volunteers initiated by the Head of the Jayapura Communication and Information Office (GG), who has an IT education background and a long history of digital village activism. His office fully supports SCN in Nimboran District and is part of the Village Development Movement, a grassroots initiative promoting digital technology for rural progress (Priyadharma 2021).

GG emphasized that VSAT is essential for reducing isolation, supporting local economic empowerment, and enabling online learning. He also noted that Papuan communities prefer practical, hands-on learning before engaging with abstract concepts—a method he associates with the "Thomas Concept" from Christian tradition: "see first, then believe."

Common Room embraced this learning style in the SCN training sessions, prioritizing practical, hands-on experiences in building digital community infrastructure. This approach is designed to spark participants' interest and curiosity, motivating them to pursue deeper knowledge and skill development as they engage directly with the technology.

7. Tembok Village, Buleleng Regency, Bali

Despite Bali's image as a global tourist destination, digital disparities remain, especially in North Bali where mountainous terrain limits connectivity. While South Bali benefits from robust tourism and digital infrastructure, areas like Tembok Village in the north still face blank spots. Many young Balinese

migrate south for jobs, including DK, the former head of Tembok Village, who returned after working in tourism due to feeling "restless" in the city. Elected at 28 in 2015, DK was in his second term during the data collection.

Tembok showcases three digital innovation practices. First, to overcome poor connectivity, the village built a bamboo-based internet tower—an affordable alternative to costly BTS infrastructure—reaching remote hilly areas.

Second is *Djangkep*, a village public service application developed through collaboration between ICT volunteers, the village-owned enterprise (BUMDES), and Common Room via the SCN program. The name *Djangkep*, from Balinese, implies completeness and reflects the app's goal to deliver integrated, responsive public services. It allows residents to access certificates (e.g., birth, death, marriage, business), school bus and health service information, and will eventually manage waste bank savings. It also enables digital administration for residents working outside the village, removing the need for them to return home for documents.

The third innovation is a separate waste bank app that turns sorted household waste into savings, which villagers can cash out.

Supported by Common Room, Tembok's efforts earned national recognition in 2021 for public service innovation. Its commitment to digital development led to its selection as host of the third Rural ICT Camp (October 2022), held alongside the G20 Bali Summit. The event explored ICT policy, community internet infrastructure, and digital solutions tailored to diverse village needs. As noted by Common Room, meaningful digital transformation in rural areas requires collaboration with visionary village leadership capable of aligning connectivity with local development goals.

8. Kasepuhan Ciptagelar, Sukabumi Regency

The origins of SCN and the Rural ICT Camp can be traced to Kasepuhan Ciptagelar (which has since relocated to Gelaralam and been renamed Kasepuhan Gelaralam), an indigenous community in the forests of Halimun-Salak National Reserve (West Java and parts of Banten). Though deeply rooted in tradition, Ciptagelar embraced digital technology through a partnership with Common Room that began in 2013 and deepened in 2016 via the GIZ-supported ICT for Agriculture (ICTAG) program. The 2016 Gambung Agreement acknowledged ICT as vital for cultural preservation,

forest protection, and economic development. This led to the 2019 Pathfinder Project with APC and local ISP Awinet, focusing on community-based internet to support cultural resilience and land rights.

As of 2023, the community-based internet infrastructure connects 37 of 568 hamlets and 11 of 360 villages, serving a population of around 30,000. Ciptagelar also built bamboo towers like in Tembok and operates CIGA TV and Radio Swara 107.7 FM since 2008. CIGA TV, also on YouTube (@cigatvciptagelar6230), reflects the philosophy *"Kudu Bisa Ngigelan Jaman, Tapi Ulah Kabawa Ku Jaman"*—keeping pace with modern times without abandoning tradition.

To sustain its network, Ciptagelar developed *Ciptagelar Hotspot* in collaboration with Awinet and supported by Common Room. Internet is sold via vouchers (hourly to monthly), starting at just Rp2,000 (US$0.15). In one year, 238,320 vouchers were sold through 86 agents. The network includes 520 public and 10 private hotspots, maintained by 10 technicians, and generated over US$353,000 between August 2020 and July 2023. Teachers receive free internet for uploading education data (Dapodik), and SCN supports routine maintenance, technician training, and digital literacy workshops.

These achievements were reinforced through two Rural ICT Camps in 2020 and 2021—held during the pandemic—with the theme "Village Resurgence, Archipelago Resurgence," promoting digital-based innovation rooted in culture and environment.

Central to Ciptagelar's success is the leadership of Abah Ugi, a respected traditional leader who balances tradition with progress. He supports digital technology that benefits the community, except in rice farming, which remains sacred and untouched by modernization. Guided by the principle *"ditambah boleh, dikurangi jangan"* (additions are welcome, reductions are not), this philosophy reflects a deep cultural belief that trading or altering rice production is taboo, as rice is seen as life itself.

9. Ngata Toro, Central Sulawesi

Ngata Toro, a remote indigenous village in Central Sulawesi near Lore Lindu National Park, is home to the To Kaili people who uphold strong cultural traditions, including a customary school (Sekolah Adat). The village,

prone to natural disasters, notably the Palu earthquake, requires resilient infrastructure, including dependable internet access for emergency alerts and cultural preservation.

Thanks to the School of Community Network (SCN) initiative, Ngata Toro now has a functioning community-managed network. A foundational team—consisting of a coordinator, two technicians, a secretary, and a treasurer—has received initial training and manages three access points. The network sells vouchers at Rp12,000 per gigabyte. To reach more users, an access point has been placed near the traditional dance studio, a popular gathering space.

Despite these gains, nonstandard infrastructure remains a challenge. Many rural networks, often built through village-owned enterprises or community initiatives, operate with uncertified or substandard equipment, risking poor service quality and data security. This underscores the urgent need for technical standardization support to ensure reliable and secure community networks in underserved areas.

Another challenge in Ngata Toro is the emerging competition from unauthorized commercial internet providers operating within the community. Since the introduction of the SCN and its voucher-based system, these providers have begun using Starlink internet services to redistribute bandwidth and resell it to local users. This development poses a setback for the SCN initiative, which operates with social objectives such as capacity building and the empowerment of Indigenous communities—goals that are not shared by the profit-driven competitors.

Discussion

1. Types of Infrastructure of Community Networks

The first step in providing meaningful internet services for rural communities is to ensure the establishment of connectivity that allows them to access the internet. To distinguish itself from mainstream services, the SCN adheres firmly to the 5L principle, which emphasizes, above all, that the technologies supporting connectivity must be simple and affordable. This approach prioritizes the use and enhancement of existing local human resources to ensure the sustainability and reliability of the service.

Based on the latest matrix data provided by Common Room (see table 1), SCNs across Indonesia show significant variation in their levels of development, infrastructure, and community management capacity. At the advanced end of the spectrum, SCNs such as Ciptagelar and Ciracap feature substantial infrastructure and well-organized management teams. These include multiple technicians, administrative staff, and structured training programs. Both sites support hundreds of access points, provide widespread internet access, and generate sustainable monthly income—demonstrating strong community engagement and technical capability. Notably, SCN Ciracap has evolved into a legal entity and is already developing a business plan to compete directly with commercial ISPs.

Table 1. Status of Selected School of Community Networks in Indonesia

Location (Level of Advancement)	Team Composition	Training Conducted	Infrastructure	Business Model
Pulo Aceh, Aceh Besar District, Aceh (Intermediate)	1 coordinator, 2 technicians (1 certified), 1 treasurer	4 technical training sessions	2 VSAT devices (1 VSAT on hold), 2 access points	Voucher: Rp15,000, bandwidth top-up every 15 days
Ciracap District, Sukabumi Regency, West Java (Upper Intermediate)	1 coordinator, 6 admins, 6 technicians	3 technical training sessions, 1 digital literacy session, 3 internal technician training sessions	2 internet sources, 200 access points	iDes Subscription. Income: 9-12 million Rupiah per month
Ciptagelar Indigenous Village, Sukabumi Regency, West Java (Advance)	1 community leader, 1 technician coordinator, 10 technicians, 1 admin, 1 treasurer	13 sessions, over 10 internal technician training sessions	542 access points, bamboo tower, weather station	Income: Rp120–165 million per month, ISP partnership (with Awinet)

Ketemenggungan Tae, Sanggau Regency, West Kalimantan (Intermediate)	1 coordinator, 2 technicians (1 certified), secretary, 1 treasurer	3 sessions	5 access points	Voucher: Rp3,000–5,000, bandwidth top-up every 10 days
Tembok Village, Tejakula District, Buleleng Regency, Bali (Basic)	1 coordinator, 2 technicians	2 technical training sessions, 2 digital literacy sessions, 1 Djangkep application training	2 access points, Bamboo Tower	N/A
Sukadana Village, North Lombok Regency, West Nusa Tenggara (Basic)	1 coordinator, 1 technician, 1 treasurer	2 IoT training sessions, 1 internet network training session, 1 digital literacy session, 1 financial management training session	1 IoT prototype for shrimp pond monitoring, 2 access points	N/A
Marannu Village, Lau District, Maros Regency, South Sulawesi (Initiation)	Not yet established	None	Installing internet source	N/A
Weepangali Village, Southwest Sumba Regency, East Nusa Tenggara (Basic)	1 coordinator, 3 technicians, 1 treasurer	2 technical sessions, 1 Training of Trainers (ToT)	Bamboo Tower, 2 access points	N/A

Taliabu Island, Taliabu Island Regency, North Maluku (Basic)	1 coordinator, 2 technicians	2 technical training sessions	1 access point	N/A
Ngata Toro Village, Kulawi District, Sigi, Central Sulawesi (Intermediate)	1 coordinator, 2 technicians, 1 secretary, 1 treasurer	1 training session	3 access points	Voucher: Rp12,000 per GB, bandwidth top-up every 4 days

SCN Ciptagelar stands out as a powerful example of CCC that is deeply embedded in customary law, which governs many aspects of life in this historically marginalized community. Despite limited resources, Ciptagelar maintains hundreds of access points and delivers essential internet services tailored to the unique needs of its residents. The technicians, many of whom hold junior network administrator certifications, combine technical knowledge with a deep understanding of the region's geography, resulting in reliable and responsive service. The SCN also collaborates closely with traditional leaders to produce and disseminate culturally relevant content that preserves and promotes Ciptagelar's heritage. Looking ahead, the team plans to develop a fiber-optic connection to enable the launch of a community-operated television channel, further reinforcing digital inclusion as a tool for cultural preservation and self-representation.

While some SCNs show promising growth and are raising their standards, many others remain at the basic to intermediate stages, still working to establish core competencies through technical, managerial, and essential training programs.

Intermediate-level SCNs, such as those in Pulo Aceh, Ngata Toro, and Ketemenggungan Tae, have established teams and some structured training, but operate fewer access points, which limits the revenue they generate from internet services. To address these challenges, they often adopt creative solutions such as using VSAT connections and managing bandwidth through local voucher systems to ensure continued service and financial sustainability.

In contrast, basic and early-stage SCNs, such as those in Tembok, Weepangali (Don Bosco Vocational Training, Southwest Sumba), and Marannu (Maros), are still in the initial phases of network development. These communities

have minimal technical training, limited personnel, and are only beginning to form foundational teams and implement training programs. Their constrained resources and nascent management structures underscore the need for additional support to scale up their connectivity and develop community-driven network systems. A common challenge across these locations is the difficulty in accessing reliable connectivity backhaul.

2. Types of Meaningful Use of Networks: Addressing Five Key Sectors

CCC in Indonesia presents a transformative approach to digital inclusion by moving beyond mere internet access to focus on its meaningful and localized use. The meaningful utilization of community networks, particularly in underserved and remote regions, intersects with five strategic sectors: health, governance, disaster resilience and climate change, education and culture, and the productive economy. Evidence across diverse local initiatives demonstrates how community-based internet infrastructure can generate social, economic, and environmental impact when intentionally designed and managed.

1. Health: Bridging the healthcare gap in remote areas

Internet connectivity has become a critical enabler of health services in remote Indonesian communities, particularly within the "3T" (frontier, outermost, and disadvantaged) regions. CCC facilitates the implementation of telemedicine, allowing rural health centers to access specialist consultations and remote diagnostics. Government collaborations, such as those between the Ministry of Health and private sector partners (e.g., Starlink), have helped extend connectivity to health centers. This access not only improves care delivery but also strengthens public health campaigns—exemplified by initiatives like *Lapor Sehat* in Ngata Toro during the COVID-19 pandemic, which utilized digital platforms for coordinated health interventions. Moreover, community participation in building digital infrastructure contributes to the effectiveness of national nutrition and health programs.

2. Governance: Enhancing access and participation

CCC fosters the digitization of public services in rural contexts, enabling broader access to state functions and improving bureaucratic efficiency. The use of e-governance systems, such as the *Djangkep* application in Tembok

Village, illustrates how digital tools can streamline administrative processes, from civil registration to permit applications. These innovations reduce the time and cost burden on citizens and increase institutional transparency. Furthermore, community networks offer platforms for participatory governance, allowing residents and local authorities to engage in dialogue and decision-making with greater immediacy and inclusivity.

3. Disaster resilience and climate change: Building responsive communities

Connectivity also plays a vital role in disaster preparedness and climate adaptation. Community networks support real-time communication and early warning systems in high-risk regions. For example, Ciracap's implementation of community-based micro-weather stations and IoT-enabled sensors provides localized environmental data to inform timely responses. Beyond reactive measures, CCC projects contribute to long-term climate adaptation by supporting community-driven environmental monitoring and resource management. Integrating digital infrastructure with renewable energy solutions also reduces reliance on conventional energy sources, enhancing both environmental sustainability and network resilience.

4. Education and culture: Empowering local knowledge systems

In the education sector, CCC initiatives reduce the digital divide by providing internet access to rural schools and students, facilitating participation in national platforms such as *Dapodik*. Community networks also support informal learning and digital literacy through initiatives like the SCN and Siberkreasi. These programs offer training to improve digital competencies among youth and adults alike. Importantly, CCC reinforces cultural resilience by supporting the creation and distribution of culturally relevant content. CIGA TV in Kasepuhan Ciptagelar (now Gelaralam), for instance, uses digital broadcasting to maintain and share indigenous narratives, aligning with the community's philosophy of technological adaptation without cultural erosion. Similarly, Ngata Toro integrates indigenous values into its digital systems, ensuring cultural preservation through modern tools.

5. Productive sectors: Strengthening livelihoods through digital access

CCC also enhances productivity in agriculture, plantations, fisheries, and micro-enterprise sectors. With digital platforms, farmers and fishers can access real-time data on market prices, weather forecasts, and sustainable practices, thereby improving yields and reducing risks. In Meulingge, internet-supported fisheries cooperatives benefit from more efficient supply chains, while Ngata Toro farmers gain better market access. Community networks also support SMEs through e-commerce platforms and digital skills training, expanding entrepreneurial opportunities and local economic resilience.

These five domains demonstrate the expansive potential of meaningful network utilization under the CCC framework. By emphasizing local relevance, collaborative management, and sociocultural embeddedness, CCC initiatives are not only expanding digital access but are also strengthening the foundations of rural resilience and self-determination in Indonesia.

Conclusion

This study has demonstrated that meaningful access, rather than mere universal access, must become the core imperative of rural digital development in Indonesia and the broader Global South. The concept of *meaningful community-centered connectivity (CCC)*, as practiced by the School of Community Networks (SCN), presents an alternative developmental pathway that is grounded in local realities, cultural specificity, and community autonomy. The infrastructure of connectivity within the SCN, ranging from bamboo towers to VSAT systems, and from locally administered voucher networks to IoT-integrated applications, embodies a practical and decentralized model of digital development that resists the technocratic tendencies of both state and corporate actors.

Importantly, this infrastructure is not deployed as an end in itself, but rather as a catalyst for community-driven change. The meaningfulness of connectivity within SCN contexts lies not in the quantity of bandwidth consumed or the number of devices connected, but in the community's ability to determine the use, governance, and sociocultural integration of digital tools. Whether by empowering indigenous leadership in Ciptagelar, enabling women's economic resilience in Sukadana, or facilitating disaster preparedness in Pulo Aceh and Ngata Toro, SCN demonstrates how connectivity becomes meaningful when it aligns with community priorities and strengthens local agency.

The theory of change developed by the Association for Progressive Communications (APC) provides a useful analytical lens for understanding the transformative potential of CCC. It moves beyond the narrow focus on service delivery and instead envisions a future where rural, remote, and marginalized communities possess the capacities, resources, and autonomy to shape their digital futures. This theory acknowledges the structural barriers embedded in commercial and bureaucratic logics and calls for participatory, inclusive, and socially motivated connectivity models. The SCN embodies this shift, operating not merely to fill access gaps but to reconfigure who builds, owns, and benefits from digital infrastructure.

Framed within the periphery-centric approach, SCN challenges the prevailing logic of center-led development. It affirms the legitimacy of peripheral communities to formulate their own digital development agendas, decentering national metrics and commercial KPIs as the only valid indicators of success. By placing rural actors as epistemic agents rather than passive beneficiaries, SCN redefines the digital periphery as a site of innovation, resistance, and transformative potential. This alternative logic resonates with multiplicity theories of development, in which culturally and geographically distinct communities are not pressured to replicate the center but are instead supported in defining meaningful progress on their own terms.

In conclusion, as an alternative practice of rural digital development, the peripherality of the SCN should not be viewed as marginal, but as central—at least for the communities it serves. This is the true essence of meaningfulness: the right and capacity of a community to decide what is meaningful for them and what is not. Rather than being subjected to pre-defined standards imposed by centralized governance or commercial platforms, communities must be empowered to determine their own technological futures. This argument resonates strongly with Amartya Sen's (1999, 3) conception of development as freedom, in which he states that "development can be seen [. . .] as a process of expanding the real freedoms that people enjoy." In the context of meaningful CCC, real freedom lies in the ability of rural and marginalized communities to make decisions about their own development pathways, including how, when, and why to adopt digital technologies. The periphery-centric approach, as embodied by SCN, confirms Sen's thesis by centering freedom not merely as access, but as agency: the freedom to define and pursue development on one's own terms. In this sense, the periphery becomes a new center, not in geography, but in epistemology and power. The promise of SCN lies precisely in this re-centering.

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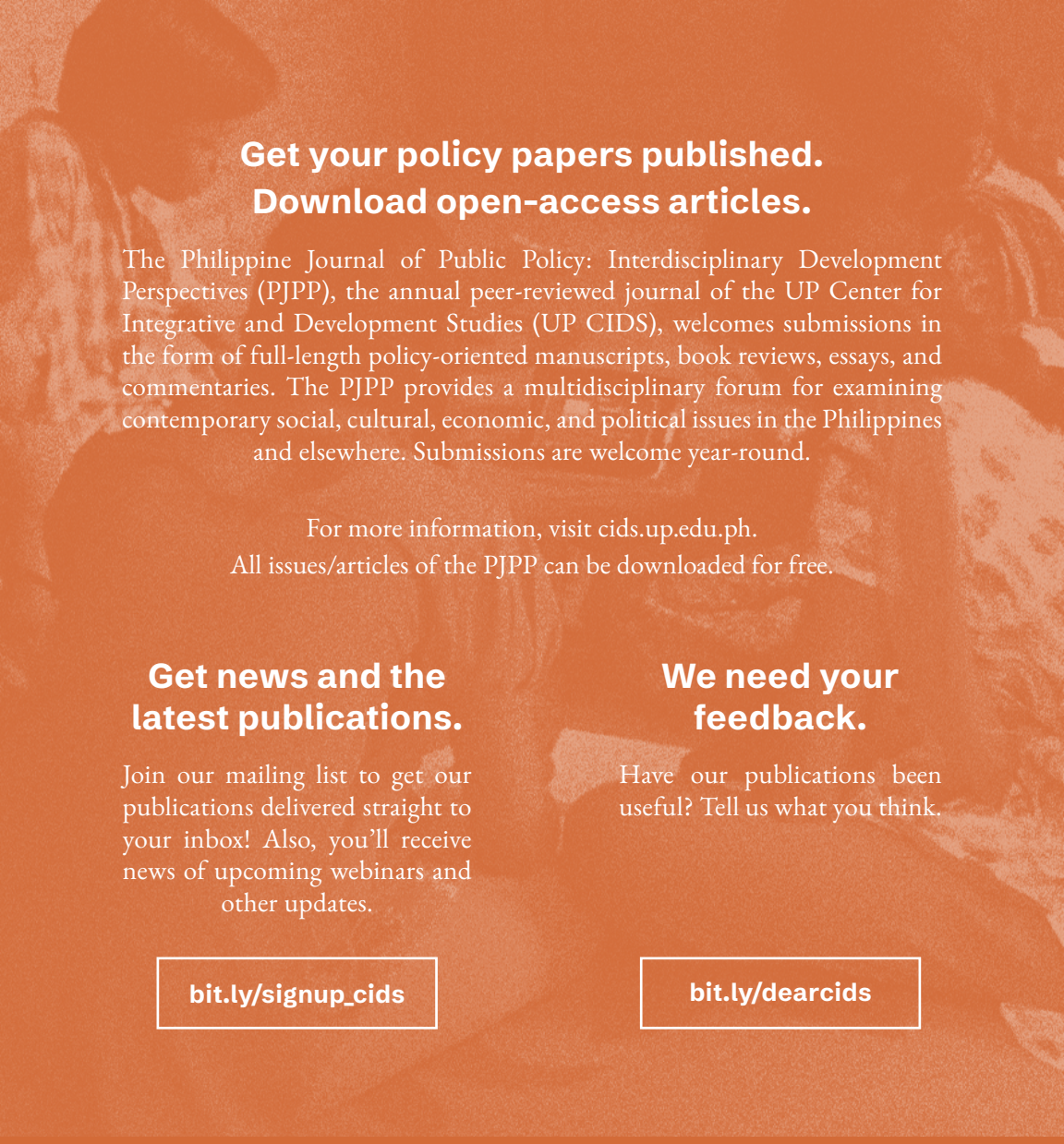

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