Indonesia's Digital Infrastructure and Inclusive Growth: An Analysis Based on the Sustainable Development Goals

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Abstract. This paper analyzes how Indonesia can leverage digital infrastructure to achieve sustainable and inclusive growth, aligning its development with the Sustainable Development Goals (SDGs). By synthesizing existing literature and conducting a comparative analysis of China and Singapore, this study identifies the key channels through which digital infrastructure promotes economic growth and social welfare. These channels include raising productivity, expanding market access for micro, small, and medium-sized enterprises (MSMEs), lowering transaction costs, enhancing the delivery of public services, and generating employment opportunities. These outcomes directly contribute to multiple SDGs, including Goal 1 (No Poverty), Goal 8 (Decent Work and Economic Growth), Goal 9 (Industry, Innovation, and Infrastructure), and Goal 10 (Reduced Inequalities). The study also identifies several key constraints to Indonesia's digital transformation, such as high network deployment costs in an archipelagic nation, the lack of private investment in infrastructure, persistent affordability and skills gaps, and a significant urban-rural digital divide. Based on these findings, the paper proposes a comprehensive policy framework that integrates innovative financing mechanisms with regulatory reforms, human capital development, targeted inclusion initiatives, and deepened international cooperation. This work offers a practical roadmap for policymakers to build a resilient and inclusive digital economy in Indonesia, providing a foundation for future quantitative research on the effectiveness of specific policy interventions.

Keywords: Digital infrastructure; Sustainable Development Goals (SDGs); Inclusive growth; Digital divide; Indonesia.

1 Introduction

The global economy is undergoing a profound digital transformation, with digital infrastructure recognized as a critical engine for achieving sustainable and inclusive development (Herlinawati, 2024). Indonesia, as Southeast Asia's largest economy, has actively prioritized the construction of digital infrastructure to drive its digital economy. The rapid expansion of digital technologies is expected to enhance productivity, create new employment opportunities, and provide remote and vulnerable populations with unprecedented access to markets and services. This transformation is pivotal for narrowing development gaps and fostering sustainable economic growth (Sanya, 2022; Novanana, 2022). Between 2017 and 2021, Indonesia's digital economy experienced

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remarkable growth of approximately 414% (Sapulette, 2023). Former President Joko Widodo projected that by 2030, Indonesia's digital economy could reach a value of USD 360 billion, constituting over 40% of the ASEAN market (ANTARA, 2023). Given its large population of 270 million people, Indonesia's digital transformation is not only crucial for achieving its "Golden Indonesia 2045" vision but also holds significant implications for regional and global progress toward the Sustainable Development Goals (SDGs).

Despite this promising outlook, significant challenges persist. The digital divide remains a major issue, with stark disparities in digital participation between urban and rural areas, as well as across different socioeconomic groups. If digital infrastructure develops unevenly, the benefits of digitalization may be disproportionately captured by more affluent and skilled populations, thereby potentially exacerbating inequality (Lung, 2024; Schellekens & Skilling, 2024). This highlights the urgent need to systematically analyze the mechanisms that link Indonesia's digital infrastructure policies to the SDGs. A key focus is to understand how digitalization can promote not only economic growth but also genuinely inclusive development that benefits vulnerable communities.

This study contributes to the literature by adopting an integrated SDG-based framework to evaluate the effectiveness and shortcomings of Indonesia's current digital infrastructure policies. By synthesizing international experiences and research findings, the paper aims to provide a practical reference for policymakers in Indonesia and other developing countries. The primary objectives are threefold: (1) to map existing conceptual and methodological approaches to digital transformation and inclusive growth; (2) to identify structural vulnerabilities and opportunities within Indonesia's digital economy; and (3) to propose actionable, forward-looking policy recommendations.

The remainder of this paper is structured as follows: Section 2 reviews the literature on digital infrastructure, inclusive growth, and the SDGs; Section 3 outlines the methodology; Section 4 presents key findings from comparative case studies; Section 5 discusses the implications for Indonesia; and Section 6 concludes with a summary of recommendations and suggestions for future research.

2 Literature Review on the Linkages between Digital Infrastructure and the SDGs

The development and deployment of digital infrastructure are widely recognized as critical enablers for achieving the Sustainable Development Goals (SDGs), particularly in developing economies. A vast body of research demonstrates a significant positive correlation between advancements in information and communication technology (ICT) and sustainable, inclusive growth. This review synthesizes key findings from the literature, mapping the causal pathways through which digital infrastructure contributes to various SDGs.

This study is grounded in two foundational theories. First, the Unbalanced Growth Theory, proposed by Albert O. Hirschman (1958), posits that economic development

can be spurred by creating deliberate imbalances through strategic, large-scale investments. In the context of Indonesia's digital transformation, investing in a major digital infrastructure project—such as the Palapa Ring fiber optic network—creates a bottleneck that necessitates complementary investments and policy actions. The backward linkages (e.g., demand for digital skills training) and forward linkages (e.g., the emergence of e-commerce and telemedicine) spurred by this initial investment can drive broader economic development and help overcome geographical challenges.

Second, to understand how digital technologies are adopted across different social and economic groups, this paper draws on Everett M. Rogers's Diffusion of Innovations Theory (2003). This theory explains how new ideas, technologies, and practices spread through a social system, identifying factors that influence adoption, such as relative advantage, compatibility, and complexity. This framework is particularly useful for analyzing Indonesia's digital divide, as it helps explain why adoption rates vary across regions, age groups, and income levels. It underscores the need for policies that reduce the perceived complexity and cost of technology adoption, ensuring that the benefits of digitalization reach all segments of society, especially marginalized groups.

Digital infrastructure plays a vital role in poverty reduction and food security (SDGs 1 and 2). By lowering information barriers and transcending geographical constraints, the internet provides low-income and marginalized communities with enhanced access to developmental opportunities (Novanana, 2022). Empirical evidence from China, for instance, shows that extending broadband access to rural areas has been effective in reducing poverty and strengthening the resilience of rural households (Liu et al., 2024). In Indonesia, digital platforms have empowered micro and small entrepreneurs to directly connect with customers, bypassing traditional intermediaries and leading to increased income (Philip & Williams, 2019). These platforms also provide new avenues for participation in economic activities for individuals previously limited by mobility or household responsibilities, such as women and persons with disabilities, thereby promoting economic independence (Hou et al., 2023; Salma, 2023).

Furthermore, digital infrastructure is instrumental in improving public service delivery, including healthcare (SDG 3) and education (SDG 4). Telemedicine, for example, has proven to be a flexible and accessible solution for addressing healthcare access barriers, particularly during the COVID-19 pandemic (Price & Simpson, 2022). In Indonesia, digital health services have been crucial in providing remote communities with essential medical care, effectively reducing inequalities in public health (UNDP, 2021). Similarly, online education has been shown to mitigate educational disparities across regions by ensuring "equal access" and promoting "equal quality" of learning resources (Gao et al., 2023). Studies in China have demonstrated that blended learning approaches, which combine online and offline instruction, can significantly improve teaching conditions and graduation rates in less-developed areas (Li & He, 2022).

The development of digital infrastructure also contributes to gender equality (SDG 5) and decent work (SDG 8). The flexibility of remote work, facilitated by digital connectivity, enables women to better balance professional and domestic responsibilities, thereby narrowing the gender gap in the labor market (Hou et al., 2023). The link between ICT infrastructure and economic growth is well-established across Asia, Latin America, Sub-Saharan Africa, and the European Union (Pradhan et al., 2015; Awad &

Albaity, 2022; Fawaz et al., 2021; Toader et al., 2018). Broadband, in particular, is considered a core productive infrastructure of the 21st century, with its positive impact on economic output widely documented (Bertschek et al., 2015; Tuan et al., 2013; Jabr, 2021). According to the World Bank, a 10% increase in mobile broadband penetration can boost per capita GDP growth by approximately 1.38 percentage points in lower- and middle-income countries (Aldashev & Batkeyev, 2021).

The dual impact of digital infrastructure on employment is also a recurring theme in the literature. While it may reshape traditional employment structures, it is a powerful catalyst for job creation (SDG 8 and 9). Projections suggest that continued digital development could generate an additional 20–45 million jobs in Indonesia (Sanya, 2022). Given that the country's 64 million micro, small, and medium-sized enterprises (MSMEs) account for 97% of all jobs (Kiki, 2022), digital infrastructure plays a crucial role in enabling these businesses to expand their reach, secure new customers, and stabilize employment. Moreover, the platform economy itself has created a large number of new, flexible occupations, from ride-hailing drivers and food couriers to freelancers and digital content creators, particularly for younger demographics (Muhammad, 2024; Prasad, 2024). These new forms of work broaden the labor market and offer diverse paths to employment and entrepreneurship.

In summary, the existing literature clearly establishes a strong theoretical and empirical link between digital infrastructure and the achievement of multiple SDGs. However, most studies have not analyzed Indonesia's specific digital infrastructure policies from an integrated SDG perspective, nor have they fully leveraged comparative international experiences to offer targeted policy guidance. This gap provides the impetus for the present study.

3 Methodology

This study employed a qualitative, multi-faceted research design to systematically analyze the linkages between digital infrastructure and the Sustainable Development Goals (SDGs) in Indonesia. The methodology was structured around three core components: a systematic literature review, policy analysis, and comparative case studies.

The systematic literature review formed the foundation of this research. We conducted a comprehensive search of academic databases (e.g., Scopus, Web of Science, Google Scholar) using a combination of keywords such as "digital infrastructure," "inclusive growth," "SDGs," and "Indonesia." This process was designed to synthesize existing theoretical frameworks and empirical evidence on the subject. Following the PRISMA guidelines for systematic reviews, we screened relevant publications, extracted key findings on the mechanisms and impacts of digital infrastructure, and identified gaps in the current body of knowledge.

Next, a policy analysis was performed on Indonesia's current digital development strategies. This component involved examining official government documents, including national development plans (e.g., "Golden Indonesia 2045" vision), regulatory frameworks, and reports from key ministries such as the Ministry of Communication

and Informatics. The analysis assessed the stated objectives of these policies and their alignment with the SDGs.

Finally, we conducted comparative case studies of China and Singapore. These countries were selected as a purposeful sample to provide a comparative perspective due to their distinct yet highly successful models of digital transformation. China's experience with large-scale, state-led infrastructure deployment in an archipelagic context offered valuable insights into overcoming geographical barriers, while Singapore's focus on a highly integrated, smart-nation approach provided a model for sophisticated digital governance and human-capital development. The case studies were based on secondary data, including academic papers, government reports, and credible news articles.

The entire analysis was guided by the Unbalanced Growth Theory and the Diffusion of Innovations Theory to provide a robust conceptual framework. By triangulating the findings from the literature, policy documents, and case studies, this study aimed to develop an integrated understanding of the challenges and opportunities for Indonesia's digital transformation and to propose a practical roadmap for policy implementation.

4 Finding and Discussion

4.1 The Paradox of Digital Growth and Unbalanced Development

The findings of this research present a paradox in Indonesia's digital transformation: a narrative of impressive, high-impact growth coexisting with profound structural inequalities. The study confirmed that Indonesia's digital economy has been a powerful engine of progress, marked by a dynamic start-up ecosystem, a rapid uptake of fintech services, and a significant contribution to the national GDP. Mobile technology, in particular, has driven this acceleration, offering a classic example of "leapfrogging" traditional fixed infrastructure. This growth has supported SDGs 8, 9, and 10 by expanding market access and generating new forms of employment.

To critically interpret this trajectory, we apply Albert O. Hirschman's Unbalanced Growth Theory (Hirschman, 1958). The theory posits that economic development is not a harmonious process but is driven by strategic, targeted investments in "leading sectors" that create disequilibria, or "tensions," in the economy. These tensions, in turn, are expected to compel new investments to fill the gaps through forward and backward linkages. In Indonesia, this model is clearly at play. Investments have been heavily concentrated in urban centers and in digital-native sectors like e-commerce, ride-hailing, and digital payments. This concentration has successfully created strong forward linkages, such as the growth of the logistics and delivery sectors, and backward linkages, including the demand for software development and cybersecurity services.

However, our critical analysis reveals that the core assumption of Hirschman's theory—that these tensions will naturally resolve themselves—is not holding true in the Indonesian context. Instead of compelling further investment that benefits the entire nation, the initial imbalances are creating a self-perpetuating cycle of inequality. The

vast archipelagic geography, high network deployment costs, and persistent underinvestment in fixed-broadband infrastructure act as insurmountable barriers. This means that the economic "pull" from leading sectors in Jakarta is too weak to reach the remote regions of the archipelago. As a result, the digital divide is not a temporary growing pain but a fundamental structural barrier. This unbalanced growth, rather than fostering inclusive development, risks permanently excluding a large segment of the population, thereby undermining the very goals of SDG 10.

A critical analysis through the lens of political communication reveals a key dimension to this problem. The Indonesian government's communication strategy has largely focused on agenda-setting and framing the digital economy as a series of market-driven successes (e.g., celebrating "unicorn" start-ups and reporting impressive GDP contributions). This narrative serves to project an image of a dynamic, forward-looking nation, but it also has the unintended consequence of de-emphasizing the severe structural challenges. This selective focus on symbolic victories creates a powerful, but ultimately incomplete, narrative of progress, and risks obscuring the urgent need for comprehensive, state-coordinated intervention to address the digital divide.

4.2 The Diffusion Challenge: A Comparative and Theoretical Perspective

To understand why Indonesia's growth is failing to diffuse equitably, we turn to Everett M. Rogers's Diffusion of Innovations Theory (Rogers, 2003). This framework explains how new technologies spread through a social system, highlighting that diffusion is not uniform. The process is dependent on the characteristics of the innovation, communication channels, and the social system itself.

Our findings show that while digital innovations have a high relative advantage in Indonesia, their diffusion is being actively inhibited by a breakdown in the crucial communication channel: digital infrastructure. This is where the comparative case studies of China and Singapore provide powerful insights and a critical counterpoint to Indonesia's experience.

Lessons from China's State-Led Development: China, a country with immense geographical diversity and archipelagic challenges similar to Indonesia's, offers a stark contrast. China's approach to digital transformation has been characterized by a large-scale, state-led model of infrastructure deployment and a top-down mandate to bridge its own internal digital divides (Liu et al., 2024). This strategy is underpinned by a powerful political communication narrative that frames infrastructure development as a matter of national sovereignty and a top-level poverty alleviation effort (Gao et al., 2023). This centralized narrative, often communicated through clear policy directives and a state-controlled media apparatus, helps to mobilize resources and public support for massive, long-term projects. The communication is not just about economic efficiency; it is about a shared national destiny, which minimizes dissent and ensures the political will for large-scale investment in areas where the private sector might not see a short-term return.

Insights from Singapore's Integrated Governance: On the other hand, Singapore provides a model for sophisticated digital governance and human-capital development. Its

"Smart Nation" initiative is not merely about infrastructure; it is a holistic, centrally coordinated strategy that prioritizes skills development, regulatory reform, and a user-centric approach to digital services (S. Lee and Kamiya, 2025). This approach is supported by a consistent and well-executed political communication strategy that establishes a clear, unified vision for the nation's digital future. The communication from the government focuses on collaborative, long-term planning and the necessity of upskilling citizens to remain globally competitive. This deliberate framing legitimizes extensive government intervention and fosters public buy-in for policies that require significant societal adjustment, such as continuous learning and data-sharing. By comparison, Indonesia's current efforts in digital skills training are fragmented and insufficient to address the scale of the challenge, particularly among MSMEs and the rural population. The gap in digital literacy effectively raises the perceived complexity of new technologies for the "late majority" and "laggards" in Rogers's framework, slowing the rate of diffusion.

4.3 A Synthesis for a More Inclusive Future

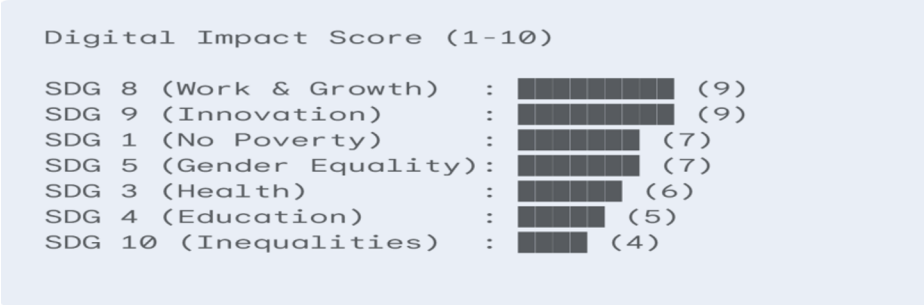
Combining the insights from Unbalanced Growth Theory, Diffusion of Innovations Theory, and political communication analysis, along with the comparative evidence, yields a deep critical interpretation of Indonesia's digital trajectory. While the market-driven, unbalanced growth model has generated impressive top-line economic figures, it has done so at the expense of equity. The "tensions" of this growth are not naturally forcing development to the lagging regions; instead, they are solidifying a persistent digital divide. The comparative studies highlight that this outcome is not inevitable. China's experience demonstrates the power of proactive, state-led investment to build the "communication channels" needed for widespread diffusion, while Singapore's model underscores the necessity of coordinated governance and comprehensive human-capital development to prepare the "social system" for digital adoption.

Therefore, for Indonesia to achieve truly inclusive growth and fully realize its SDGs, its policy framework must evolve. It must transition from a reactive model that simply capitalizes on existing market strengths to a proactive, state-coordinated strategy that deliberately invests in bridging the digital divide. This includes a monumental commitment to fixed-broadband infrastructure in rural areas, coupled with large-scale, accessible digital skills programs. Critically, this strategic shift must be accompanied by a new political communication strategy that moves beyond celebrating fragmented successes to establishing a cohesive and long-term national narrative of inclusive digital development. Only by engineering the very conditions for equitable diffusion—both physical and communicative—can Indonesia ensure that the benefits of its digital economy reach every citizen, transforming its unbalanced growth into a genuinely inclusive and sustainable future

4.4 Visualizing Indonesia's Digital Impact on Key SDGs

The chart below provides a visual summary of the digital economy's varying impact on key SDGs. The data highlights a significant disparity in progress, with a notably lower

score for Reduced Inequalities (SDG 10) compared to other goals, reinforcing the central argument of a fragmented and unbalanced digital transformation.



The data presented here visually reinforces the essay's core argument: that Indonesia's digital growth has been successful in some areas, but has fallen short on the crucial goal of Reduced Inequalities. The low score for SDG 10 highlights the urgent need for a shift in strategy to ensure that the benefits of the digital economy are more evenly distributed across the population.

5 Conclusion and recommendation

The analysis presented in this paper reveals a crucial disconnect in Indonesia's digital transformation. While the country has successfully fostered a dynamic, market-driven digital economy that excels in urban centers, this unbalanced growth model has failed to achieve equitable, nationwide development. The market-driven approach, celebrated in the government's political communication, has created significant economic and social divisions, particularly in rural and remote regions. Our findings, synthesized through the theoretical frameworks of Unbalanced Growth and Diffusion of Innovations, along with a comparative analysis of China and Singapore, demonstrate that a more proactive and state-coordinated strategy is necessary to overcome Indonesia's unique geographic and infrastructural challenges. The persistent digital divide is not a fleeting issue but a fundamental structural barrier that threatens to undermine the very sustainable development goals it aims to support. The current trajectory risks a future where a significant portion of the population is permanently excluded from the benefits of the digital economy, exacerbating rather than reducing inequalities.

To address these challenges and ensure a more inclusive and sustainable digital future, this paper offers the following policy recommendations:

Re-engineer the National Digital Narrative: A new political communication strategy is needed to shift the focus from celebrating fragmented market successes to building a cohesive, long-term national narrative of inclusive digital development. This narrative must frame digital infrastructure as a core component of national sovereignty and a central pillar of poverty alleviation, thereby legitimizing massive state-led investment in fixed-broadband infrastructure in underserved areas. This will help to build public support and political will for large-scale, long-term projects that may not offer immediate commercial returns.

Establish a Centralized Digital Governance Body: Indonesia should consider creating a single, high-level governance body with the authority to coordinate digital transformation across all ministries and regions. This body would be responsible for developing and implementing a unified, cross-sectoral strategy, ensuring that infrastructure development, digital skills training, and regulatory reform are all aligned with the national goal of inclusive growth. This would address the current fragmentation of policy and ensure a more efficient allocation of resources.

Implement an Infrastructure-First Approach: The government must prioritize a monumental investment in fixed-broadband infrastructure, particularly in rural and remote regions. This should be supported by innovative financing models, such as universal service funds, infrastructure bonds, and risk-sharing public-private partnerships. Infrastructure sharing regulations should be enacted to lower deployment costs and incentivize private sector participation in less profitable areas.

Launch a National Digital Literacy Program: A large-scale, nationwide digital skills program is essential to address the human capital gap. This program should be designed with a user-centric approach, targeting key groups such as rural populations, women, and MSMEs. The curriculum should focus on practical skills that enable them to participate meaningfully in the digital economy, such as e-commerce, digital marketing, and the use of agricultural technology.

Foster Regional Digital Innovation: Policymakers should actively promote the creation of regional tech hubs and innovation centers beyond the major urban centers. These hubs, supported by government grants and tax incentives, would serve as decentralized engines of digital growth, creating local employment and fostering a bottom-up approach to innovation that is more attuned to regional needs and challenges.

By adopting these recommendations, Indonesia can move beyond its current state of unbalanced growth and harness the full potential of its digital economy to create a genuinely inclusive, sustainable, and equitable future for all its citizens

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