

# The Hidden Costs of the Generative AI Boom: How Overinvestment Exacerbates the Digital Divide in Developing Countries

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**Abstract:** Between 2024 and 2025, a global investment frenzy in generative artificial intelligence (AI) has emerged, with governments and enterprises worldwide competing to deploy large language models, AI chips, and intelligent applications. However, in developing countries with limited resources, such a “technological leapfrogging” strategy may entail severe structural risks. This paper argues that blind pursuit of cutting-edge AI not only diverts investment from critical basic digital infrastructure (including broadband networks, power supply, and digital literacy education) but also risks widening the digital divide across urban-rural, regional, and social groups. By analyzing policy practices and practical dilemmas in India, Vietnam, selected African nations, and central and western regions of China, this study reveals that the lack of a technology strategy aligned with developmental stages can easily lead to a dual predicament: “underutilization of advanced technologies” coexisting with “collapse of basic capabilities”. The paper advocates for a “stratified AI strategy”, prioritizing the consolidation of digital foundations before selectively developing lightweight or high social-return AI applications, to achieve inclusive technological progress.

**Keywords:** Generative artificial intelligence; Digital divide; Developing countries; Technology policy; Resource mismatch

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## 1. Introduction

From 2024 to 2025, generative AI has swept the globe at an unprecedented pace. From Silicon Valley to Bengaluru, governments and enterprises around the world have poured huge sums of capital into large language models, AI chips, and intelligent applications. According to a 2024 report by McKinsey, global AI investment has exceeded \$300 billion, nearly tripling since 2022 <sup>[1]</sup>. The International Monetary Fund (2025) has further identified Generative AI as a key force reshaping the global economy over the next five years <sup>[2]</sup>. Against this backdrop, many developing countries have launched national AI strategies, seeking to achieve catch-up growth through technological leapfrogging.

Beneath the surface of this seemingly inclusive technological revolution, however, lie profound structural contradictions. The World Bank (2024) notes that over 40% of the global population remains unconnected to the internet, predominantly concentrated in South Asia, sub-Saharan Africa, and Southeast Asia<sup>[3]</sup>. In rural India, daily power supply falls short of 8 hours; in mountainous regions of Vietnam, 4G signals are intermittent; and in some county-level primary and secondary schools in western China, basic computer equipment is still lacking. Against such a fragile digital foundation, does large-scale investment in high-computing, high-threshold Generative AI align with these countries' developmental stages?

This paper poses a critical question: under conditions of limited resources, can excessive investment in AI crowd out fiscal and policy attention to more urgent basic infrastructure such as broadband, power, and digital literacy? If public resources are concentrated on AI demonstration zones or national teams for large language models while neglecting the basic digital access rights of grassroots populations, technological progress may widen rather than narrow the digital divide across urban-rural, regional, and class lines.

The contribution of this paper lies in moving beyond the technological determinism narrative to provide a critical framework based on developmental stage adaptability. It emphasizes that technology adoption must match local institutional capacity, infrastructure, and human capital levels, and accordingly proposes a stratified, incremental AI development strategy.

## **2. The global AI investment frenzy and its implicit assumptions**

Since the breakthrough of generative AI in 2023, an unprecedented global investment boom has emerged. This wave is driven by two complementary forces as follows:

- (1) Fierce competition among tech giants: OpenAI has led iterations with its GPT series, Google launched Gemini to regain its voice, and Chinese companies such as Baidu, Alibaba, and Tencent have successively released large language models including “ERNIE Bot” and “Tongyi Qianwen” to compete for domestic and global ecological niches;
- (2) Governments worldwide have elevated AI to the status of a national strategy: The European Union has introduced the Artificial Intelligence Act, China has launched the “AI+” initiative, and India has invested \$1 billion in its “National AI Mission”. Driven by the combined forces of capital, politics, and public opinion, AI has been framed as the core engine of a new round of economic growth<sup>[4]</sup>.

However, the mainstream narrative is built on two untested implicit assumptions as outlined.

- (1) AI is a general-purpose productivity tool that all countries should deploy as soon as possible, analogizing it to electricity or the internet and attributing to it inherent inclusivity<sup>[5]</sup>;
- (2) Developing countries can achieve ‘leapfrog development’ through AI”, skipping industrialization to directly enter the intelligent economy. This view is heavily influenced by the “leapfrog development” experience of Africa, which skipped fixed-line telephony to directly popularize mobile communications.

Yet generative AI is not an out-of-the-box end product but a complex system highly dependent on supporting ecosystems. Its implementation requires at least three pillars: technical talent with algorithm tuning capabilities, high-quality structured data infrastructure, and regulatory capacity to effectively govern data privacy and algorithmic risks. Most developing countries lack these conditions: universities can cultivate a small number of top engineers, but basic education cannot support universal digital literacy; enterprises have not even established basic ERP systems, let alone generated training data; and governments lack institutional tools to govern AI monopolies and biases.

For this reason, blind application of the “general-purpose tool” or “leapfrog development” logic can easily

lead to a disconnect between technology and reality. Economist Schumacher (1973) proposed the theory of appropriate technology, emphasizing that technology must match local resources and skill levels <sup>[6]</sup>. Lall's (2000) technological learning ladder model also pointed out that technological capabilities must be accumulated gradually from use and maintenance to innovation <sup>[7]</sup>. As a complex system at the top of the technological ladder, generative AI, if forcibly introduced when underlying capabilities are weak, will not only fail to deliver results but may also hinder the overall digitalization process due to resource mismatch. Therefore, a rational examination of the AI boom must return to the fundamental principle of developmental stage adaptability.

### **3. Practical dilemmas of developing countries: Fault lines beneath the boom**

Despite the optimism of the global AI narrative, the actual picture of technology implementation in most developing countries is far more complex than advertised. Beneath the superficial “ambition of AI strategies” lie deep-seated contradictions intertwined with weak infrastructure, human capital gaps, and policy resource mismatch, making it difficult for advanced AI to take root and potentially exacerbating internal inequality <sup>[8]</sup>.

#### **3.1. Severe infrastructure gaps persist**

Generative AI relies on stable electricity, high-speed networks, and data collection terminals, which remain scarce resources in many developing countries. According to 2024 World Bank data, only 48% of rural households in India have stable internet access, and a large number of villages receive less than 6 hours of daily power supply, insufficient to support the operation of local AI servers. Although Vietnam is a major manufacturing exporter, the vast majority of small and medium-sized enterprises (SMEs) have not yet deployed IoT sensors or ERP systems, resulting in fragmented production data that cannot be integrated into AI supply chain platforms. In sub-Saharan Africa, the problem is even more fundamental: countries such as Nigeria and Kenya have a power coverage rate of generally less than 60%, and the cost of data center construction and operation is extremely high. Even if advanced models are introduced, they become one-time demonstrations due to unsustainable computing power <sup>[9]</sup>. Without roads, even the fastest cars cannot travel, this is the primary barrier to AI at the grassroots level.

#### **3.2. Severe human capital gaps**

In recent years, universities in many countries have expanded enrollment in AI-related majors in an attempt to quickly fill the talent gap, but have neglected the long-term lack of basic education. In India, Indonesia, the Philippines, and other places, primary and secondary schools generally lack computational thinking or digital literacy training, forcing students to learn programming logic from scratch when entering university. The result is a structure of prosperity at the top and emptiness at the base: top graduates are highly sought after by multinational corporations with high salaries, while SMEs struggle to recruit even “engineers capable of debugging API parameters”, let alone develop customized models adapted to local languages or industrial needs. AI applications are therefore highly concentrated in a few sectors such as finance and e-commerce, failing to benefit groups that are more in need of technological empowerment, such as agriculture, handicrafts, or primary healthcare.

#### **3.3. Policy resource mismatch exacerbates inequality**

More alarmingly, there is a misalignment in the orientation of public policies. Driven by catch-up anxiety, some countries have overly tilted limited fiscal resources toward high-visibility projects. For example, a Southeast Asian country allocated 40% of its science and technology budget to a national large language model in 2024, while

cutting funding for digital training programs targeting farmers and micro-entrepreneurs. The outcome: a glossy AI innovation center was built in the capital, attracting international attention, while rural e-commerce stagnated due to opaque logistics information and incompatible payment systems. Similar situations are also seen in some central and western cities in China, local governments are eager to apply for AI demonstration zones, but multimedia equipment in rural schools has not been updated for years, and teachers lack basic digital teaching capabilities. This choice has inadvertently reinforced the divide between the “digital elite” and “marginalized groups”.

To clearly present this pattern, the following table compares the current situation in three countries (**Table 1**).

**Table 1.** Comparative overview of AI investment, digital readiness, and structural risks in selected developing countries

Country	AI strategy investment	Internet penetration rate	Digital skills	Main risks
India	High (\$1B AI mission)	55% (32% in rural areas)	Low	Widening urban-rural digital divide
Vietnam	Medium-high	73%	Medium	Disconnection of small and medium-sized enterprises
Nigeria	Low but growing rapidly	43%	Very low	Infrastructure gaps constraining development

In summary, advancing advanced AI without a solid foundation not only fails to deliver results but may also sacrifice the digital rights of broader groups. The real challenge is not whether a country has large language models, but whether technology can truly serve those who need it most.

#### 4. Why the “leapfrog development” narrative is misleading

“Leapfrog development” is a classic concept in development economics, referring to latecomer countries skipping traditional evolutionary stages through the adoption of new technologies to achieve rapid catch-up. The most successful case is Africa, which skipped fixed-line telephony to directly popularize mobile communications in the late 20th century, significantly improving communication accessibility. For this reason, with the rise of generative AI, many policymakers naturally wonder: can developing countries skip the traditional digitalization stage and directly embrace AI to achieve a new round of “corner overtaking”?

However, analogizing AI to mobile phones is a serious misjudgment. There are essential differences in their technological attributes: mobile phones are terminal consumer technologies that users can use simply by purchasing a device and inserting a SIM card, with minimal reliance on local infrastructure. In contrast, generative AI is a systemic production technology whose effective operation is highly dependent on a complete digital ecosystem, including high-quality structured data, stable computing power, professional talent, and adapted scenarios<sup>[9]</sup>. Without electronic medical records, AI cannot diagnose diseases; without supply chain data, AI cannot optimize inventory; without local corpora, large language models struggle to understand dialects or cultural contexts. In other words, AI is not an “off-the-shelf” product but a complex system that requires continuous feeding, debugging, and governance<sup>[10]</sup>.

Ignoring this distinction has led to practical setbacks. For example, a Latin American country spent heavily to introduce an AI medical imaging system in 2023, but due to the widespread lack of electronic medical records in public hospitals, patient information remains in paper form, the system has been long-idle due to a lack of data input, becoming an expensive ornament. Furthermore, a third-tier city in western China built an “Artificial Intelligence Industrial Park” in 2024, offering substantial subsidies to attract enterprises. However, two years

later, the occupancy rate is less than 20%. Enterprises generally report that the local area lacks AI engineers, data annotation teams, and real application scenarios, making it difficult to carry out substantive business. These cases show that even the most advanced technologies cannot take root in soil lacking basic capabilities.

A deeper problem is that the “black box” nature of AI exacerbates dependence on external technology. Unlike the past, when importing production lines allowed for gradual digestion and absorption, current Generative AI is mostly provided in the form of closed cloud services (AI-as-a-Service). Local users can neither view algorithm logic nor conduct localized fine-tuning. While this model lowers initial barriers, it locks in long-term technological dependence, weakening the autonomous decision-making capacity of developing countries in critical areas.

Therefore, blind application of the “leapfrog development” logic to promote AI deployment is not only unrealistic but may also lead to resource waste and strategic misjudgment. True technological progress does not lie in who first announces the possession of large language models, but in who can embed technology into the real socio-economic fabric. AI without infrastructure support is like a sports car without a road, even with surging power, it cannot move an inch. Developing countries urgently need to wake up from the catch-up illusion.

## **5. Policy recommendations: Building a stratified AI adoption strategy**

Faced with the generative AI boom, developing countries should abandon the fantasy of achieving everything in one step and shift to a pragmatic, incremental three-tier advancement strategy, directing limited resources precisely to links that best match their national developmental stages <sup>[11]</sup>.

### **5.1. Tier 1: Consolidate digital foundations (highest priority)**

Advanced AI must be premised on a solid digital foundation. Governments should prioritize expanding rural broadband coverage, improving power stability, and building low-cost 4G/5G base stations and distributed microgrids through public-private partnerships. At the same time, primary and secondary school curricula should integrate computational thinking and data literacy, not mandating programming, but cultivating students’ ability to understand information logic, identify data biases, and use digital tools safely. This is the foundation for safeguarding citizens’ digital rights <sup>[12]</sup>.

### **5.2. Tier 2: Promote “lightweight AI” applications**

Once basic foundations are initially in place, priority should be given to adopting lightweight solutions based on cloud APIs, avoiding the construction of expensive computing power in-house. For example: SMEs can call multilingual translation APIs to build local customer service; agricultural departments can combine satellite imagery with open-source models to warn of droughts and pests; inclusive financial institutions can use lightweight algorithms to provide microcredit to farmers without credit records. Such applications are low-cost, quick to show results, and generate high social returns, gradually fostering local AI usage habits.

### **5.3. Tier 3: Selectively deploy advanced AI**

Advanced technologies such as large language models should be limited to regions with mature talent, industrial, and data governance capabilities (e.g., Bengaluru, Shenzhen, Nairobi Tech City), adopting a localized pilot strategy. The key is to establish public-private partnership (PPP) mechanisms: enterprises are responsible for technology and operations, governments open compliant scenarios and desensitized data, and universities undertake talent training and ethical evaluation, thereby sharing risks and stimulating innovation.

#### **5.4. Tier 4: Promote inclusive global AI governance**

The international community should integrate the “development dimension” into AI rule-making, avoiding high standards that implicitly construct technological barriers. Developed countries and tech giants should open-source, low-computing models (such as the Llama and Mistral series) to the Global South, and provide supporting localized training and technical support to build a diverse, open, and shared global AI ecosystem.

#### **5.5. Aligning AI ambition with digital foundations in developing countries**

Through this stratified strategy, developing countries can both seize technological opportunities and uphold the bottom line of fair and sustainable development. Through this stratified strategy, developing countries can both seize technological opportunities and uphold the bottom line of fair and sustainable development. However, achieving this balance requires a clear recognition of existing structural constraints. In many developing countries, unstable electricity supply, weak broadband networks, and insufficient digital literacy significantly limit the effective deployment of advanced AI systems. Under such conditions, large-scale investment in cutting-edge AI technologies may not only fail to generate proportional economic returns but may also crowd out urgently needed resources for broadband expansion, education, and the digital transformation of small and medium-sized enterprises, leading to structural mismatches in development priorities <sup>[13]</sup>.

Moreover, the symbolic pursuit of technological advancement can produce fiscal inefficiencies, such as underutilized AI industrial parks or intelligent systems lacking adequate data ecosystems to function effectively. These outcomes reflect a misalignment between technological ambition and developmental readiness. At the same time, the distributional consequences of premature AI expansion warrant careful consideration. Technological dividends often accrue disproportionately to urban, highly skilled, and capital-rich groups, while rural and low-income populations risk further marginalization, thereby exacerbating existing social inequalities <sup>[14]</sup>.

Given these risks, an inclusive technology strategy becomes particularly critical. Such a strategy prioritizes the consolidation of digital foundations, reliable infrastructure, human capital development, and broad-based digital access, before gradually introducing AI applications tailored to local contexts and sectoral needs. In this sense, the value of technological progress lies not in its complexity or symbolic sophistication, but in its capacity to expand participation and generate inclusive benefits across society <sup>[15]</sup>.

### **6. Conclusion**

This paper emphasizes that the generative AI boom should not overshadow the basic reality that developing countries are still in the early stages of digitalization. Under conditions of unstable power supply, weak networks, and insufficient digital literacy, excessive investment in advanced AI will not only fail to deliver results but may also crowd out resources for more urgent areas such as broadband, education, and SME digitalization, resulting in structural mismatch. This blind pursuit of technological advancement not only leads to fiscal waste (e.g., idle AI industrial parks, intelligent systems without data support) but also exacerbates social inequality. Technological dividends are concentrated among urban elites, while rural and low-income groups are further marginalized. Therefore, this paper calls for a shift to an inclusive technology strategy: centered on human needs, prioritizing the consolidation of digital foundations, and then gradually introducing AI applications adapted to local conditions. The value of technology lies not in complexity, but in inclusivity. It should be noted that this paper is based on policy and case analysis and has not yet quantified causal relationships. Future research can combine micro-data from enterprises or households to verify the resource crowding-out effect.

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