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Building National Digital Infrastructure to Promote Digital Economic Development of Localities in Vietnam

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Abstract

Developing and constructing a synchronized and modern national digital infrastructure to support the digital economy is a prevalent development trend among many countries. Prioritizing the advancement of a robust digital infrastructure plays a crucial role in driving digital economic development at both the national and local levels. This paper analyzes the current state of Vietnam's national digital infrastructure development and its impact on promoting local digital economies. It proposes solutions to further enhance digital infrastructure development in the forthcoming period.

Keywords: Building, Digital infrastructure, Economic, Localities, Promote.

1. Introduction

The digital economy is becoming an inevitable global trend, with traditional economies increasingly affected by the Fourth Industrial Revolution. Digital technologies and novel business models have fundamentally transformed the socio-economic landscape of many countries. Digitalization is no longer a distant future but a contemporary reality, permeating almost all sectors, from commerce and payment systems to transportation, education, and healthcare. According to research conducted by the Fletcher School's Center for Global Business at Tufts University (USA), Vietnam currently ranks 48th out of 60 countries in terms of the pace of digital economic transformation while standing 22nd globally in digital development speed. These figures indicate a significant shift in the business models of Vietnamese enterprises, marking a turning point that elevates Vietnam's socio-economic landscape to a new level. Furthermore, the Economy SEA 2022 report on Southeast Asia's digital economy (Google, Temasek, & Bain & Company, 2023) highlights that Vietnam's Internet economy, measured by Gross Merchandise Value (GMV), reached USD 23 billion in 2022, representing a growth of 28% compared to 2021. Vietnam's Internet economy ranks third in Southeast Asia, followed by Indonesia with USD 77 billion and Thailand with USD 35 billion (VNA, 2024). Nevertheless, Vietnam is projected to become the fastest-growing Internet economy in the region due to the rapid expansion of e-commerce. For digital economy development, however, the role of digital infrastructure remains critical. Experts emphasize that digital infrastructure plays a fundamental role, often called the "infrastructure of infrastructures." However, it is a reality that developing digital infrastructure requires active participation from multiple economic and social stakeholders. Infrastructure systems, particularly information technology, telecommunications, data networks, electricity, and energy infrastructure, play crucial roles and form the foundational basis for ensuring sustainable growth of the digital economy. Modern, high-quality, integrated, widely interconnected, and secure telecommunication, IT, and data infrastructure, together with stable and high-quality power and energy systems, constitute essential platforms for implementing digital economic technologies and services, thereby fostering the advancement of Vietnam's digital economy. The development of digital infrastructure, serving as a foundation for digital government, digital economy, and digital society, has been clearly outlined in the documents of the 13th National Party Congress, as well as in the National Digital Transformation Program towards 2025 with an orientation to 2030 approved by the Prime Minister. In constructing digital infrastructure, it is essential to consider the following: (i) Infrastructure must be developed proactively and ahead of demand rather than reactively. Historical experiences have repeatedly demonstrated that proactively developed infrastructure creates new development opportunities and generates new demands. Roads must exist before people can travel; similarly, (ii) digital infrastructure should not be confined merely to telecommunications and the internet. Instead, it represents a complex and comprehensive ecosystem encompassing connectivity, equipment, data, applications, and technological research and development. These elements mutually support each other to ensure synchronized development. Furthermore, (iii) revolutionary advancements inherently involve uncertainties, making it impossible to anticipate all possible developments or measure impacts in isolated or short-term contexts. Therefore, digital transformation necessitates adopting a new, flexible, and holistic perspective that considers long-term implications and broader spillover effects on development (Ministry of

Information and Communications, 2023). To effectively achieve national and local digital economic development objectives, Vietnam must accelerate the establishment of its digital infrastructure in the coming period.

2. Current Situation of Digital Infrastructure Development in Vietnam in the Recent Period

Documents of the 13th National Party Congress have identified "robustly developing digital infrastructure and establishing synchronized national, regional, and local data infrastructure that is seamlessly interconnected and unified, forming a solid foundation for digital economic and social development" as a priority direction in infrastructure development to foster Vietnam's digital economy. This effort aims to achieve the target set by the Prime Minister in Decision No. 749/QĐ-TTg dated June 3, 2020, approving the "National Digital Transformation Program towards 2025 with orientation to 2030," specifically to have the digital economy contribute 20% of Gross Domestic Product (GDP) by 2025 and approximately 30% by 2030.

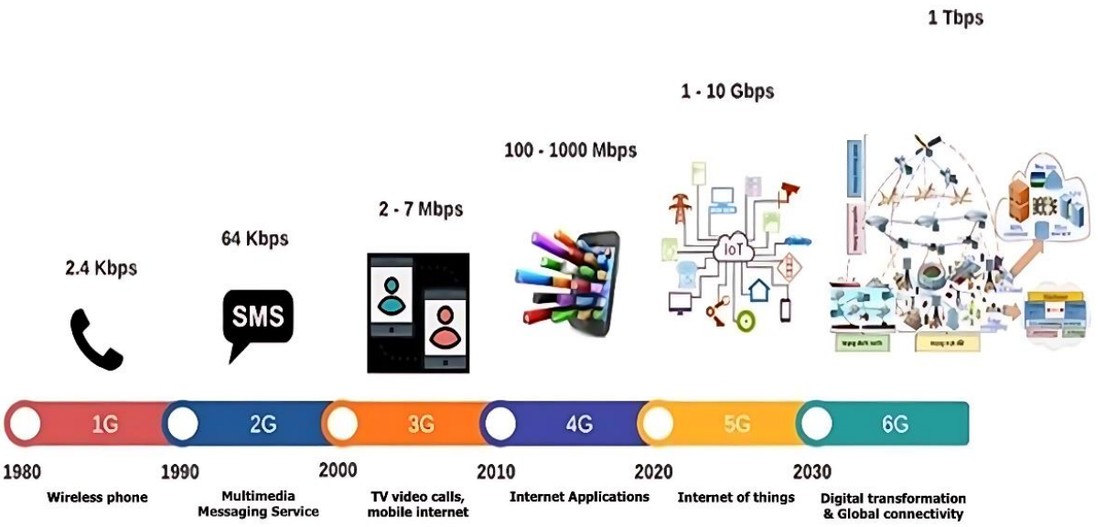

Figure 1.
Forecast of telecommunications infrastructure development to 2030.
Source: Ministry of Information and Communications (2022).

Regarding the digital infrastructure of several centrally governed cities, Da Nang consistently held the top position during the 2018–2020 period. However, according to the Digital Transformation Index (DTI) rankings 2022, recently published by the Ministry of Information and Communications, Ho Chi Minh City has advanced to the top position regarding digital infrastructure and digital institutional frameworks.

Table 1. Digital infrastructure of centrally governed cities.

City	Indicator				Rank		
	Technical infrastructure	Human infrastructure	Application index	ICT index	2018 Rank	2019 Rank	2020 Rank
Da Nang	0.79	0.99	1	0.92	1	1	1
Can Tho	0.57	1	0.48	0.68	4	10	14
Ho Chi Minh City	0.69	0.84	0.23	0.58	5	7	2
Hanoi	0.59	0.72	0.4	0.56	6	8	3
Hai Phong	0.34	0.52	0.18	0.34	45	43	29

Source: Ministry of Information and Communications (MIC) and calculations by the authors.

Many localities across Vietnam have issued plans for digital infrastructure development with the following objectives: (i) to establish broadband, ultra-broadband, universal, secure, sustainable, and open digital infrastructure (including broadband telecommunications infrastructure, data center and cloud computing infrastructure, digital technology infrastructure, and digital platforms serving infrastructural roles). This infrastructure aims to meet communication requirements for the leadership, direction, and management activities of Party committees and governmental authorities at all levels; to satisfy the communication and entertainment needs of the public; and to be ready to address connectivity, data processing, and network security demands; (ii) to develop digital infrastructure that supports the advancement of digital government, digital economy, and digital society at the provincial level. This includes improving the quality of 4G networks, gradually deploying 5G networks, and universalizing broadband Internet, particularly in mountainous, remote, isolated, and socio-economically disadvantaged regions. Additionally, there is a clear shift from essential telecommunications services towards information technology and communication services promoting digital infrastructure development. Binh Duong is among the localities that have promulgated a digital infrastructure development plan for 2025.

Cloud Computing Infrastructure: Currently, Vietnam has three main groups of cloud infrastructure providers: foreign enterprises (e.g., Google, Microsoft), large-scale domestic enterprises with comprehensive investments (Viettel, VNPT, CMC, FPT), and smaller enterprises providing specialized applications or services. According to reports by ResearchMarket and TechSCI, Vietnam's cloud computing market was valued at approximately USD 200 million (VND 4,600 billion) by the end of 2020. However, Vietnamese enterprises hold only about 20% of the domestic cloud computing market share (equivalent to over VND 900 billion). The remaining 80% is dominated by foreign providers such as Google, AWS, and Microsoft Azure (Ministry of Information and Communications, 2023).

Information and Communication Technology (ICT) Infrastructure: ICT infrastructure is a decisive factor influencing the ability to transform and extend digital service applications into traditional economic activities. According to a report by the Commonwealth Scientific and Industrial Research Organisation (CSIRO, 2019), Vietnam possesses advantages in several ICT infrastructure areas, particularly regarding 5G networks, internet penetration, and smartphone adoption. The 5G network is considered a new-generation technology that ushers in unprecedented connectivity and technological advancement. Offering significantly greater capacity and speed, 5G fosters unattainable innovation with the previous 4G LTE standards. Vietnam was among the first countries to conduct 5G trials beginning in 2020. The country's three major telecommunications providers—Viettel, Vinaphone, and Mobifone—have implemented 5G networks in Hanoi, Ho Chi Minh City, and several provinces and cities. Alongside high-speed internet, affordable internet costs are favorable for developing digital platforms, especially in lower-middle-income countries such as Vietnam (Ministry of Information and Communications, 2022).

3. Development of Key National Internet Infrastructure

Vietnam Internet Network Information Center (VNNIC) has implemented Anycast and IPv6 technologies for the national Domain Name System (DNS). Regarding the national Internet exchange point, in the early 2000s, Vietnam's Internet infrastructure was still in the early stages of development, with high access costs and network quality insufficient to meet user demands. A primary reason for this was the high cost of international connection channels, compounded by domestic internet enterprises' inability to directly interconnect. Therefore, in 2003, the Ministry of Posts and Telecommunications—now known as the Ministry of Information and Communications—established the Vietnam National Internet Exchange (VNIX), assigning its direct management and operation to VNNIC, following the principles of neutrality and non-profitability.

Over nearly 20 years of establishment and development, VNIX has significantly contributed to Vietnam's Internet growth, connecting various enterprises, reducing costs, and optimizing service quality and national internet infrastructure security. VNIX membership has expanded to include organizations holding IP/ASN allocations managed and assigned by VNNIC, and it supports bilateral and multilateral peering policies. As of 2019, VNIX had 21 member organizations, including key entities such as the Vietnam Internet Network Information Center, FPT Telecom Joint Stock Company, CMC Telecom Infrastructure Joint Stock Company, MobiFone Telecommunications Corporation, and Saigon Tourist Cable Television Company. VNIX provides fundamental benefits including streamlined connectivity, cost savings for members, improved network service quality, and enhanced safety through backup and incident response measures.

Vietnam has accumulated nearly two decades of Internet infrastructure development, resulting in relatively modern infrastructure compared to ASEAN and international standards, adequately supporting electronic transactions on the internet. Particularly noteworthy is the growing investment in wireless and satellite-based connectivity systems in recent years, a trend expected to continue, aligning with overall socio-economic development demands, especially those related to Vietnam's digital economy (Ministry of Information and Communications, 2023).

Thus, establishing digital infrastructure and innovating digital applications to develop the digital economy—creating new drivers for economic growth and labor productivity—is critically important. The degree, pace, and effectiveness of digital government, digital economy, and digital society development significantly depend on digital infrastructure advancement. Recently, the government, ministries, sectors, and local authorities have prioritized and actively promoted digital infrastructure development, achieving noteworthy outcomes. However, building digital infrastructure requires continuous investment, comprehensive development, synchronization, and modernization to address practical needs and readiness for achieving Vietnam's digital economy development objectives.

4. Contribution of Digital Economy to GDP in Selected Vietnamese Localities

Vietnam has quickly grasped emerging technology trends and proactively developed strategic directions and solutions to participate in the Fourth Industrial Revolution and transition to a digital economy. Resolution No. 52/NQ-TW identified digital economy development as one of Vietnam's three key priorities, setting a goal that by 2025, the digital economy would account for approximately 20% of GDP, with labor productivity increasing by an average of over 7% per year, and by 2030, the digital economy would surpass 30% of GDP.

The Vietnam Digital Economy Report 2023 presented measurements and rankings of the digital economy's proportion within the GDP for all 63 provinces and cities nationwide. The findings clearly distinguished between the share of the digital economy attributed to information and communication technology (ICT) and that attributed to sectors beyond ICT, providing a comprehensive perspective on the state of the digital economy at the local level. Results indicated that the share of ICT-driven activities largely influences the digital economy's contribution to each locality's GDP.

Localities with high ICT-driven digital economy proportions can be divided into two groups. The first group comprises provinces with substantial contributions from hardware processing, manufacturing, and electronic and optical component production. This group exhibits very high ICT-driven economic proportions, driven by both domestic and foreign enterprises located in industrial zones. However, their digital economy proportions remain relatively low; typical provinces include Bac Ninh, Thai Nguyen, and Bac Giang.

The second group includes provinces and cities with highly developed service sectors, characterized by significant contributions from ICT-related services and digital content within their local economies. These localities generally exhibit relatively high GDP levels and serve as national economic centers, such as Hanoi, Ho Chi Minh City, and Binh Duong Province. Geographically, provinces with high ICT digital economy proportions are predominantly located in Northern Vietnam, specifically within the Red River Delta and the Northern Midlands and Mountainous region.

Meanwhile, localities demonstrating high shares of non-ICT digital economy sectors are primarily those with strengths in services and tourism, concentrated mainly in the North Central Coast and Central Coast regions, or in

manufacturing and processing industries prevalent in the Mekong Delta (Posts and Telecommunications Institute of Technology, 2023).

Table 2. Contribution of the Digital Economy to GDP in selected localities of Vietnam, 2022.

Locality	ICT-driven Digital Economy as % of GRDP	Non-ICT Digital Economy as % of GRDP	Total Digital Economy as % of GRDP	Digital Economy Ranking
Việt Nam	9.02	5.24	14.26	
Bac Ninh	53.70	3.12	56.83	1
Thai Nguyen	38.73	4.20	42.92	2
Bac Giang	37.31	4.82	42.13	3
Hai Phong	24.50	4.99	29.48	4
Vinh Phuc	19.46	3.40	22.87	5
Đa Nang	8.86	10.90	19.76	6
Ho Chi Minh city	8.56	10.10	18.66	7
Hanoi	11.79	5.36	17.15	8
Phu Tho	8.21	7.22	15.43	9
Ha Nam	11.00	3.50	14.51	10
Binh Dương	7.41	3.92	11.34	14

Source: Posts and Telecommunications Institute of Technology (PTIT) (2023).

The provinces and cities in Northern Vietnam generally exhibit high levels of digital economy spillover effects within sectors such as electricity, gas, hot water, steam, and air conditioning production and distribution. Meanwhile, provinces and cities in the Red River Delta show strong digital economy spillovers primarily in service sectors, notably finance, banking and insurance, healthcare and social assistance, arts, entertainment, and recreation. This characteristic resembles the service-oriented provinces in the Central Coast and Southeast regions.

Bac Ninh leads the list with the highest proportion of digital economy in GDP, at 56.83%, primarily driven by an exceptionally high ICT digital economy share of 53.70%. However, its non-ICT digital economy proportion is relatively modest at 3.12%. Provinces and cities occupy the remaining top five positions with the highest ICT digital economy proportions nationwide, notably hosting significant industrial zones specializing in high-tech manufacturing.

Da Nang records the highest proportion of non-ICT digital economy among all localities. The total digital economy proportion in Da Nang's GRDP stands at 19.76%, ranking sixth nationwide. Ho Chi Minh City and Hanoi occupy seventh and eighth positions, respectively, with total digital economy proportions of 18.66% and 17.15%. Although Ho Chi Minh City has a slightly lower ICT proportion than Hanoi (8.56% compared to 11.79%), its non-ICT digital economy proportion is considerably higher (10.10% compared to Hanoi's 5.36%). Phu Tho and Ha Nam provinces rank ninth and tenth, with digital economy shares in their GRDP at 15.43% and 14.51%, respectively.

Provinces in the Central Highlands and Mekong Delta regions exhibit relatively high non-ICT digital economy proportions but lower ICT proportions. The provinces with the lowest digital economy proportions are spread from the Central region to the Mekong Delta, with ICT digital economy proportions of around 2% and non-ICT proportions ranging from 2% to 4%. Ba Ria-Vung Tau province is a unique case due to the substantial contribution of the oil and gas industry to its total GRDP, ranking fifth nationally in overall GRDP. Due to the unique nature of its mining sector, the mining industry was excluded from Ba Ria-Vung Tau's GRDP calculations (GRDP*) to assess its digital economy proportion more accurately. Despite having the lowest ICT digital economy proportion, Ba Ria-Vung Tau's non-ICT digital economy share is relatively high at 5.62%, ranking twelfth nationwide.

Seven provinces and cities exceed the national average for ICT digital economy proportions, eighteen localities surpass the national average for non-ICT digital economy proportions, and eleven have overall digital economy proportions above the national average. This indicates uneven digital economy contributions across the country, with economic activity concentrated primarily in major economic hubs. Nonetheless, the high proportion of the non-ICT digital economy across many provinces and cities indicates active engagement in technological adoption and digital transformation within local production activities.

Given limitations in human resources, infrastructure, and social awareness, achieving the 2025 target of the digital economy accounting for 20% of GDP and developing a robust digital technology enterprise community remains challenging for Vietnam. Lessons drawn from international trends suggest several critical steps for Vietnam. The government must adopt flexible management policies to liberate enterprises from restrictive regulations. Strategic investments in technology infrastructure, particularly 5G and 6G networks, are essential, demanding focused and synchronized efforts to avoid scattered and inefficient investment outcomes. Both public and private sectors should invest significantly in upgrading digital technical infrastructure and advanced digital technologies to facilitate innovative connectivity applications, especially cashless payment systems and enhanced e-government efficiency. These represent essential foundations for online activities. Based on robust telecommunications infrastructure, Vietnam should prioritize building national and specialized databases alongside developing cybersecurity measures to ensure information security in cyberspace.

5. Solutions for Developing Digital Infrastructure to Promote Local Digital Economies

Developing Vietnam's digital infrastructure to transform the digital economy into a key driver for economic growth, contributing to the country's achievement of upper-middle-income status by 2030 and high-income status by 2045, is essential. To effectively and rapidly develop national digital infrastructure, the following solutions should be implemented:

Firstly, it amends and elevates national technical standards and regulations regarding broadband service quality to match those of developed countries. Establish national technical standards for digital technologies such

as AI, blockchain, and IoT. Develop IoT-specific national technical standards for healthcare, education, industry, agriculture, transportation, energy, electricity, water, and smart cities, emphasizing enhanced security and safety for IoT applications. Establish criteria to evaluate local and national digital infrastructure development, aligned with international evaluation standards. Implement measurement, monitoring, evaluation, and regulatory management systems for telecommunications infrastructure, data centers, cloud computing infrastructure, digital technology infrastructure, and digital platforms. Issue a set of digital infrastructure management, monitoring, and evaluation criteria. Conduct annual surveys, data collection, and publication of statistical results to measure and monitor the achievement of infrastructure development objectives at national and local levels.

Secondly, issue decrees guiding amendments to the Telecommunications Law, expanding management scope, resolving difficulties, and fostering conditions for broadband telecommunications and cloud computing infrastructure development. Elevate standards and regulations on network equipment, service quality, and user experience for digital services. Amend the Law on Radio Frequency to clearly regulate frequency resource allocation methods for developing 5G and subsequent mobile networks to serve diverse economic sectors. Develop a Digital Technology Industry Law to create a controlled sandbox regulatory environment, enabling trials and application of new technologies and digital infrastructure components. Consider adding digital infrastructure construction to the list of specially incentivized sectors under the Investment Law to attract private investment. Provinces and cities should ensure regional and provincial plans incorporate strategies for managing and promoting digital infrastructure development, prioritizing broadband infrastructure, data centers, Internet exchange points, and international connectivity stations.

Thirdly, refine policies ensuring industry, regional, and provincial planning readiness for digital infrastructure development, prioritizing spaces and facilitating broadband infrastructure development, data centers, Internet exchange points, and international connectivity landing stations. Permit digital infrastructure development on public land and share the use of infrastructure with other sectors. Establish national and regional data centers integrated with electricity infrastructure, undersea fiber optic cables, landing stations, domestic backbone fiber optic networks, and Internet exchange points. Research and formulate frequency spectrum planning and allocation strategies to fully meet broadband mobile communication (4G, 5G, and subsequent generations) and IoT infrastructure development needs.

Fourthly, investments should be significantly increased, and high-speed fixed broadband infrastructure (Gbps) should be developed by promoting public-private partnerships (PPP) to mobilize private sector resources under balanced benefit and risk-sharing principles among the government, investors, and citizens. Develop a roadmap for phasing out obsolete technologies to free frequency resources for new technologies (4G, 5G, and future generations), reducing operational costs for businesses and supporting broadband service universalization. Encourage enterprises to establish virtual mobile telecommunications networks (MVNOs). Efficiently utilize Vietnam's Public Telecommunications Service Fund funding to support universalizing fixed and mobile broadband services in public benefit areas.

Fifthly, policies should be developed promoting cloud computing adoption among governmental agencies, organizations, enterprises, and citizens, prioritizing cloud services provided by Vietnamese enterprises within IT application projects. This strategy aims to stimulate widespread cloud computing adoption and set standards for integrating cloud computing and IoT infrastructure within key economic sectors, including healthcare, education, industry, agriculture, transportation, energy, electricity, water, and smart cities.

6. Conclusion

The development of national digital infrastructure is pivotal in driving the growth of the digital economy at both national and local levels in Vietnam. The research highlights the significant progress Vietnam has made, especially regarding telecommunications, ICT infrastructure, cloud computing, and Internet network advancements. Notably, regions such as Bac Ninh, Thai Nguyen, and Ho Chi Minh City demonstrate substantial contributions to the digital economy, primarily through ICT and service-oriented sectors. However, disparities remain evident across various localities, emphasizing the need for balanced, inclusive, and sustainable digital infrastructure growth.

To achieve Vietnam's ambitious goals of the digital economy contributing significantly to GDP by 2025 and 2030, targeted and strategic actions must be undertaken. The research proposes enhancing national standards, refining legislative frameworks, encouraging public-private partnerships, and promoting widespread adoption of emerging technologies like cloud computing, IoT, and 5G networks. Continuous investment, synchronized development across sectors, and proactive policy-making are critical. By addressing these strategic areas, Vietnam can ensure a robust digital infrastructure foundation, unlocking substantial economic potential and positioning itself favorably in the global digital economy landscape.

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