

Impacting Information Technology and Telecommunications Infrastructure on the Digital Economy

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Abstract

Digital technologies such as Artificial Intelligence, Big Data, and the Internet of Things are developing at breakneck speed, creating a solid wave of digital transformation globally. The digital economy is increasingly asserting its role as a new growth driver. Therefore, the study's objective is to explore the critical factors influencing the digital economy and propose policy recommendations for enhancing the digital economy. The study applies quantitative research methods, mainly through actual data surveying of economic experts, to evaluate factors affecting the digital economy. The authors used the structural equation model to measure the impact of factors on the digital economy in five big cities in Vietnam. The data collection strategy involves direct interviews via a structured questionnaire with a sample size of 800 economic experts and analysis using SPSS version 20.0 and Amos software. The finding identifies eight critical factors influencing the digital economy at a significant level of 0.01 and eight accepted hypotheses. The study's novelty contribution highlights the considerable influence of information technology and telecommunications infrastructure on Vietnam's digital economy. Finally, the authors proposed policy recommendations to enhance the digital economy; moreover, this model can be used in each locality or the whole country in researching and evaluating the impact of factors on the digital economy. Moreover, digital transformation has become a global trend, and digital recommendations will be applied to better manage environmental issues toward green growth and sustainable development.

Keywords:

Digital;
Technology;
Policy Recommendation;
Sustainable;
Digital Economy.

Article History:

Received:	02	December	2024
Revised:	13	February	2025
Accepted:	05	March	2025
Published:	01	April	2025

1- Introduction

From a broad perspective, the digital economy influences four main areas: (1) the expansion of e-commerce; (2) the increase in Internet users; (3) the development of digital goods and services; and (4) the enhancement of transparency—a key advantage of the digital economy that helps reduce corruption by enabling online, transparent activities and supporting effective economic control [1, 2]. Among its most notable effects are reductions in transaction costs, particularly those related to time and finances; diminished information asymmetry leading to more efficient supply-demand matching; improved production efficiency through automation, which shortens production cycles and enhances quality and reliability; and the elimination of intermediary layers, allowing direct links between supply and demand via digital platforms that boost productivity and operational efficiency [2–4].

Of these impacts, the most evident is the digital economy's role in enhancing transparency, which is seen in two key ways. First, it helps reduce manipulation, fraud, and achievement-driven biases in certain administrative sectors, particularly where the objectivity of data—such as accounting and statistical information—is concerned [3, 5]. Second,

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DOI: <http://dx.doi.org/10.28991/ESJ-2025-09-02-026>

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the digital economy provides tools to detect and monitor corruption and bribery, as digital information is processed by computers and transmitted directly from the grassroots level to centralized processing and oversight institutions. This helps prevent undue influence and manipulation at intermediate levels of data synthesis.

Despite these benefits, the contribution of the digital economy to the national gross domestic product (GDP) has declined since 2022. This decline is primarily attributed to a decrease in the production of computers, electronic, and optical products—industries that account for more than 30% of the digital economy's added value—due to reduced global demand, which has affected both output and exports [4–6]. Nonetheless, the value-added from service sectors that utilize information technology in production, business, management, and operations has shown an upward trend.

According to the content provided by the General Statistics Office of Vietnam, the digital economy includes core digital economic sectors and the digitalization of other sectors. According to this content, in 2023, the core digital economic sector will reach 7.42%, accounting for 60.19% of the total proportion of the entire digital economy. Digitalization of other sectors will reach 4.91%, accounting for 39.81%. Thus, the core digital economic sector accounts for one and a half times higher proportion than the digitalization of the remaining sectors. Some industries with high average added value in 2020-2023 are wholesale and retail trade account for about 13% of the total added value of the digital economy. Production and distribution of electricity, gas, hot water, steam, and air conditioning account for an estimated 4%. Production of prefabricated metal products accounts for about 2%. Radio and television broadcasting accounts for about 2% of the total, and financial services account for about 2%.

Based on the above-mentioned studies, the authors identified gaps in the literature based on insufficient comprehensive studies on factor integration: (1) Most studies focus on specific factors influencing the digital economy but fail to examine how multiple factors interact holistically. (2) Lack of integrated models that measure the simultaneous impact of multiple critical factors on the digital economy. (3) Limited regional context in digital economy research: while global trends are widely explored, limited research addresses Vietnam's specific context of digital economy development. (4) Insufficient region-specific studies that tailor findings and policy recommendations for Vietnam or similar developing economies. (5) Lack of empirical testing in comprehensive models based on previous works fails to rigorously test the impacts of identified variables using advanced quantitative methods like structural equation modeling. Therefore, the authors develop and empirically test a model combining eight critical factors: digital transformation capacity, policies, human resources, consumer behavior, fintech, market, and integration. The authors use structural equation modeling to identify these factors' hierarchical significance and interdependence. Vietnam-specific contextual analysis based on conducting regional case studies in Vietnam's top five cities to address unique challenges and opportunities for digital economy growth. Highlight policy and infrastructural differences between urban and rural regions.

Quantitative and qualitative validation based on utilizing mixed-methods research based on qualitative interviews and quantitative SEM analysis to ensure robustness and reliability. As mentioned below, test hypotheses with large-scale survey experts and confirm the results with a bootstrap approach. Finally, the authors combine regional specificity and advanced quantitative validation; this approach will provide a more comprehensive understanding of the digital economy. It ensures practical policy implications for Vietnam and other developing economies striving for sustainable digital transformation. Therefore, the study determines critical factors affecting the digital economy and provides policy implications for the short- and long-term digital economy.

The article follows this format to give readers a clear outline: (1) The authors formulate the study's hypotheses after reviewing relevant theoretical and empirical works on the digital economy. (2) The authors describe the research process step by step, including the quantitative and qualitative parts, how to choose a sample, and how to analyze the results. (3) The authors give the study's outcomes, which include SEM results, descriptive statistics, and reliability testing. (4) The authors review the main points, what they mean, and how they add to the existing body of knowledge. The authors conclude the study by outlining its shortcomings, future research directions, and policy recommendations to improve the digital economy.

2- Literature Empirical Review and Hypothesis Development

2-1-Digital Economy (DE)

A term that describes economic activity that relies primarily on digital technology and the Internet is the digital economy. The old economic paradigm is giving way to a new one that relies on digital production, distribution, and consumption made possible by technological advances [6, 7]. The digital economy includes e-commerce, digital finance, online services, and Industry 4.0, where businesses apply advanced technology to improve performance and enhance competitiveness. It also opens up many new opportunities for businesses and consumers, from reducing transaction costs and increasing access to international markets to creating innovative business models [7, 8]. An essential element of the digital economy is big data, artificial intelligence (AI), blockchain, and cloud technology, helping businesses optimize operations and provide personalized solutions and humanization for customers. The

digital economy facilitates business development and improves people's quality of life through digital applications and services in many fields, such as health, education, and entertainment [9, 10]. The digital economy creates many opportunities for global economic development but poses challenges in management, security, and digital disparities between countries.

2-2- Information Technology and Digital Infrastructure (IT)

Information technology uses computer systems, networks, software, and other devices to process, store, and transmit information. In the context of the digital economy, IT plays a crucial role in data management: Collecting, storing, and analyzing Big Data to support business decision-making and process optimization [1, 11, 12]. Media and communication: IT allows the rapid transmission of information through email, social networks, mobile applications, and digital media channels. Process automation: Software systems help automate many business processes, from human resource management to supply chain management. Information security: Cyber and data security are essential parts of IT, helping protect personal information and business digital assets [3, 13, 14]. Digital infrastructure is the technical foundation for deploying digital services and applications [15, 16]. Thus, the authors gave hypothesis H1 below:

H1: *Information technology and digital infrastructure affect the digital economy.*

2-3- Digital Transformation Capacity in Businesses (DT)

Enterprise digital transformation capability is an organization's ability to apply digital technologies and integrate them into business operations to improve performance, create new value, and compete more effectively in the context of the digital economy [2, 17, 18]. This capability is based on technology and includes human, process, and strategic elements. Enterprise capacity greatly influences the digital economy in the following ways: Businesses with strong capabilities can create better products and services, attract more customers, and compete better in the digital market [19, 20, 21]. Enterprise capabilities help optimize production and business processes, reduce costs, and increase performance and profits [22]. Thus, the authors gave hypothesis H2.

H2: *Digital transformation capacity in businesses affects the digital economy.*

2-4- Government Policies and Laws (GP)

Laws and government policies play a vital role in regulating, promoting, and protecting economic and social activities, managing the digital transformation process, and developing the digital economy. They create a stable and transparent legal and policy environment so businesses, individuals, and organizations can sustainably operate and grow [4, 23, 24]. Law is essential in regulating digital economic activities and creating a legal framework for sustainable development. Key areas where the law has an important role include protecting intellectual property rights [8, 25, 26]. In the digital economy, protecting intellectual property rights is very important to encourage creativity and innovation. Copyright, patent, and trademark laws help protect digital products and services from infringement and illegal copying [27, 28]. Cybersecurity and information security by cybersecurity legal regulations help protect personal data and business information from cyberattacks, fraud, and privacy violations [5, 29]. These laws also stipulate the responsibilities of businesses in safeguarding information and protecting consumer rights. Thus, the authors gave hypothesis H3 the following:

H3: *Government policies and laws affect the digital economy.*

2-5- Human Resources (HR)

Human resources are essential and indispensable in developing any organization, business, or economy. It refers to an organization's entire workforce, country, or economy, including people's knowledge, skills, experience, and abilities in performing work and contributing to general development [30, 31]. Human resources are decisive in enhancing labor productivity, improving organizational performance, and contributing to economic growth [6, 32]. Some important roles of human resources include promoting innovation and creativity [33, 34]. Competent employees with innovative and creative thinking will help organizations develop new products and services, improve processes, and create competitive advantages. Thus, the authors proposed the final hypothesis H4 as follows:

H4: *Human resources affect the digital economy.*

2-6- Digital Consumer Needs and Behavior (DC)

Digital consumer behavior and needs are changes in how consumers access, shop, and consume products and services through digital platforms. The rise of technology and the Internet has created a new shopping and consumption environment where consumers increasingly rely on digital solutions to meet their needs [7, 35, 36]. Digital consumer behavior reflects how consumers interact with digital platforms and tools to find information, shop, and consume

products or services [9, 37]. Some key characteristics of digital consumer behavior include searching for information online: Consumers often search for information about products and services through search engines, social networks, and e-commerce websites [12, 38, 39]. User reviews, blog posts, and how-to videos are essential sources of reference before purchasing. Thus, the authors gave hypothesis H5 the following:

H5: *Digital consumer needs and behavior affect the digital economy.*

2-7- E-commerce and Financial Technology (EF)

Financial technology (Fintech) and e-commerce are two fields that are growing strongly in the digital age and playing an essential role in changing how consumers, businesses, and organizations interact with each other and the market [10, 40, 41]. Both sectors use technology to create new solutions, improving performance, convenience, and user experience. Financial technology, or fintech, combines finance and technology, creating innovative financial products and services through information and telecommunications technology [9, 42, 43]. Fintech has changed how individuals and businesses use financial management, payments, and loans. Main fields of fintech based on digital payment: This is the fastest-growing field in fintech, including e-wallets, mobile payments, and contactless payment systems. Platforms like PayPal, MoMo, ZaloPay, and Apple Pay have changed how consumers pay online and in brick-and-mortar stores [44, 45]. Thus, the authors gave hypothesis H6 the following:

H6: *E-commerce and financial technology affect the digital economy.*

2-8- International Economic Integration (IE)

International economic integration is the process by which countries increase cooperation and linkages in economic, trade, and financial activities to develop the economy and increase the exchange of goods, services, and capital flows [15, 46, 47]. International economic integration contributes to creating a unified global market where countries are economically interdependent while expanding their development capabilities and improving their competitiveness in the international arena [17, 48]. International economic integration occurs at many levels, from strengthening economic cooperation between countries to forming closely linked economic regions [11, 49]. There are various levels of integration, including, at its most fundamental level, a free trade area and an economic union in which all member nations have committed to do away with trade barriers and tariffs. Thus, the authors gave hypothesis H7 the following:

H7: *International economic integration affects the digital economy.*

2-9- Market (MA)

The large market for digital economic development refers to the opportunities and potential for economic development by applying digital technologies on a global scale. In digital solid transformation, exploiting this market promotes economic growth and brings social and technical benefits to countries and businesses [19, 50, 51]. The digital economy market offers many potential opportunities for governments and companies, especially in the following areas based on expanding consumer markets. The digital economy allows firms to access international markets without being limited by geography [21, 27, 52, 53]. This is especially important for small and medium-sized enterprises (SMEs), helping them compete with large businesses globally. Enhance production efficiency: Applying digital technology such as artificial intelligence, robotic automation, and data analysis helps increase production efficiency and reduce costs. This creates a competitive advantage in producing high-quality, low-cost goods and services. Thus, the authors gave hypothesis H8 the following:

H8: *Market affects the digital economy.*

When we talk about an economy that relies heavily on digital technology, particularly online transactions, we're talking about the digital economy, which is a crucial part of the socio-economic system. The digital economy refers to any industry that uses digital tools. When looking at the big picture, it's clear that the digital economy has done wonders for Vietnam's economic growth and for bringing Vietnamese companies into the global technological network. In light of this, it is critical to assess the state of the digital economy and provide suitable policy suggestions to help Vietnam's economy thrive in this era of globalization. Based on the review of relevant local and international research initiatives, the authors reveal a dearth of studies examining the influence of variables on the digital economy. The authors have put forth a particular study model in Figure 1.

Figure 1 shows eight independent factors influencing the digital economy in Vietnam: (1) Information technology and digital infrastructure (IT), (2) Digital transformation capacity in businesses (DT), (3) Government policies and laws (GP), (4) Human resources (HR), (5) Digital consumer needs and behavior (DC), (6) E-commerce and financial technology (EF), (7) International economic integration (IE), and (8) Market (MA). Besides, Figure 1 also shows that the dependent factor is the digital economy (DE).

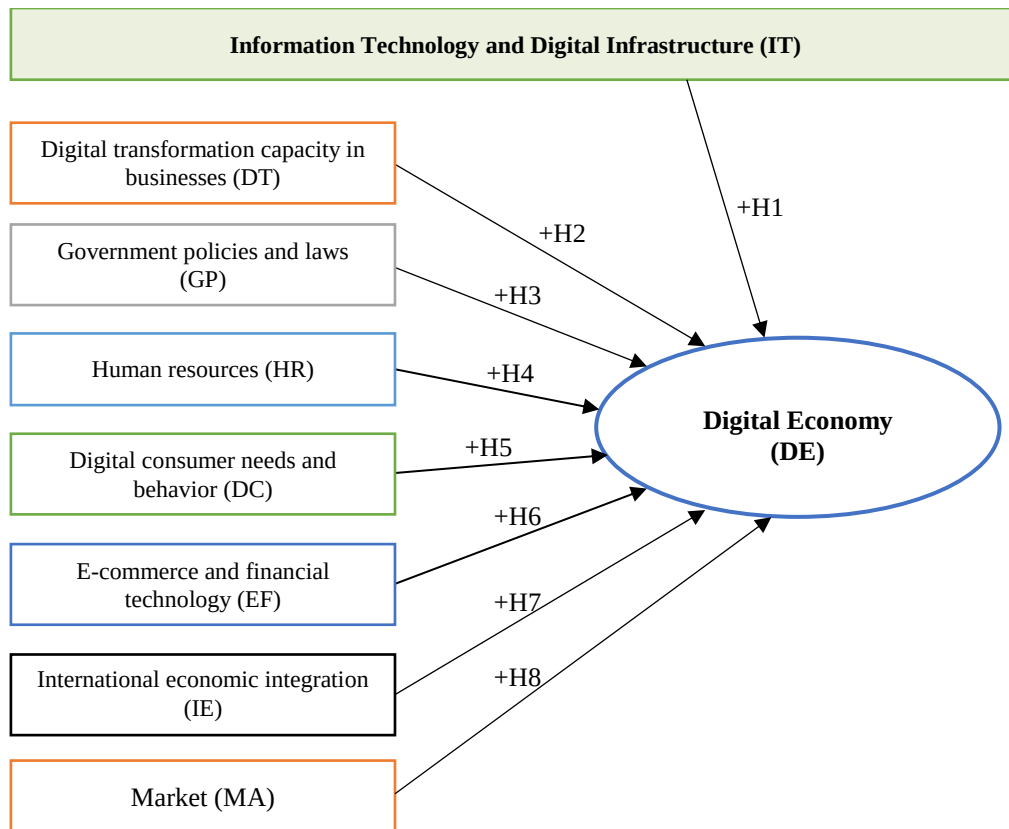


Figure 1. A research model for critical factors affecting the digital economy

3- Research Methodology

This research consists of three phases: (1) conducting qualitative research, (2) quantitative (preliminary) research, and (3) formal quantitative research. Qualitative research is conducted through an in-depth interview to establish the scales and research hypotheses in Figure 1. Before getting data, all participants consented to engage in this study after receiving comprehensive information regarding the research objectives, methodologies, and possible consequences. Written consent for participation was acquired. Participants provided written consent by signing a document that outlined the study's purpose, their rights, and confidentiality assurances. All participants consented to engage and reply to the author's inquiries in Table A1 for research questionnaires (Appendix I). Besides, questionnaires had ethics approval from the Faculty of Postgraduate Studies at Lac Hong University (LHU), Vietnam (<https://lhu.edu.vn/244/Khoa-Sau-dai-hoc.html>). To examine essential elements impacting Vietnam's digital economy, this study takes a structured mixed-methods approach, combining qualitative and quantitative methodology. This three-stage process permits empirical confirmation through quantitative analysis while simultaneously assuring conceptual depth through means of qualitative, as follows in Figure 2:

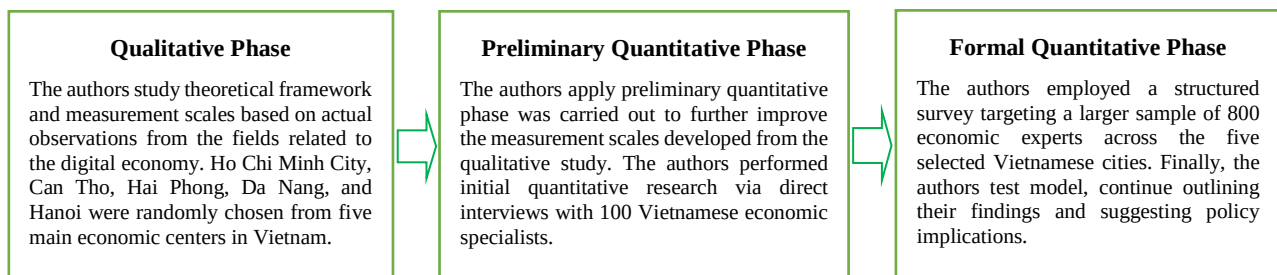


Figure 2. A research process for critical factors affecting the digital economy

3-1- Qualitative Phase

The goal of the qualitative phase was to establish some basic theoretical framework and measurement scales based on actual observations from the field. Ho Chi Minh City, Can Tho, Hai Phong, Da Nang, and Hanoi were randomly chosen from five main economic centers in Vietnam, and thirty economic experts and nine company managers were interviewed in depth during this phase. Participants were selected for their extensive background in digital economic transformation, allowing them to aid in the creation of a conceptual framework that applies to the given situation. The

semi-structured interviews employed open-ended questions to uncover essential factors and relationship hypotheses in digital economics. We developed certain conceptions and theories based on the systematic coding and thematic analysis of interview data, which revealed repeating patterns and insights. Along with helping with the original design of measurement scales, this iterative approach ensured that these constructions aligned with the local economic environment and the specific dynamics of digital change.

This phase uses accurate information and data to evaluate the development of the digital economy in Vietnam, as well as information and data. Primary data through the use of econometric models to calculate the impact of factors on the digital economy. Thereby, the study compares, compares, verifies, and draws research results. Therefore, the authors proposed the research and development process of the ranking executed through the steps:

Step 1: The authors must identify the study problem and conceptual framework grounded in a theory of digital economy based on an overview and systematization of the theory on factors affecting the digital economy [54]. In step 1, the study conducted three analyses: (1) Provide a theoretical framework for examining concepts associated with the digital economy; (2) Analyze the interconnections among the concepts within the research model; (3) Develop a preliminary scale for the research concepts, precisely the scale of factors influencing the digital economy.

Step 2: The authors propose to develop conceptual measurements via empirical research and group discussions with nine corporate managers from various cities and provinces in Vietnam pertinent to the digital economy, including Ho Chi Minh City, Can Tho, Hai Phong, Da Nang, and Hanoi. Simultaneously, the authors conducted interviews and group discussions with 30 economic experts to obtain recommendations regarding the magnitude of the digital economy based on practical experience with digital economic development policies in Vietnam.

Step 3: This phase has two distinct tasks: (1) Modify and enhance the scale of scaled notions; (2) Develop a collection of variables on a new scale for inclusion in the model. The initial study will modify and enhance the original scales via focus group discussions. Focus group interviews were performed, and multiple groups were established and interviewed. The outcome of this stage is the modification of the absolute scale, referred to as the changeable scale, based on the results of 30 economic experts' qualitative analysis of the impact of factors on the digital economy. These methods are used to interrogate and test arguments, analyze them, and evaluate them through experts. The experts' experiences and suggestions will benefit the author in building an econometric model and developing policy implications.

3-2- Preliminary Quantitative Phase

A preliminary quantitative phase was carried out to further improve the measurement scales developed from the qualitative study. During this stage, a sample of one hundred economic specialists from large cities was chosen randomly to guarantee they were well-versed in digital economics. First and foremost, we wanted to use quantitative testing to confirm the notions and see how reliable the scales were. Reliability testing was carried out using Cronbach's Alpha to determine internal consistency. The dimensionality and factor loadings of the constructs were examined using exploratory factor analysis (EFA). It was essential to find any problems with the scales during this preliminary phase so that we could fix them before the primary survey. The results of this stage helped improve the survey tool so that it was more consistent with theoretical predictions and had higher dependability. Organizing preliminary quantitative research includes the following steps:

Step 1: The authors must determine research goals: Clearly define the research goals, questions that need to be answered, and hypotheses that need to be tested. Decide on appropriate data collection and processing methods, such as surveys, experiments, or secondary data analysis. Build a clearly structured survey questionnaire with qualitative and quantitative questions directly related to the variables to be measured.

Step 2: The authors must survey sample selection: Preliminary survey sample selection is based on random or non-random sampling methods following research objectives and ensuring representativeness.

Step 3: The authors must have data Collection: The authors performed initial quantitative research via direct interviews with 100 Vietnamese economic specialists. The survey for economic specialists in this study is suitable since the digital economy is evaluated through the questionnaire developed after step 2. The sample size comprises $n = 100$ experts. Economists interviewed Vietnamese cities and provinces, particularly in major urban centers such as Ho Chi Minh City, Can Tho, Hai Phong, Da Nang, and Hanoi. The authors use statistical analysis tools to process and analyze collected data. Analytical methods may include descriptive statistics, reliability analysis such as Cronbach's Alpha, and exploratory factor analysis (EFA). Evaluate and adjust: Evaluate preliminary results, thereby adjusting measurement tools, data collection methods, or research hypotheses, if necessary, before conducting official quantitative research [54].

The methodology used the following reasoning to choose five cities in Vietnam for the study: Hanoi, Ho Chi Minh City, Da Nang, Hai Phong, and Can Tho. These cities represent essential economic and geographic centers in Vietnam. We discuss whether or not they are representative and explain why we chose them: (1) Vietnam's political and administrative centers are located in Hanoi. Influencing the digital economy through government initiatives and laws is a focus for policy-making and national governance. (2) Businesses are based in Ho Chi Minh City, Vietnam's most significant economic hub. (3) The city is at the forefront of technology adoption, startup ecosystems, and international

business activity. Increasing investment in technology and innovative local initiatives have helped propel Da Nang Local to an emergent digital powerhouse. The city is also famous for its emphasis on tourism, which contributes to its rapid growth. (4) The port city of Hai Phong is an essential hub for logistics and industry, and it has made significant strides in digitizing supply chains, trade, and manufacturing. (5) As a symbol of the rural and agrarian digital revolution, Can Tho serves as the Mekong Delta Hub, the economic heart of the agriculturally wealthy Mekong Delta. As a result, these metropolitan areas encompass a wide range of digital economy activities in Vietnam, including industrial transformation, rural integration, and urban innovation.

3-3- Formal Quantitative Phase

Building upon the refined constructs, the formal quantitative phase employed a structured survey targeting a larger sample of 800 economic experts across the five selected Vietnamese cities. As central hubs in Vietnam's digital economy, these cities provided a suitable demographic for generalizing the findings to the national context. The survey utilized a structured questionnaire with a five-point Likert scale to quantitatively capture expert opinions across the study's identified dimensions. A purposive sampling strategy was again applied to target respondents with relevant digital economic expertise, enhancing the findings' external validity. Having the 800 surveys distributed to experts by email, 757 valid responses were collected, providing a robust sample size for the ensuing statistical analysis. Data was processed using SPSS 20.0 and AMOS, with confirmatory factor analysis (CFA) and structural equation modeling (SEM) employed to rigorously test hypothesized relationships and evaluate model fit. Reliability and construct validity were further established through Cronbach's Alpha and composite reliability indices, while convergent and discriminant validity were assessed through AVE (average variance extracted) and factor correlation matrices. This structured methodology ensured that the qualitative insights grounded the research in practical relevance, while the quantitative phases provided statistical rigor, enabling the study to draw empirically supported conclusions about the digital economy's influencing factors.

The collection of primary data for research is carried out by distributing surveys to subjects with a questionnaire system designed on a Likert scale with 5 levels, of which level 5 corresponds to the level "Strongly agree" and level 1 corresponds to the level "Strongly disagree" for each question or criterion given by the questioner.

Step 1: The authors use a non-probability random sampling method to perform quantitative research with a sample size of 800 economists (757 votes processed). These five Vietnamese cities, such as Ho Chi Minh City, Can Tho, Hai Phong, Da Nang, and Hanoi, are home to many economic professionals and have disproportionately impacted the country's digital economy. First, exploratory factor analysis (EFA) is used for calibration, and second, Cronbach's alpha is used for reliability assessment. An evaluation of the scale's reliability was conducted using the Cronbach Alpha coefficient analysis. When the coefficient is more than 0.6, the scale is considered reliable. The primary variable is the correlation coefficient, averaged with other variables on the same scale. If the coefficient is significant, the variable is highly correlated with the different variables in the set. The variable and total must have a correlation greater than 0.3. All components with a total correlation coefficient lower than 0.3 are removed from the scale since they are considered insignificant. The writers use exploratory factor analysis (EFA) to determine if the conceptual scale is legitimate. The authors conducted CFA and SEM studies after identifying EFA; consequently, it is crucial to consider the scale structure and the differences across factors [54].

Step 2: Persist in data collection: In this phase, the authors formally studied significant urban centers, specifically Can Tho, Ho Chi Minh City, Da Nang, Hai Phong, and Hanoi. The survey participants are economic experts. The data collection strategy involves direct interviews via a structured questionnaire, with a sample size of $n = 800$ economic experts (each city has 160 experts discussed). The sampling method employed is probability sampling, specifically utilizing random sampling techniques for assessment. Following data collection, the information was subjected to coding, data entry, cleaning, and analysis using SPSS version 20.0 and Amos software. Assess the reliability of the scales using Cronbach's alpha, utilizing the data gathered in Step 2. In this phase, the authors reassessed the trustworthiness of the ranks by analyzing the system's quantity. Cronbach's alpha is derived from data obtained through formal research.

Step 3: The authors evaluated the scale value by looking at the EFA and CFA of the SEM framework, which stands for Structural Equation Modeling. In step 2, data is acquired from a formal study, and Cronbach's alpha coefficient is used to accurately assess the scale used in EFA analysis. The CFA approach is used to evaluate the reliability of the measures. Based on the model testing results, the authors proposed implications for governance. The writers concluded by outlining their findings and suggesting policy implications to boost the digital economy [54].

4- Results and Discussion

4-1- Analysis of the Situation for Vietnam's Digital Economy during 2021-2023

Vietnam's digital economy during the previous two decades has attained a notably strong growth rate. 2023 is a challenging year for the world economy, particularly Vietnam, due to climate change, international conflicts, monetary policies, and rising commodity prices. In addition, there are new difficulties, such as conflicts in the Middle East, export bans, and the "securitization" and "weaponization" of trade instruments. According to the World Bank (WB), GDP in 2023 will only reach 2.6% (lower than 3% in 2022) and continue to slow down in 2024, with an increase of 2.4% in

2024 when the US and China grow slowly. Along with that, inflation (CPI) will decrease from a peak of 8.6% in 2022 to 5% by the end of 2023. However, 2023 is also the year of the explosion of new technologies, especially artificial intelligence (AI). AI has become a strategic field, attracting the attention and discussion of society about opportunities, impacts, and international cooperation.

Vietnam is still a bright spot in the world economic integration region, promoting Free Trade Agreements (FTAs) and enhancing economic independence and autonomy. According to the General Statistics Office, Vietnam's economy has recovered growth in the second half of 2023, GDP in 2023 increased by 5.05%, lower than the target, but there was an improvement between quarters, and inflation was controlled at 3.25%. The business sector has been restructured, with the number of newly registered enterprises reaching a record level, up 4.6% compared to the expected. Total realized social investment capital increased by 6.2%, with the state sector having the fastest growth. Besides, foreign direct investment (FDI) remains a bright spot, with total registered and implemented FDI capital reaching nearly 36.6 billion USD and 23.18 billion USD. Import-export turnover is estimated at 683 billion USD, with a positive trade balance of 28 billion USD. Both exports and imports decreased, but there was an improvement at the end of the year, especially from FTAs.

Regarding the 2024 economic forecast, the main challenges and risks in 2024 are that global political conflicts continue to evolve in a complex manner, which increases strategic competition among major countries. In addition, some banks in the US and Switzerland had a recession, an increase in public and private debt, global financial and monetary market risks, and a significant increase in bad debt and default risks. Threats to energy and food security remain, while international prices, inflation, and interest rates have decreased slightly but remain significant. Financial and monetary risks have increased, slowing down the global economic recovery. This situation has negatively affected sectors such as exports, investment, consumption, international tourism, and financial markets in Vietnam.

According to the measurement results of the General Statistics Office, the proportion of the added value of the digital economy in GDP in 2023 is 12.33%, of which the core digital economy contributes 7.42% (accounting for 60.19%), and digitalization of other industries contributes 4.91% (accounting for 39.81%).

The digital economy in Vietnam's GDP tends to grow in 2020-2023. In 2020, this proportion was 12.66%; in 2021, it was 12.87%; in 2022, it was 12.63%. However, in 2023, the proportion of the digital economy in GDP showed signs of a slight decrease, reaching only 12.33%. The reason is that the manufacturing industry of electronic products, computers, and optical products (accounting for more than 30% of the total added value of digital economic activities) decreased due to lower world demand. In addition, the impact of the Covid-19 epidemic has disrupted economic and social activities, leading to a decline in some digital economic sectors such as e-commerce, online tourism, etc. However, the proportion of the digital economy in Vietnam's GDP is still high compared to other countries in the region. According to World Bank statistics, the proportion of the digital economy in Vietnam's GDP is higher than that of Thailand (12.1%), Indonesia (8.3%), the Philippines (6.9%), Singapore (17.3%), and Malaysia (23.1%).

At the end of 2023, the Ministry of Information and Communications announced the results of national digital transformation with 62 set goals. Of these, 18 goals have been completed, accounting for 29%; 27 are highly likely to be completed (43.5%), and the remaining 17 require concentrated efforts to complete on time (27.5%). The 2023 plan sets out 126 tasks, of which 102 have been completed, reaching a rate of 81%. Vietnam is in the top 50 countries in innovation and digital transformation, ranking 46 in the World Intellectual Property Organization's Innovation Index in 2023.

To create growth momentum for 2024, Vietnam needs to focus on consolidating and renewing existing growth drivers while restructuring the economy after a prolonged recession due to the pandemic and taking urgent measures to address weaknesses in businesses and projects. Regarding the forecast of Vietnam's economic development in 2024, the report "Vietnam's Economy in 2023 and Prospects for 2024: Reforms to Accelerate Growth Recovery" presents two forecast scenarios for 2024, with economic growth possibly reaching 6.13% and 6.48%. Exports, the trade surplus, and inflation are also forecasted to be positive. The optimistic scenario requires policy solutions to reform the macroeconomic foundation, strengthen business environment reform, support new economic models, and institutional reform. Experts emphasize the role of institutions and labor productivity in promoting economic growth while mentioning challenges from global economic fluctuations. The optimistic scenario also emphasizes promoting innovation, developing new economic models, and reforming the business environment. The Government also proposes to address challenges such as backlog of documents, discipline, and difficulties in capital absorption to create momentum for Vietnam's economic growth recovery.

Advantages and difficulties in developing the digital economy in Vietnam: Vietnam possesses several advantages and conducive conditions for advancing the digital economy, particularly the demographics of youth and the number of internet users. Vietnam has significant market potential for digital economic products and services due to its young population and rising number of internet users. Statistics indicate that over 72% of the population utilizes smartphones, 68% of Vietnamese individuals engage in daily video viewing and music listening on mobile devices, and 70% of mobile users utilize 3G or 4G networks.

Accelerated expansion of the e-commerce sector: The proliferation of cellphones and the Internet has engendered a robust e-commerce market, presenting numerous prospects for enterprises and investors. Vietnam is home to approximately 30,000 enterprises in hardware, software, digital content, telecommunications, and information technology services, 10,000 software technology firms experiencing a robust growth rate of about 15-20% annually, and over 50 financial technology companies offering deposit and electronic payment services. Transportation companies, including Grab, Uber, FastGo, Be, and VATO, have introduced numerous applications to enhance competition. Several Vietnamese startups, like Mytour and Luxstay, are vying with prominent companies such as Booking, Agoda, and Airbnb in the tourist sector. Moreover, Vietnam annually boasts tens of thousands of innovative startups in the digital industry, many of which have showcased their capabilities and executed numerous high-tech projects.

According to the Ministry of Information and Communications, the Vietnamese Government has launched some programs and policies to encourage the expansion of the digital economy. These include a plan for the fourth industrial revolution, efforts to support tech startups, and programs to advance the creation and use of national digital platforms for digital transformation, digital Government, digital economy, and digital society. Along with the Master Plan for e-commerce expansion from 2021 to 2025, the Prime Minister has approved the National Digital Transformation Program through 2025, with a vision that extends to 2030. This project fully acknowledges the importance of digital transformation for Vietnam. Its goals include updating the distribution system, making businesses more competitive, and increasing domestic and export markets.

With the establishment of many high-tech companies and R&D centers, Vietnam's information and communication technology (ICT) industry is booming. A high user density characterizes the rapidly evolving, vast, and concurrently evolving network of telecommunications, information technology, and the Internet. Viettel, VNPT, and Mobifone, the three leading domestic mobile network operators, coordinated the announcement of their coverage zones and the official start of 5G service testing by the end of 2020. This put Vietnam among the first countries worldwide to access this technology, which significantly advanced the country's digital economy. A significant step forward in Vietnam's telecoms and IT sector, the Government has gradually developed the capacity to produce 5G equipment, in contrast to preceding technologies that were mostly imported. The labor potential in Vietnam is characterized by low costs and rapid adaptability to new technologies, facilitating favorable conditions for firms to execute digital economic initiatives. The expanding consumer market: Increasing earnings and the burgeoning middle class in Vietnam generate demand for digital products and services.

Given these advantages and conducive conditions, Vietnam possesses significant potential to advance the digital economy and enhance the progress and sustainable development of the national economy. Nevertheless, in addition to the benefits of reaching the digital economy in Vietnam today, specific challenges persist, including the information technology framework; notwithstanding swift advancements, Vietnam's information and communications technology (ICT) infrastructure remains constrained in several regions, particularly in rural and mountainous areas. Cybersecurity and information security provide significant challenges to the advancement of Vietnam's digital economy, including the threats of cyberattacks, breaches of information security, and cybercrime. Cybersecurity protocols must be enhanced to safeguard data and online transactions.

Despite the increase in Internet and smartphone access, there are still disparities in access to digital technology between regions and social classes in Vietnam. The infrastructure for the digital economy is not synchronous; a common national database has not been built; the logistics system is weak; the rate of enterprises applying digital technology and software is still meager, of which 59% is for human resource management applications, 29% for supply chain management, and 32% for customer relations. Human resource development to promote the digital economy, Vietnam has invested in developing highly skilled human resources in information and communication technology and applying digital technology to other business areas. However, the shortage of quality human resources in this field still exists. Training and attracting talents with high professional knowledge and creativity remains a significant challenge. Policy and legal regulations: The institutional and legal environment for digital economic development is still loose, unsynchronized, and lacking transparency and creativity.

The study's results on Vietnam's digital economy shed light on the more significant trends and difficulties in the digital economies of Southeast Asia and the world. These larger frameworks are supported by and contradicted by the following insights: (1) Vietnam is getting on board with Southeast Asia's more significant digital shift. The rise of e-commerce and financial technology, along with developments in information technology, are driving a digital transformation wave in Vietnam and other Southeast Asian nations. Investment in 5G networks, internet access, and digital payment systems is a top priority for the regional governments, mirroring Vietnam's approach. (2) Vietnam's youthful demographics, high internet penetration, and high levels of digital engagement among the country's youth reflect regional trends in which "digital natives" propel the expansion of online commerce, social media, and financial transactions. The ASEAN digital integration framework seeks to establish a single digital market throughout Southeast Asia, enabling cross-border trade and technology sharing; Vietnam's focus on international economic integration aligns with this goal. Finally, Vietnam's digital economy stands out from the rest of Southeast Asia in terms of its cultural adaptability, centralized policymaking, and economic structure, all of which contribute to its distinctive position in the digital economy. Differentiating itself from other countries in the region, the nation is working to close the gap between rural and urban areas, improve its IT infrastructure, and capitalize on its manufacturing capabilities. These results show that if Vietnam fixes its cybersecurity, legal frameworks, and labor preparedness issues, it might become a major participant in the international digital economy.

4-2-Analysis of Descriptive Statistics and Cronbach's Alpha for Factors Affecting the Digital Economy

Table 1 tests the reliability of the scale, including eight independent factors: (1) Information technology and digital infrastructure, (2) Digital transformation capacity in businesses, (3) Government policies and laws, (4) Human resources, (5) Digital consumer needs and behavior, (6) E-commerce and financial technology, (7) International economic integration, and (8) Market. Table 1 shows that Cronbach's alpha for critical factors affecting the digital economy is higher than 0.7.

Table 1. Testing descriptive statistics and Cronbach's alpha for critical factors influencing the digital economy

Items	Cronbach's alpha	Mean	Std. Deviation
Information technology and digital infrastructure (IT)	0.959	-	-
IT1	0.940	3.075	0.987
IT2	0.957	3.058	1.015
IT3	0.949	3.108	0.969
IT4	0.935	3.106	0.985
Digital transformation capacity in businesses (DT)	0.868	-	-
DT1	0.846	2.340	0.670
DT2	0.810	2.423	0.687
DT3	0.851	2.379	0.653
DT4	0.817	2.436	0.713
DT5	0.846	2.440	0.715
Government policies and laws (GP)	0.944	-	-
GP1	0.931	3.412	0.942
GP2	0.886	3.345	0.957
GP3	0.939	3.277	1.001
Human resources (HR)	0.962	-	-
HR1	0.937	3.073	0.979
HR2	0.961	3.052	1.001
HR3	0.956	3.086	0.966
HR4	0.944	3.063	0.999
Digital consumer needs and behavior (DC)	0.954	-	-
DC1	0.802	3.382	0.867
DC2	0.812	3.506	0.958
DC3	0.844	3.322	0.970
DC4	0.799	3.366	0.889
E-commerce and financial technology (EF)	0.950	-	-
EF1	0.929	3.032	0.981
EF2	0.942	3.046	0.993
EF3	0.939	3.083	0.948
EF4	0.930	3.067	0.986
International economic integration (IE)	0.951	-	-
IE1	0.928	3.036	0.987
IE2	0.942	3.041	0.999
IE3	0.943	3.083	0.958
IE4	0.930	3.057	1.003
Market (MA)	0.874	-	-
MA1	0.850	2.329	0.660
MA2	0.811	2.435	0.678
MA3	0.866	2.380	0.655
MA4	0.826	2.431	0.710
Digital economy (DE)	0.946	-	-
DE1	0.936	3.415	0.950
DE2	0.889	3.350	0.961
DE3	0.938	3.299	0.984

Moreover, Table 1 displays the descriptive statistics and Cronbach's alpha coefficients for factors associated with the digital economy. Each construction has multiple items, with Cronbach's alpha reflecting internal consistency, while the mean and standard deviation characterize the distribution of responses. Below is a summary: (1) Information technology and digital infrastructure have Cronbach's alpha of 0.959, indicating excellent reliability. Mean scores for individual items range from 3.058 to 3.108, reflecting moderate levels of access and quality in digital infrastructure. (2) Digital transformation capacity in businesses has Cronbach's alpha of 0.868, indicating good reliability. Mean scores for the items related to business management, financial capacity, and technology adoption are generally low, with averages between 2.340 and 2.440, suggesting notable challenges in these areas. The standard deviations highlight consistent variability across responses. (3) Government policies and laws have Cronbach's alpha of 0.944, indicating excellent reliability. Mean scores range from 3.277 to 3.412, implying that respondents generally believe government policies are essential in driving the digital economy. The standard deviations indicate variability in opinions. (4) Human resources has a Cronbach's alpha of 0.962, indicating excellent reliability. Mean scores are around 3.052 to 3.086, which implies moderate satisfaction with the human resources available to support the digital economy, with slight variability in the responses. (5) Digital consumer needs and behavior has a Cronbach's alpha of 0.954, indicating excellent reliability. Mean scores indicate that consumer needs are diverse (3.322 to 3.506), with respondents feeling reasonably confident in digital security, though variability in responses is noticeable. (6) E-commerce and financial technology have a Cronbach's alpha of 0.950, indicating excellent reliability. Mean scores suggest a moderate level of growth and development in e-commerce and fintech, with scores between 3.032 and 3.083, highlighting the rising importance of these sectors. (7) International economic integration has Cronbach's alpha of 0.951, indicating excellent reliability. Mean scores for international integration factors are moderate, around 3.036 to 3.083, showing the role of international factors in promoting the digital economy. (8) Market has Cronbach's alpha: 0.874, indicating good reliability. The mean scores range from 2.329 to 2.431, reflecting a moderate to low influence of markets (financial, technological, etc.) on the digital economy. Standard deviations suggest variability in responses.

Table 2 shows eight factors affecting the digital economy, with a significance level of 0.01. The article's novelty is finding out that information technology and digital infrastructure have the most substantial impact on the digital economy in Vietnam, with a standardized estimate of 0.529. Table 2 displays that information technology and digital infrastructure are the most critical factors driving the digital economy, followed by consumer needs and behavior. Factors like government policies, human resources, e-commerce and fintech, international economic integration, and markets also play significant roles, though their effects are more moderate. The results suggest that for the digital economy to thrive, efforts should strengthen digital infrastructure, enhance policy frameworks, and foster digital consumer behavior while addressing digital transformation and human resource development gaps.

Table 2. Testing critical factors affecting the digital economy

Relationships	Standardized estimate	S.E	C.R	P-value	Result
DE ← IT	0.529	0.030	16.382	***	Accepted H1
DE ← DT	0.085	0.048	2.741	0.006	Accepted H2
DE ← GP	0.090	0.034	3.174	0.002	Accepted H3
DE ← HR	0.081	0.025	2.782	0.005	Accepted H4
DE ← DC	0.175	0.033	5.306	***	Accepted H5
DE ← EF	0.092	0.026	3.047	0.002	Accepted H6
DE ← IE	0.085	0.031	2.625	0.009	Accepted H7
DE ← MA	0.079	0.053	3.651	***	Accepted H8

*** with 1%.

(1) Information technology and digital infrastructure (IT) has a standardized estimate of 0.529; C.R. is 16.382, and the P-value is 0.000 ***, as shown in Table 2. The relationship between IT and the digital economy is highly significant, with a robust, standardized estimate of 0.529. This suggests that information technology and digital infrastructure are fundamental drivers of digital economic development. The critical ratio (C.R.) of 16.382 further supports the robustness of this relationship [1, 11, 12, 55]. High-speed internet access, widespread telecommunication coverage, and quality broadband services directly influence economic activities by providing a foundation for digital transformation. This finding aligns with prior research indicating that well-developed digital infrastructure is a critical enabler of e-commerce, Fintech, and other digital services. The strong influence of IT on the digital economy emphasizes the need for governments and businesses to invest in improving digital infrastructure to accelerate economic growth.

(2) Digital transformation capacity in businesses (DT) has a standardized estimate of 0.085; C.R. is 2.741, and the P-value is 0.006, as shown in Table 2. While the impact of DT on the digital economy is statistically significant, the relatively low standardized estimate (0.085) suggests that its positive effect is not as pronounced as IT [2, 17, 18, 56]. This implies that businesses' ability to adopt digital transformation through management, financial capacity, and technology utilization contributes to economic growth, but its direct influence may be constrained by other factors, such as policy and infrastructure. The low effect size could also reflect the uneven readiness of businesses, tiny and medium-sized enterprises (SMEs), to fully embrace digital tools and integrate them into their operations. It suggests a gap in digital transformation capabilities that needs addressing to maximize the potential of the digital economy.

(3) Government policies and laws (GP) have a standardized estimate of 0.090; C.R. is 3.174, and P-value is 0.002 in Table 2. Government policies and regulations are crucial in driving digital economic growth, as demonstrated by the significant result and a standardized estimate of 0.090. While the impact is smaller than that of IT, it still indicates that well-structured policies create a conducive environment for digital businesses to flourish [4, 23, 24, 57]. Effective regulatory frameworks, incentives for startups, and clear guidelines on data protection and cybersecurity can encourage investment in digital sectors. Additionally, the Government's role in fostering innovation through policies that promote AI, IoT, and blockchain technologies is critical. This finding aligns with the literature highlighting the importance of policy intervention in enhancing digital infrastructure and literacy.

(4) Human resources (HR) has a standardized estimate of 0.081; C.R. is 2.782, and P-value is 0.005 in Table 2. Human resources significantly but moderately impact the digital economy, with a standardized estimate of 0.081. This suggests that the quality and capacity of the workforce are essential for digital economic development [20, 30, 31, 58]. Skilled labor is required to operate and manage digital systems, adopt advanced technologies, and drive organizational innovation. The finding implies that while HR plays a role, there may be a shortage of digital skills and expertise, which can hinder the full realization of the digital economy's potential. To strengthen this factor, businesses and governments must prioritize education and training programs that build digital competencies, such as coding, data analytics, and digital marketing.

(5) Digital consumer needs and behavior (DC) has a standardized estimate of 0.175; C.R. is 5.306, and the P-value is 0.000 *** in Table 2. Digital consumer needs and behavior exhibit a substantial and statistically significant impact on the digital economy, with a standardized estimate of 0.175. This relationship underscores the increasing importance of consumers in driving demand for digital products and services [7, 35, 36, 59]. The digital economy grows as businesses adapt to meet diverse consumer preferences and provide secure and seamless digital experiences. The result suggests that consumer confidence in digital security and the convenience of online services significantly influence economic activities in the digital space. It highlights the need for businesses to focus on understanding consumer behavior and enhancing user experience, which is critical for sustaining growth in the digital economy.

(6) E-commerce and financial technology (EF) has a standardized estimate of 0.092; C.R. is 3.047, and P-value is 0.002 in Table 2. The positive relationship between EF and the digital economy, with a standardized estimate of 0.092, suggests that e-commerce and Fintech are pivotal in fostering economic development [10, 40, 41, 60]. The growth of electronic payment services, the rise of fintech startups, and increasing e-commerce revenues reflect the sector's ability to enhance convenience and transaction efficiency. However, the moderate effect size indicates that while e-commerce and Fintech are essential, their impact may still be constrained by regulatory challenges, consumer trust, or digital infrastructure. To optimize their potential, there is a need for more vital collaboration between businesses, financial institutions, and policymakers to create an enabling environment for these sectors to thrive.

(7) International economic integration (IE) has a standardized estimate of 0.085; C.R. is 2.625, and P-value is 0.009 in Table 2. International economic integration has a statistically significant but relatively modest effect on the digital economy, as shown by the standardized estimate of 0.085 [15, 46, 47, 61]. This suggests that global interconnectedness facilitates access to cutting-edge technologies, knowledge sharing, and new market opportunities, contributing positively to the digital economy. However, the impact may be limited by domestic factors such as regulatory barriers or insufficient adaptation to global standards. The result highlights the importance of international collaboration and the adoption of global best practices in fostering a competitive and innovative digital economy.

(8) Market (MA) has a standardized estimate of 0.079; C.R. is 3.651, and P-value is 0.000 *** in Table 2. The influence of market factors on the digital economy is significant, though the effect size (0.079) is modest compared to other variables [5, 17, 48]. This suggests that financial and technological markets play a role in developing the digital economy, but their direct impact is limited. Factors such as internet usage, daily access time, and innovation (as reflected in patents and inventions) have positive but not overwhelming contributions. The relatively low effect size could indicate that market conditions, while important, are secondary to infrastructure, policies, and consumer needs. Fostering a more dynamic and competitive market environment is crucial to enhance the digital economy.

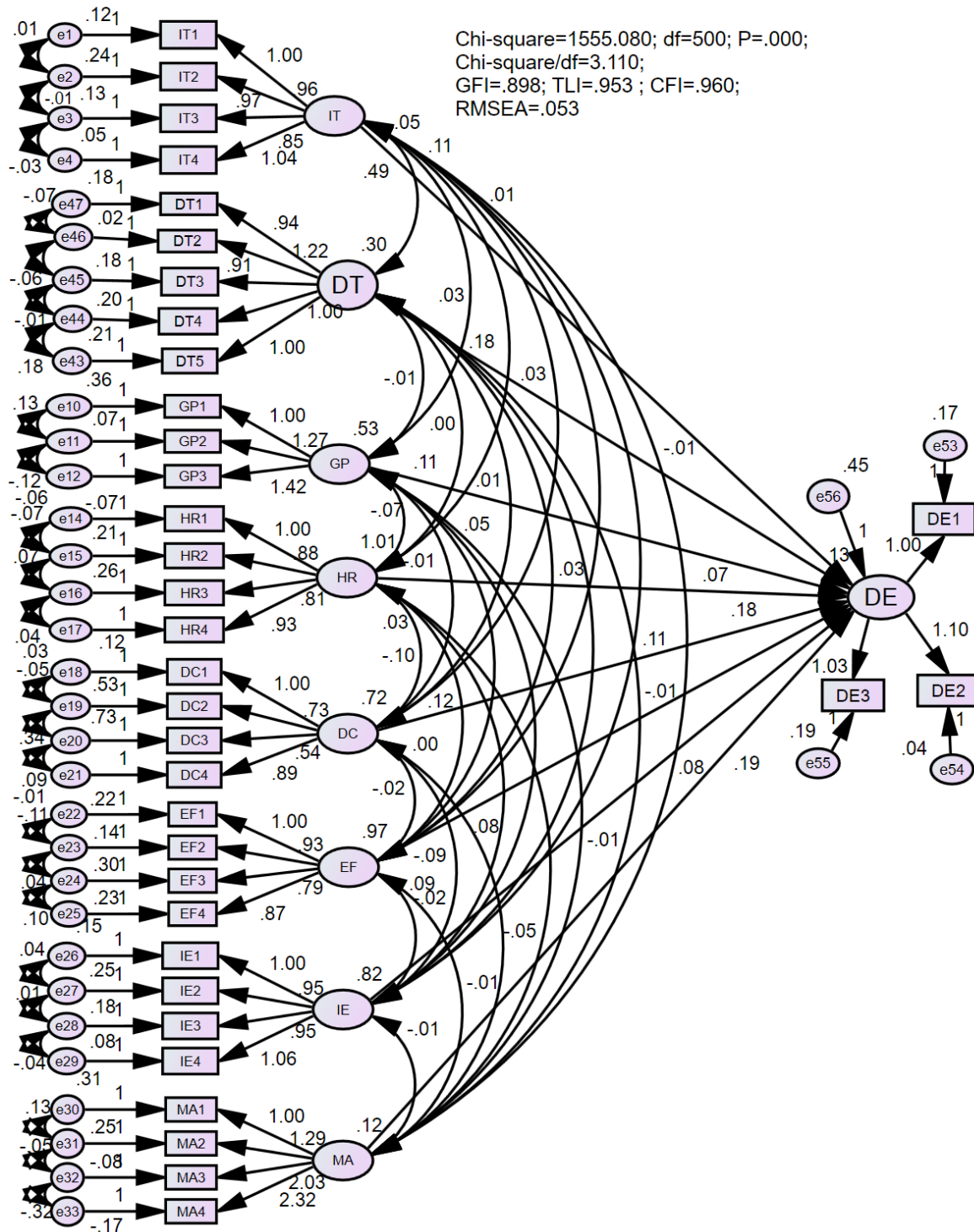


Figure 3. Testing for critical factors affecting digital economy (ED)

Figure 3 shows that the assessment of the critical factors affecting the digital economy is $CMIN/DF = 3.110$ (< 5.0), $GFI = 0.898$ (> 0.800), $TLI = 0.953$ (> 0.900), $CFI = 0.960$ (> 0.900), and $RMSEA = 0.053$ (< 0.08). The study aims to determine the eight factors affecting the digital economy in Vietnam, especially the Information technology and digital infrastructure's most substantial impact on the digital economy in Vietnam, with a standardized estimate of 0.529, which is the most important.

Table 3 exhibits bootstrap testing with 50,000 samples to investigate factors influencing the digital economy at a significance level of 0.01. This finding is entirely consistent with Vietnamese applied economic theory and practice principles. This outcome provides policymakers with scientific evidence to consult and make informed predictions.

Table 3. Testing Bootstrap 50,000 samples for factors affecting the digital economy

Parameter	SE	SE-SE	Mean	Bias	SE-Bias	Result
DE ← IT	0.042	0.000	0.491	0.001	0.001	1.00
DE ← DT	0.049	0.000	0.132	0.001	0.001	1.00
DE ← GP	0.039	0.000	0.098	0.009	0.005	1.80
DE ← HR	0.026	0.000	0.069	0.001	0.003	0.33
DE ← DC	0.041	0.000	0.169	0.007	0.004	1.75
DE ← EF	0.026	0.000	0.072	0.008	0.005	1.60
DE ← IE	0.035	0.000	0.081	0.001	0.003	0.33
DE ← MA	0.049	0.000	0.185	0.007	0.004	1.75

The research used bootstrapping with 50,000 samples, a strong technique for dealing with non-normal data and other possible violations of assumptions. By resampling the data, bootstrapping improves the estimates and confidence intervals even in less-than-ideal situations. The results should be more reliable with a sample size based on 757 participants (800 participants, 43 samples lacking information), since support vector machines work better with more enormous datasets, even when only slightly violated assumptions are considered. The five cities chosen reflect the key regions of Vietnam and have made substantial contributions to the digital economy; therefore, their inclusion is warranted. However, the study notes that its concentration on cities may have introduced bias. While these urban centers do a good job of shedding light on Vietnam's digital revolution, the results would be more applicable and comprehensive if the study had included more rural and underdeveloped areas.

4-3- Discussions

The eight factors influencing the digital economy highlight the need for a multi-dimensional policy approach. Investments in digital infrastructure, regulatory reforms, human resource development, and market incentives are critical to fostering a thriving digital economy. Governments should collaborate with the private sector to create an enabling environment that promotes digital innovation, enhances consumer confidence, and ensures inclusive growth. By implementing these specific policy recommendations, governments can create the conditions necessary for sustainable development and global competitiveness in the digital age:

(1) Accepted H1: Information technology and digital infrastructure (IT) significantly affect the digital economy based on the estimate of 0.529, $p=0.000$ in Table 2 [3, 13-15]. Investment in high-speed Internet and telecommunication infrastructure, such as governments, should prioritize expanding high-speed internet access and improving telecommunication coverage, particularly in rural and underserved areas. Public-private partnerships can be established to fund infrastructure projects that enhance broadband connectivity and ensure equal access to digital services across regions. Incentives for technology upgrades by providing tax incentives or subsidies to businesses and telecommunications providers for upgrading existing network infrastructures to support emerging technologies like 5G and fiber-optic networks. National digital infrastructure strategy: Formulating a national strategy focusing on developing digital infrastructure and aligning with global standards to ensure competitive digital services that fuel innovation and digital economic growth. Build and develop telecommunications infrastructure in a modern direction, becoming the foundation. Besides, it encourages the development of applications and services based on digital technology.

(2) Accepted H2: Digital transformation capacity in businesses (DT) has a modest yet significant effect based on the estimate of 0.085, $p = 0.006$ in Table 2 [2, 19-21]. Support for SME digitalization: Governments should provide targeted support to small and medium-sized enterprises (SMEs) for digital transformation, including grants, low-interest loans, and training programs focused on digital adoption. Create digital transformation advisory centers to assist businesses in adopting cutting-edge technologies such as AI, IoT, and blockchain. Digital skills training for business leaders can be achieved by establishing training programs for business owners and executives to improve their understanding of digital technologies and how to integrate them into business operations. This can be done through government-sponsored certification programs in collaboration with industry experts. Tax incentives for digital investments, such as introducing tax credits for businesses that invest in new digital technologies, such as cloud computing, automation, and data analytics, to improve productivity and competitiveness in the global digital economy. Increase investment in education, training, and development of human resources with information, communication, and digital technology skills. Develop training programs, encourage learning about information and communication technology, and keep current with new technology trends. Promote cooperation between universities and businesses to provide training programs suitable to labor market needs.

(3) Accepted H3: Government policies and laws (GP) positively impact the digital economy based on the estimate of 0.090, $p = 0.002$ in Table 2 [8, 25, 26, 28]. Enact comprehensive digital economy legislation. Governments should develop a comprehensive legal framework that covers critical areas such as data protection, cybersecurity, intellectual property rights, and digital transactions. This framework should be aligned with international standards to ensure trust in the digital economy. Startups support policies by introducing policies that encourage innovation in digital startups, such as providing seed funding, tax breaks for tech entrepreneurs, and incubation programs. Focus on nurturing local digital talent and fostering innovation ecosystems. Regulatory sandboxes are established to allow digital businesses, especially fintech and other innovative digital sectors, to test new products and services in a controlled environment, ensuring compliance while encouraging innovation. Create a stable and favorable legal environment, perfect institutions, and policies for digital economic development. Flexible and adaptive policies and legal norms are needed to encourage investment and development in the digital economy while protecting the rights of consumers and businesses through the enforcement of relevant regulations and laws. Creating a favorable business environment for the digital economy, such as strengthening public-private cooperation to promote the development of digital economy projects and initiatives.

(4) Accepted H4: Human resources (HR) contribute to the digital economy based on the estimate of 0.081, $p = 0.005$ in Table 2 [6, 15, 31, 32]. Develop a National digital skills agenda by implementing nationwide programs to improve digital literacy and skills, focusing on current workers and students. This can include coding boot camps, certifications in emerging technologies, and continuous education programs for workers transitioning into the digital economy. Public-private partnerships for skill development are fostered by fostering collaborations between the Government, educational institutions, and private sector companies to develop industry-relevant curricula. This ensures that graduates have the necessary skills to meet the demands of a rapidly evolving digital economy. Attracting global digital talent through implementing policies that attract international digital talent by simplifying visa processes and offering competitive packages to professionals in tech-related fields. Create digital nomad visa programs allowing tech workers to remotely contribute to the local economy. Provides financial opportunities and cooperation opportunities between businesses and research and development organizations. Supported research and development of new technology products. Improve the effectiveness of policy packages to support digital transformation for enterprises, especially capital and human resources policies. At the same time, policies should be established to support new business models and encourage Vietnamese technology products. Promote support for small and medium-sized enterprises to apply e-commerce and digital technology.

(5) Accepted H5: Digital consumer needs and behavior (DC) play a significant role based on the estimate of 0.175, $p = 0.000$ in Table 2 [7, 12, 38, 39]. Consumer awareness programs can be launched by launching campaigns that increase consumer awareness about digital services, their benefits, and how to securely use them. This will help build confidence in the digital economy, especially regarding online transactions and data privacy. Strengthening consumer protection laws by implementing stronger consumer protection regulations and ensuring digital businesses are held accountable for data breaches or fraudulent activities. Establish dedicated digital consumer protection agencies that resolve e-commerce and digital services disputes. Encourage user-centric innovation by encouraging businesses to innovate by focusing on consumer needs, such as creating personalized services, enhancing user experience, and improving data security. This can be supported by government-backed innovation grants for customer-centric digital solutions. Create databases and digital economic information systems. Build and maintain databases and information systems to collect and analyze data related to the digital economy. Use data to make strategic decisions and shape digital economic policies to meet people's increasing needs.

(6) Accepted H6: E-commerce and financial technology (EF) influence the digital economy based on the estimate of 0.092, $p = 0.002$ in Table 2 [9, 42-44]. Digital payment infrastructure encourages the development of a robust digital payment infrastructure by promoting cashless transactions through mobile banking, e-wallets, and other fintech solutions. The Government can introduce incentives for consumers and merchants who adopt digital payment methods. E-commerce ecosystem development by creating policies that support the growth of e-commerce platforms, including logistics and supply chain improvements, data-driven marketing solutions, and support for e-commerce SMEs. Additionally, regulatory barriers to cross-border e-commerce should be addressed to facilitate international trade. Promoting financial inclusion by leveraging fintech solutions to promote financial inclusion, particularly in underserved populations. Introduce policies that support micro-lending platforms and digital banking services, ensuring accessibility to financial services for all. Develop promotional and marketing strategies to increase awareness and use of digital economy services and products. Encourage collaboration between industry, government, and other partners to create effective marketing campaigns.

(7) Accepted H7: International economic integration (IE) is a positive factor based on the estimate of 0.085, $p = 0.009$ in Table 2 [6, 17, 40, 48]. Bilateral and multilateral digital trade agreements encourage international economic integration by negotiating bilateral and multilateral agreements that facilitate digital trade, data flow, and e-commerce. Such contracts should focus on reducing tariffs and regulatory barriers for digital services and promoting technology sharing across borders. International collaborations in R&D by fostering cooperation in research and development with other countries, focusing on emerging digital technologies such as AI, quantum computing, and blockchain.

Governments should facilitate joint ventures between domestic and international firms to share knowledge and expertise. Participation in global digital standards initiatives by ensuring active participation in global digital standards organizations to stay aligned with international best practices in data governance, cybersecurity, and e-commerce regulation. This will improve competitiveness and market access for digital businesses. Strengthen international cooperation in sharing experiences and knowledge on digital economic development. Build partnerships with countries and international organizations to take advantage of opportunities for collaboration and support.

(8) Accepted H8: Market (MA) also significantly affects the digital economy based on the estimate of 0.079, $p = 0.000$ in Table 2 [21, 31, 52, 53]. Creating a digital innovation hub by establishing digital innovation hubs or technology parks to support the growth of digital technology startups, research, and product development. These hubs can foster collaboration between academia, industry, and Government, creating a fertile ground for market-driven innovation. Venture capital and funding support by introducing policies that promote venture capital investment in the digital economy, especially in high-potential areas like fintech, e-commerce, and artificial intelligence. Provide financial incentives for investors who fund early-stage digital ventures, thus fueling market growth. Incentivizing R&D in digital technologies by promoting market-driven research and development by providing tax breaks and grants to businesses engaged in digital technology innovation. Encouraging patents and intellectual property protection in digital sectors can stimulate market activity. Vietnam needs to spend more resources on human resource development for the digital economy. Specifically, the state requires a strategy and plan to provide education and training so everyone has the necessary skills and knowledge to participate in the digital economy. This includes training in digital literacy, computing skills, and other areas relevant to the digital economy.

In conclusion, the digital transformation theories, frameworks for economic development, and behavioral theories of technology adoption form the basis of this research's theoretical approach. With these points of view, we can begin to isolate and examine the driving forces behind the digital economy. Here is a more detailed explanation of the theoretical foundation: (1) The research provides the groundwork for digital economy frameworks that view the sector as an interconnected system affected by human, institutional, and technological elements. According to a previous study, digital economic activities, including e-commerce, digital finance, and online services, rely heavily on information technology and telecommunications infrastructure. (2) Research-based structural equation modeling (SEM) models the interactions among components influencing the digital economy, such as government policies, human resources, and market forces. This quantitative technique provides a strong statistical foundation for assessing the hypotheses, which aligns with contemporary theoretical models of interrelated economic processes. (3) The study's findings inform behavioral theories of consumer adoption, which investigate the effects of digital consumers' wants and actions on the uptake of digital services by fusing ideas from behavioral economics and technological acceptance theories. This research delves into consumer preferences, trust, and the demand for secure and smooth digital experiences, drawing from frameworks such as the technology acceptance model and the unified theory of acceptance and use of technology. The institutional economics field examines government policy and law-making ideas, focusing on regulatory frameworks' function in fostering innovation, protecting markets from volatility, and reducing vulnerabilities to cyberattacks and other dangers. Fifthly, globalization theories, including international economic integration, highlight the significance of international cooperation, technology exchange, and cross-border trade as drivers of the digital economy. The novel theoretical contributions from the current study enhance preexisting theoretical models by combining these many frameworks into a holistic, multidimensional model. It unifies previously disjointed research on the digital economy by focusing on its technical, institutional, and behavioral aspects simultaneously. This method provides a comprehensive view of the elements impacting digital transformation, especially in Vietnam. Because of the specific socioeconomic issues in Vietnam, the study model works well there, where digital economic development is happening quickly. Policymakers, corporations, and researchers may all benefit from the study's conclusions because it draws on theories from various fields to ensure it's helpful in both global and local situations. In the current era, the digital economy is not just a trend but a force completely changing how we work, communicate, and consume. From the explosion of the internet to the spread of artificial intelligence and blockchain, the digital economy has created a constant wave of innovation and change. In this context, it is essential to grasp and evaluate the impact factors and understand the trends, challenges, and opportunities of the digital economy, thereby providing some recommendations for developing the digital economy in Vietnam in the near future.

5- Conclusions and Policy Recommendations

5-1-Conclusions

In today's world, the digital economy is more than a fad; it transforms how people work, communicate, and consume. From the rise of the Internet to the growth of artificial intelligence and blockchain, the digital economy has driven a steady tide of innovation and change. In this setting, grasping and understanding the digital economy's trends, difficulties, and opportunities is vitally significant. Therefore, the paper finds eight factors affecting the digital economy with a significance level of 0.01, and eight hypotheses are accepted. The novelty highlights the significant influence of

information technology and telecommunications infrastructure on Vietnam's digital economy. To develop the digital economy quickly and sustainably, it is necessary to cooperate with the state and the business community to promote positive impacts from influencing factors. Based on the above viewpoints, many different recommendations must be implemented to promote positive impacts from factors affecting the digital economy. Each recommendation has an essential position in promoting Vietnam's digital economy today. Accordingly, it is necessary to thoroughly grasp and synchronously implement recommendations from both the state and businesses and consider these as essential content to gradually improve the quality of digital economic development in Vietnam in the present and the future. Finally, the results highlight the significance of frameworks for policies, infrastructure investments, and digital skills development in promoting long-term economic growth. There needs to be strong infrastructure and receptive regulatory settings for e-commerce and digital consumer behavior to substantially impact the digital economy. Vietnam can speed up its path to a digital economy that is sustainable, inclusive, and competitive by tackling these essential elements through focused policies and joint endeavors based on the policy recommendations below.

5-2- Policy Recommendations

The study finds eight essential factors influencing the digital economy with a significance level of 0.01 and eight acceptable hypotheses. The uniqueness emphasizes the enormous impact of information technology and telecommunications infrastructure on Vietnam's digital economy. Besides, Vietnam is vigorously promoting building an e-government digital government, strongly reforming the administrative system towards digitalization, and improving the quality of human resources. The Government aims to make Vietnam an international software center, promote entrepreneurship, develop smart cities, strengthen policy mechanisms, and dialogue with the business community. With political determination, a reasonably positive institution, and a technological foundation, this is the basis for Vietnam to be confident in its ability to successfully transition from a traditional economy to a digital economy. To achieve the ambitious growth objective sanctioned by the National Assembly, it is necessary to focus on the implementation of specific policies targeted at capitalizing on opportunities and resolving problems, as indicated below:

(1) The results from Table 2 indicate that information technology and digital infrastructure (IT) exhibit a standardized estimate of 0.529 and a p-value of 0.000, confirming its critical role in driving the digital economy. Therefore, Vietnam needs to propagate and disseminate knowledge about the benefits of broadband internet and encourage people to use broadband internet for study, work, and entertainment. Build and synchronously develop national data infrastructure. Form a system of national, regional, and local data centers connected synchronously and unifiedly. Form reliable and stable data systems for the state and businesses. Invest in equipment systems to collect, store, process, and protect public data. Vietnam should improve its information and communication technology (ICT) infrastructure. Invest in network and telecommunications infrastructure to improve internet access and speed. Develop network services, especially in rural and mountainous areas. Enhance 4G network upgrades and increase 5G network deployment speed while promoting the application of advanced Internet to keep up with world trends. Build and develop modern telecommunications infrastructure to become a foundation. In addition, encourage the development of applications and services based on digital technology. Among the tasks and solutions to create the foundation for digital transformation, developing digital infrastructure that is ready to meet the explosive demand for connection and data processing plays an essential role for Vietnam. This includes building and developing high-quality broadband infrastructure nationwide; re-planning frequency bands, developing 5G mobile network infrastructure, and early commercialization of 5G mobile networks; expanding regional and international internet connections, especially developing submarine optical cables, making Vietnam one of the regional connection centers; and developing Internet of Things (IoT) network connection infrastructure. Information technology infrastructure plays a crucial role in Vietnam's digital economy since it was identified as the most influential component in the study. Filling in critical gaps through deliberate policymaking, such as increasing access to broadband, encouraging innovation, and closing the gap between urban and rural areas. In addition, by rolling out 5G networks to urban and rural regions, Vietnam can unlock the full potential of its digital economy. Prioritize funding for fiber-optic networks so that even rural areas may access the internet at high speeds. Thanks to these initiatives, the country's economic transition will be accelerated and positioned to compete in the global digital arena.

(2) The findings also highlight that digital consumer needs and behavior (DC) has a standardized estimate of 0.175 with a p-value of 0.000, underscoring its considerable influence on the digital economy. Therefore, Vietnam should prioritize consistency with Vietnam's production and integration development process, establish various forms of domestic trade and business organization, help raise product commercial value, link and promote the development of domestic production, foster growth of e-commerce and its connections to traditional trade, and so on. (iv) bolster digital economy advertising and promotion. Create advertising campaigns to raise brand recognition and demand for services and goods the digital economy offers. To develop successful advertising campaigns, it is recommended that relevant industry groups, governments, and other partners work together. An ideal scenario would be for Vietnam to host yearly e-commerce events, where companies and organizations could showcase cutting-edge e-commerce models and

technologies, attracting new customers and encouraging them to develop their own e-commerce habits and expertise. Keep the initiative going to help SMEs with their digital transformation, use tech to boost their production and business models, and identify key sectors and topics to study so we can create tech that can increase production and business. Lastly, Vietnam must keep helping businesses find the most cost-effective ways to ship their products at home and abroad. Furthermore, in order to strategically boost cross-border e-commerce activities, management authorities should have plans to assist export firms through this medium. This would provide conditions for Vietnamese manufacturing enterprises to diversify their export channels in international markets.

(3) E-commerce and financial technology (EF) records a standardized estimate of 0.092 and a p-value of 0.002, indicating a significant positive impact on the digital economy. Therefore, Vietnam should continue to develop diverse types of commercial infrastructure, harmoniously combining traditional trade with modern trade, consistent with the nature and level of market development in each area and the whole country. Complete the conventional market system based on upgrading markets in rural and mountainous regions and develop market models that ensure food hygiene and safety. Vietnam should create digital economy databases and information systems. Build and maintain databases and information systems to collect and analyze data related to the digital economy. Use data to make strategic decisions and shape digital economy policies. Strengthen network security and information security. Establish rules and guidelines for the protection of networks and data. The best way to stop cyberattacks is for countries to work together more closely and share information and strategies. To promote cross-border e-commerce activities, we are gradually expanding to the region and building an online system to manage transportation, delivery, and order fulfillment services for e-commerce. We are also creating an address database system and a Vietnam Digital Map platform to support the online management of postal, transportation, and order fulfillment services nationwide. Using mobile platforms, smart cards, and big data, create solutions for infrastructure sharing between e-commerce and retail distribution service providers and intelligent connection and sharing solutions between businesses, consumers, and the government. Public digital signatures, personal digital signatures on mobile, blockchain storage, and other digital technologies will all play a role in the authentication platform used to authenticate electronic contracts and documents used in commercial transactions. Developing infrastructure for storing, retrieving, and managing electronic documents used in business, such as electronic invoices, electronic stamps, electronic warehouse delivery documentation, and others. Constructing a system to facilitate the sharing of electronic identification and authentication for use in online transactions.

(4) Government policies and laws (GP) show a standardized estimate of 0.090 and a p-value of 0.002, highlighting the pivotal role of regulatory frameworks in shaping the digital economy. Therefore, Vietnam should enact suitable industrial policies to enhance the integration between the domestic economy and the foreign direct investment sector, mainly through initiatives that bolster startups and enterprises excelling in technology application and development, notably in medium technology and supporting industries linked to global value chains. Facilitate productive collaboration among the Government, the business sector, and technological universities to advance the growth of targeted industries, particularly the information technology sector. Vietnam should create a stable and favorable legal environment and perfect institutions and policies for digital economic development. Flexible and adaptive policies and legal regulations need to be implemented to encourage investment and development in the digital economic sector while protecting the rights of consumers and businesses by implementing relevant rules and laws. Create a favorable business environment for the digital economy by strengthening public-private cooperation to promote the development of digital economic projects and initiatives. Encourage technology enterprises and digital startups by creating a friendly, stable, and supportive business environment for technology enterprises and startups, encouraging innovation and creativity. Provide financial opportunities and cooperation opportunities between businesses and research and development organizations. Support the research and development of new technology products. Improve the effectiveness of policy packages supporting digital transformation for businesses, especially capital and human resources policies. Concurrently, measures should be instituted to foster innovative business models and promote technology products from Vietnam. Encourage and facilitate the use of digital technologies and e-commerce by small and medium-sized businesses. Establishing a fundamental and all-encompassing legal foundation for the creation, building, and implementation of e-Government must be expedited through the completion of relevant institutions. When it comes to digital economic activity, there needs to be a system to settle disagreements between digital businesses, customers, and employees, particularly between digital businesses and more conventional businesses. Keeping up with the current trend in the development of the digital economy, we must perfect laws and rules about money, electronic payments, network security, tax management, and cross-border services to avoid trade fraud, tax evasion, false and damaging information, etc. Develop the ability to administer digital platforms and perfect the state management apparatus of the digital economy to produce a safe and healthy digital environment. To organize and run the digital economy, it is necessary to have digital economic institutions that can provide direction and oversight. Consequently, if the solutions mentioned above are quickly implemented to complete our country's digital economic institutions, it will genuinely facilitate the growth of the digital economy and help achieve the national digital transformation target by 2030.

(5) International economic integration (IE), with a standardized estimate of 0.085 and a p-value of 0.009, reflects the importance of global economic engagement. Therefore, Vietnam should organize the effective implementation of

international economic integration commitments: Promoting the role of the National Committee for International Economic Cooperation in inter-sectoral coordination, further strengthening connection, coordination, centralized management, and unification between strategic planning for international economic integration and implementation of negotiations and implementation of integration commitments. Urge and supervise ministries, branches, and localities to effectively implement international economic integration commitments. Vietnam should strengthen international cooperation and create partnerships. Strengthen international cooperation in sharing experiences and knowledge on digital economic development. Build partnerships with countries and international organizations to take advantage of opportunities for collaboration and support. The Government should prioritize the expansion and development of the digital economy by continuously improving policies and action programs. The National Assembly should prioritize overseeing the development of the digital economy by strengthening the monitoring of the law's implementation and conducting periodic summaries and evaluations of the results. Simultaneously, it ought to effectively direct, augment, and revise the law to make it more applicable to the real-life circumstances of our nation's digital economy and worldwide economic integration.

(6) The standardized estimate for digital transformation capacity in businesses (DT) is 0.085, with a p-value of 0.006, showing a moderate but essential influence on the digital economy. Therefore, Vietnamese enterprises must increase connectivity and cooperation in production and business activities. There is division and coordination in production and business activities in general, as well as science and technology activities in particular. Cooperation is carried out by jointly implementing and sponsoring science and technology projects and programs, supporting knowledge and technology transfer, exchanging and arranging scientific and technological staff to work at partner units, and bringing products to market. Strengthening the connection and cooperation with FDI enterprises and enterprises in developed countries is a favorable condition to help Vietnamese enterprises grasp new standards and techniques and access new knowledge and technology. This is also considered the most effective shortcut and anticipatory solution. However, to achieve maximum efficiency when receiving new knowledge and technology, domestic enterprises need to prepare well regarding human resources to best absorb the results of global technological advances. With the spirit of innovation of today's businesses, comprehensive digitalization is an indispensable solution for businesses, especially with the Government's digital transformation policy in recent years. Companies need to be mentally and financially prepared, creating a solid foundation for the digital transformation process in the future. Leaders and managers need to improve their expertise in digital transformation to make the right decisions to change and invest in businesses.

(7) Human resources (HR) is reflected by a standardized estimate of 0.081 and a p-value of 0.005, demonstrating its significant contribution to the digital economy. Therefore, Vietnam needs a mechanism to encourage the creation of links between schools and businesses. In the 4.0 digital era, it will be very effective when students can study and work in a natural environment. However, very few companies currently have a strategy to nurture human resources right from the 2nd and 3rd years and have plans to allow students to work flexibly. And vice versa, schools only focus on training and do not pay much attention to cooperation with businesses. Between businesses and universities, as well as training facilities, there is a lack of close coordination mechanisms; businesses must be the place to place orders for universities regarding human resource needs. Vietnam continues training and developing digital human resources, increasing investment in education, training, and developing human resources with skills in information and communication technology and digital technology. Develop training programs and encourage learning about information and communication technology, continually updated with new technology trends. Encourage partnerships between educational institutions and private sector organizations to address gaps in the workforce through customized training programs. Another challenge for SMEs is acquiring the high-quality people resources needed for digital transformation, who can learn and use new technology to help with the transition. Every year, Vietnam's domestic IT training programs fall short of the need, and the country's human resource shortage makes it harder to build its digital economy and society. Businesses rely on their employees more than anything else. A company's long-term growth plan should include a strategy for developing its human resources. Specifically, organizations need to find ways to train their current employees, particularly their core staff and specialists, to be better at what they do by expanding their knowledge base and providing them with the tools they need to succeed. Technically and professionally competent; multilingual (fluent in English and other languages); adept at using computers and other information technology to increase worker output; Be proactive in hiring practices and plan ways to augment your company's high-quality human resources.

(8) Market (MA) records a standardized estimate of 0.079 with a p-value of 0.000, confirming its impact on the digital economy. Therefore, Vietnam should implement preferential policies on taxes, fees, and charges for establishing new science and technology enterprises or converting science and technology organizations to enterprise mechanisms. Tax the environment and impose strict sanctions on establishments that use outdated, polluting technology to force them to innovate and use advanced, modern, non-polluting technology. Ensuring and creating conditions for subjects in the science and technology market to access credit capital sources at low interest rates. Vietnam should strengthen digital economy promotion and marketing. Develop promotion and marketing strategies to increase awareness and use of digital services and products. Encourage collaboration between business organizations, governments, and other partners to create effective marketing campaigns. Organize conferences, workshops, and conversations to connect and share

information and experiences and increase knowledge about digital transformation in localities, businesses, and communities. Improve the infrastructure of delivery and logistics services for e-commerce, apply new technologies in logistics activities, encourage piloting and deploying the application of new means of transport to support the transportation and delivery of goods in e-commerce, encourage comprehensive solutions to connect logistics enterprises from the first to the last mile, and thoroughly research solutions for cross-border delivery and urban logistics.

5-3- Limitations and Further Research

The study tackles five essential factors: Information technology and digital infrastructure (IT), digital transformation capacity in businesses (DT), government policies and laws (GP), human resources (HR), digital consumer needs and behavior (DC), e-commerce and financial technology (EF), international economic integration (IE), and Market (MA). However, the digital economy still has many influencing factors that have not been included in the model, and the scope of the survey is only 5 cities in Vietnam. Therefore, future research needs to add more variables to the model, investigate and survey more subjects, and cover more provinces. Besides, it is necessary to consolidate secondary data and deeply analyze the current state of the digital economy in Vietnam over the past many years to see the overall picture of the digital economy. There is still a lot of work to be done to develop the digital economy and increase the contribution of this field to GDP. In addition to the response of the people and the positivity of businesses, the role of the Government, ministries, and branches is needed to promote digital economic development. The interconnectedness of the digital economy is demonstrated by the interplay between IT infrastructure and other elements, such as education, government policy, and financial services. Harnessing these synergies would allow Vietnam to construct a digital economy that is more inclusive, resilient, and sustainable. More in-depth examination of these connections is needed in future studies to shed light on the policymaking process.

6- Declarations

6-1-Author Contributions

Conceptualization, L.T.H. and P.T.T.; methodology, L.T.H.; software, L.T.H.; validation, L.T.H. and P.T.T.; formal analysis, L.T.H.; investigation, P.T.T.; resources, L.T.H.; data curation, P.T.T.; writing—original draft preparation, L.T.H.; writing—review and editing, P.T.T.; visualization, L.T.H.; supervision, P.T.T.; project administration, L.T.H.; funding acquisition, P.T.T. All authors have read and agreed to the published version of the manuscript.

6-2-Data Availability Statement

The data presented in this study are available in the article.

6-3-Funding and Acknowledgements

This research was supported by Lac Hong University (LHU), Vietnam. The authors would like to express their sincere thanks to the management of LHU for their support and encouragement.

6-4-Institutional Review Board Statement

Not applicable.

6-5-Informed Consent Statement

Not applicable.

6-6-Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors.

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Appendix I

Table A1. Research questionnaires

Code	Factors affecting the digital economy	5-point Likert scale				
		(1)	(2)	(3)	(4)	(5)
IT1	Internet access speed	(1)	(2)	(3)	(4)	(5)
IT2	Telecommunication coverage	(1)	(2)	(3)	(4)	(5)
IT3	The popularity of broadband Internet service	(1)	(2)	(3)	(4)	(5)
IT4	Network service quality	(1)	(2)	(3)	(4)	(5)
DT1	Business management and operations affect the digital economy in your area.	(1)	(2)	(3)	(4)	(5)
DT2	Business financial capability affects your local digital economy.	(1)	(2)	(3)	(4)	(5)
DT3	Firms' production and business technology affect your local digital economy.	(1)	(2)	(3)	(4)	(5)
DT4	Company human resource capability affects digital economic development where you live.	(1)	(2)	(3)	(4)	(5)
DT5	Business adoption of AI, IoT, and blockchain	(1)	(2)	(3)	(4)	(5)
GP1	Government policies drive digital economic progress	(1)	(2)	(3)	(4)	(5)
GP2	The Government has recently issued and implemented many good digital economy policies	(1)	(2)	(3)	(4)	(5)
GP3	Programs to encourage and support startups in the digital field	(1)	(2)	(3)	(4)	(5)
HR1	The Government supports human resource quality while developing digital economic development initiatives	(1)	(2)	(3)	(4)	(5)
HR2	Business in the country's digital economic development trend include human resource quality	(1)	(2)	(3)	(4)	(5)
HR3	Local human resources fulfill digital economic development standards	(1)	(2)	(3)	(4)	(5)
HR4	Businesses' training and HR investment need to grow the local digital economy	(1)	(2)	(3)	(4)	(5)
DC1	Consumer needs are increasingly diverse	(1)	(2)	(3)	(4)	(5)
DC2	Businesses satisfy customer needs more in the digital economy	(1)	(2)	(3)	(4)	(5)
DC3	Assessing user confidence in digital security	(1)	(2)	(3)	(4)	(5)
DC4	Understand consumer needs	(1)	(2)	(3)	(4)	(5)
EF1	The development of other economic sectors, such as financial technology	(1)	(2)	(3)	(4)	(5)
EF2	E-commerce revenue as a percentage of total retail revenue increases year by year	(1)	(2)	(3)	(4)	(5)
EF3	Level of use of electronic payment services	(1)	(2)	(3)	(4)	(5)
EF4	Number of startups in the field of digital technology	(1)	(2)	(3)	(4)	(5)
IE1	International economic integration strongly promotes the development of the digital economy	(1)	(2)	(3)	(4)	(5)
IE2	International economic integration creates pressure for change	(1)	(2)	(3)	(4)	(5)
IE3	International economic integration creates opportunities to access technology	(1)	(2)	(3)	(4)	(5)
IE4	The extent to which knowledge and technology are shared between countries	(1)	(2)	(3)	(4)	(5)
MA1	The level of influence of the financial market on digital economic development	(1)	(2)	(3)	(4)	(5)
MA2	Average daily internet access time	(1)	(2)	(3)	(4)	(5)
MA3	The level of influence of the science and technology market	(1)	(2)	(3)	(4)	(5)
MA4	Number of patents and inventions registered in the field of digital technology	(1)	(2)	(3)	(4)	(5)
DE1	Contribution of the digital economy to economic growth	(1)	(2)	(3)	(4)	(5)
DE2	Investment in digital economic development is increasingly large, with requirements	(1)	(2)	(3)	(4)	(5)
DE3	Production and business activities are based on digital platforms	(1)	(2)	(3)	(4)	(5)

Note: A 5-point Likert scale states the level of agreement in five points. The 5-point Likert scale consists of the below points – (1) Strongly Disagree; (2) Disagree; (3) Neither Agree nor Disagree; (4) Agree; (5) Strongly Agree.