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BLOCKCHAIN APPLICATION IN MODERN LOGISTICS: INTERNATIONAL EXPERIENCE AND SOME RECOMMENDATIONS FOR VIETNAM

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Abstract

In the development of e-commerce and digital economy, Blockchain is increasingly showing its irreplaceable importance (Narayanan et al., 2016). Using qualitative research using descriptive analysis and secondary data synthesis, this report provides an overview of Blockchain and its applications in the development of Logistics industry in the United States, German Federation, Korea, China. Finally, the report gives recommendations such as the need to prioritize Blockchain and e-Logistics applications in the national Logistics development strategy, and to pay attention to the development of Logistics infrastructure and information technology infrastructure. As a foundation for Blockchain development, investment in the development of e-Logistics systems is urgent, it is necessary to create mechanisms, policies, and an environment to welcome the application of new technologies to the Logistics industry in Vietnam.

Keywords: *Blockchain, Logistics, e-Logistics*

1. Introduction

Nowadays, when the competition of the logistics market is extremely fierce, the demand of customers is constantly increasing, e-Logistics has become a viable and preferred solution for manufacturers in the global network, new technology applications such as blockchain have brought a series of innovations to the traditional logistics process, making it more advanced than ever before. The foundation of the global supply chain began to be formed in the 1990s on the basis of the desire to establish separate import centers and delivery centers of retail businesses, but after 2000, the e-fulfillment distribution network began to be focused by retailers. In the context of the new market, Logistics not only serves the import and export of goods but also meets the domestic market and at a higher level, e-Logistics will be an important foundation of e-commerce, then international experience shows that blockchain application in modern logistics has been and will still be a preferred trend.

2. Overview of blockchain application in Logistics

In the strong development of the economy, logistics has become increasingly important due to the readiness of necessary resources to ensure the smooth flow of goods from production points to the ultimate consumer to meet customer needs. According to Jonsson & Mattsson (2005), the process of planning organizing and controlling all activities in the flow of raw materials, from raw materials to the final consumption stage and the reverse flows of produced goods to provide good service, low costs, low capital constraints and minimal environmental limitations are the central tasks of Logistics. The global Internet has dramatically changed the socio-economic face of countries. Especially, the Internet has given birth to the field of e-business including business processes spanning the entire value chain from purchasing, supply

chain management, marketing, sales, customer service and business relationships (electronic business, e-business), e-commerce is an important link of e-business, including buying or selling products electronically through online services or the Internet, technologies such as mobile commerce, electronic payment, supply chain management, Internet marketing, online transaction processing, electronic data interchange (EDI), e inventory management systems and automatic data collection have all brought about many changes in all aspects of daily life, especially for changing the operating model of enterprises, notably logistics companies.

E-Logistics, according to Joseph et al. (2004), is a supporting delivery process to fulfill online e-commerce orders. Additionally, e-Logistics involves the use of information technology and communication to support a range of logistics activities, as emphasized by Gunasekaran et al. (2007) in online models with customers (B2C) or business-to-business (B2B) interactions. Compared to traditional logistics, e-Logistics has several differences. Traditional companies focus on self-reliant logistics strategies, manually managing human resources, records and physical resources for transportation and warehousing. In contrast, e-Logistics emphasizes the operation of resource planning systems (Enterprise Resource Planning - ERP), supplier relationship management systems (Supplier Relationship Management - SRM), along with the utilization of the Internet and blockchain technology.

Blockchain is a chain-like data structure that securely stores and transmits information. It is linked together through complex cryptographic algorithms (Narayanan et al., 2016). In traditional commerce and logistics, transactions are risky as they rely solely on paper documents and face uncertainty in terms of product delivery, quality and payment. Distributed Ledger Technology (DLT), which blockchain is a part of, can be envisioned as a shared and immutable ledger that facilitates the recording of transactions and asset tracking within a business network (Iansiti & Lakhani, 2017).

Blockchain, as a chain-like technology, enables secure data transmission based on highly complex cryptographic systems, similar to an accounting ledger of a company where money is closely monitored and all transactions are recorded on a peer-to-peer network. Each block contains information about its creation time and is linked to the previous block, along with a timestamp and transaction data. Once data is accepted by the network, it becomes immutable. Blockchain is designed to resist fraud and data tampering.

Blockchain technology – a combination of 3 technology types:

- Cryptography: to ensure transparency, integrity and privacy, Blockchain technology has used public keys and hash functions.

- Peer-to-peer network: Each node in the network is considered a client and also a server to store a copy of the application.

- Game theory: All nodes participating in the system must comply with consensus rules (PoW, PoS,... protocols) and be driven by economic incentives.

Blockchain system can be divided into three main types:

Public: Anyone has right to read and write data on the Blockchain. This process of validating transactions on the Blockchain requires a lot of nodes to participate. Therefore, attacking this Blockchain system requires a huge cost and is really not feasible.

- Private: Users are only granted the right to read data and do not have the permission to write because that is reserved for a trusted third party organization. Since this is a Private Blockchain, the transaction validation time is quite fast because only a small amount of equipment is needed to validate the transaction.

- Permissioned (also known as Consortium): It is a form of Private but include some other features. It is a combination of Public and Private.

Blockchain has an advantage in Logistics because the data on blocks cannot be changed or tampered with (Ming Li et al., 2019), by applying smart contracts, approval and customs clearance can be faster and more efficient, reducing the time for goods processing at customs checkpoints. Blockchain ensures reliable data across the e-Logistics ecosystem (Iansiti & Lakhani, 2017) because the entire network contributes to data validation. Blockchain-based smart contracts are proposed contracts that can be partially or fully executed without the need for human interaction. One key feature of smart contracts is that they do not require a trusted third party (such as a trustee) to act as an intermediary between contract-signing entities - the blockchain network self-executes the contract. This can reduce conflicts between entities during value transfers and enable a higher level of transaction automation.

3. Practical application of blockchain in Logistics development in the world

Blockchain promotes the development of the logistics industry. With smart features, Blockchain application in the Logistics industry is indispensable. This is the technology that helps stir up the Logistics industry not only in the world. The application of Blockchain technology in the Logistics industry enhances the transportation process, saving time and costs through automated operations and management. When combined with transportation management software, blockchain ensures error-free transportation processes. It efficiently manages product conditions such as temperature, usage time, status… Blockchain also contributes to reducing additional costs associated with terminals, ports, as all records are publicly available, transparent and clear.

If the goal of Logistics is efficiency and cost savings, Blockchain fulfills these requirements and offers even more advantages. From speed to transparency and reliability, blockchain enables direct ordering from distributors and manufacturers, facilitating access to a wider range of sellers globally. In contrast, traditional methods often rely on mechanical processes such as fax or paper-based communication, resulting in higher costs and longer processing times. The significant development of logistics operations is therefore greatly facilitated by blockchain technology. Here are some examples of Blockchain applications in logistics development in countries with advanced supply chain services such as the United States, Germany, South Korea and China:

In the United States, there is a lot of evidence showcasing the superiority of blockchain technology in e-Logistics development, typically Blockchain in Transport Alliance (BiTA) is a forum for the Logistics industry to discuss and develop plans to implement ledger technology in transportation, BiTA is working on common standards and practices for the industry in an effort to affirm the benefits of blockchain including logistics giants such as UPS, FedEx, Uber Freight, Union Pacific Railroad and Project 44...; Chronicled is a leader in the U.S. life sciences industry with its blockchain-powered MediLedger Network that bridges the gap between trading partners, its fully decentralized ecosystem helps industries including pharmaceuticals, commodities and others keep track of every action their shipments take while ensuring complete privacy by allowing full control over data as well as sharing it without involving third party intermediaries, Chronicled combines blockchain with AI and IoT devices to automate traceability and instant approval of financial transactions within the transportation industry, Chronicled's blockchain-enabled IoT devices provide logistics companies with deeper insights into environmental conditions and custodial transfer processes, so businesses can move their products around the world safely and efficiently; Slync (Slync.io is a SaaS operations platform for global shippers and logistics providers to bring higher productivity and process efficiency through Intelligent Automation) combines blockchain and AI to provide retailers, manufacturer and supplier real-time insights into all their local and global shipments. The platform enables shippers to automate repetitive workflows, predict bottlenecks or challenges in the logistics process and operate real-time visibility and control over their transportation operations.

In the Federal Republic of Germany, Frankfurt city is a pioneering example of e-Logistics development serving e-commerce in the country, which is a global leader in logistics. Frankfurt's direction focuses on establishing a modern warehouse system covering an area of 650,200 square meters, leading the logistics industry in Germany. With an area of 40,000 square meters, Felix Waschulewski is one of the most advanced warehouses serving e-commerce in the city. It has the capability to handle up to 50,000 parcels per day, thanks to the application of blockchain (block storage) to optimize workforce and warehouse management capabilities. Another example is the Lufthansa Cargo Logistics Center in Frankfurt, which utilizes various e-tracking applications. These include eTracking, which allows easy online access to information about shipments or flight status, as well as setting alerts to monitor shipments. The eServices provide mobile device applications for locating shipments and submitting complaints. eFreight replaces traditional paper documents that have been used in the air transport industry for decades with standardized electronic messages, regulated data exchanges and optimized air cargo transport. Quick drop-off/Quick pick-up enables faster listing of shipments for quick drop-off or pick-up. These technologies enable the handling of around 80% of global air cargo volumes, leading in pharmaceuticals and other life science products that have strict requirements for time and temperature. Lufthansa Cargo is also responsible for the primary distribution of Covid-19 vaccines globally.

In South Korea, blockchain technology has gained attention since 2018 and has been widely applied in various industries such as finance, logistics, commerce and healthcare. Blockchain has contributed to the success of the e-commerce market in Seoul with its cutting-edge controlling system. LG CNS, a subsidiary of the LG Group, has implemented an AI solution that automatically categorizes packages with a 99.8% accuracy rate based on size. Efficient applications based on big data analysis provide optimized solutions for multimodal transport deployment and workforce requirements. The South Korean government has invested approximately USD 9 million to support the development of blockchain technology domestically. The application of blockchain for containers at the Busan Port, the fifth-largest seaport in the world that handles 40% of total export shipping fees, 80% of container shipping fees and 42% of South Korea's seafood production, was initiated in 2019 by the Ministry of Oceans and Fisheries and the Ministry of Science and Technology of South Korea. This project is a notable example of the application of blockchain in the development of logistics in South Korea. Initially, the process of moving containers between ships involved complex procedures with numerous steps and employees relied on a large number of paper documents, emails and container lists provided to transport receivers and planners. By keeping all parties updated through a distributed and immutable ledger, blockchain was seen as a solution to streamline and efficiently move containers by securely and transparently sharing relevant documents. Additionally, real-time quantity and quality checks can be performed with all information available on the distributed ledger at any given time.

In China, In China, a country with many of the world's largest seaports such as Shanghai Port, Shenzhen Port, Ningbo-Zhoushan Port and Hong Kong Port, the adoption of blockchain technology has received significant attention from the government. China launched the Blockchain-based Service Network (BSN) in April 2020 as a global framework to deploy and operate a variety of blockchain applications. BSN is considered the infrastructure technology for interconnecting China entirely. If successful, it can provide a convenient way to share data, value and digital assets. The use of blockchain to enhance traceability in logistics is one of the emerging trends in China's third-party logistics market. Blockchain is a tamper-proof sequential information chain that records events and transactions. The blockchain system consists of records protected by cryptography and multiple users can access or add data to the chain without altering or deleting existing information. By utilizing blockchain, the need for a central authority to maintain records is

eliminated. The technology is highly regarded in China for enhancing security, reducing fraud, automating data flow, improving traceability and tracking capabilities, reducing paperwork and increasing transparency.

In general, Blockchain solutions will create documentation and record the transfer of all goods used throughout a shipment. Every time a pallet moves, a container is filled or a delivery attempt is made, it generates a clear record. Blockchain also records transactions and can store digital copies of important paperwork such as purchase orders, bills of lading and customs documents, enabling rapid updates. This allows carriers to keep shippers and recipients informed of any delays in the movement of goods or changes in expected delivery times during the entire transportation process. Blockchain records temperature zones for cold chain operations, providing not only a digital record but also improving the safe handling of temperature-sensitive materials. It reduces the risk of bacterial contamination or foodborne illnesses. Additionally, Blockchain establishes a digital link between tracking software and hardware tools such as serial numbers, barcodes, RFID tags and the actual products. The application of Blockchain in the development of e-Logistics extends beyond individual companies or localities. It has become a national-level strategy in many advanced logistics nations. The implementation of Blockchain technology has the potential to revolutionize the logistics industry, enhancing transparency, security, efficiency and traceability throughout the supply chain.

4. Some recommendations for Vietnam

Through an overview of Blockchain and Blockchain application in logistics development in some countries with developed e-logistics services such as the United States, Germany, South Korea, China, this report provides some recommendations for Vietnam, specifically:

Firstly, there needs to be a priority given to the application of Blockchain, specifically in Logistics, in the national logistics development strategy. In practice, depending on their capacity and resources, each company may have different levels of e-Logistics implementation, ranging from (1) self-provided logistics, (2) partial logistics service outsourcing, (3) fully outsourced logistics, (4) providing comprehensive logistics services, to (5) e-Logistics on an e-commerce platform. Each level of Logistics will correspond to a corresponding level of Blockchain application. Although Blockchain initially requires significant investment, the benefits it brings in terms of connectivity, cost savings, transparency and efficiency in logistics services are substantial and practical. The application of Blockchain in e-Logistics is no longer an issue limited to individual companies or localities; it needs to become a national strategy.

Next, it is necessary to focus on the development of logistics infrastructure, where information technology infrastructure serves as the foundation for Blockchain development. The logistics infrastructure (intelligent transportation systems for maritime, river, road, rail, air transport, warehouse systems, etc.) is a prerequisite for e-Logistics. The information technology infrastructure (communication networks, transmission systems, computing devices, network connectivity devices, security, safety and auxiliary equipment, internet technology) is the foundation for e-commerce development and provides sufficient conditions for Blockchain implementation. Strong and corresponding logistics and information technology infrastructures are the foundation for robust Blockchain and e-Logistics applications. It is not possible to effectively implement Blockchain without a solid foundation in these areas.

At the same time, investment in developing e-Logistics system (e-Logistics system) is urgent. In order to develop e-Logistics, each chain in the system needs to be modernized such as e-banking system, e-customs, manufacturers, warehouses, distributors, courier technology, this requires determination and

high synchronization of all levels, industries and enterprises, it is not easy to implement in a short time without the determination to invest as well as support resources from the State.

Finally, it is necessary to create mechanisms, policies and environment that anticipate the application of new technologies in the logistics industry in general. In the global era of the Internet and the digital economy, it is crucial to take proactive steps in adopting new technologies rather than following a sequential roadmap. To stay ahead in technology adoption, specific measures need to be implemented, such as a technology-driven logistics strategy, enhancing the legal framework for logistics, establishing a fund to support the early adoption of e-Logistics technology. Additionally, it is important to strengthen international cooperation and globalize the logistics economy in Vietnam to leverage more robust resources for development.

5. Conclusion

Blockchain today has gone beyond its original blockchain function to become a prerequisite application in modern logistics, it is an effective hand in logistics processes and activities (Gunasekaran et al., 2007). Blockchain has brought great changes along with outstanding productivity for proven logistics activities in the world. In the era of the Internet and e-commerce, where online business models are fundamentally reshaping the landscape of commodity economy, the application of Blockchain in logistics is increasingly asserting its vital role in the economy. In this trend, it is crucial to pay special attention to the application of Blockchain in the strategic investment and development of logistics, particularly in e-Logistics, which is becoming a leading sector in the country's economy.

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FACTORS AFFECTING THE DEVELOPMENT OF THE DIGITAL ECONOMY IN VIETNAM

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Abstract

The objective of this paper is to assess the factors affecting the development of the digital economy in Vietnam. The data used in the article was collected from 250 samples. The study used quantitative analysis methods, Cronbach's Alpha reliability test, exploratory factor analysis (EFA), pearson correlation test, linear regression analysis. The research results show that there are 6 factors affecting the digital economy, including: Legal environment, human resources, research & development, digital infrastructure, business environment and information security. In particular, the factor "Ensuring network security" has the strongest impact and the factor "Research and development" has the weakest impact. This research result contributes to building knowledge in the digital economy and identifying the relationship of factors influencing the development of the digital economy in Vietnam. From the research results, the author has proposed policy implications to raise the level of digital economy development in Vietnam in the future.

Keyword: *Regression analysis; Digital economy development; digital infrastructure digital financial service.*

Introduction

Since the third global industrial revolution in the 1970s brought the popularity of computers and the Internet to the world, new economic forms based on computer technology and Internet communication technology began to emerge [1]. Since the twenty-first century, computer technology and Internet technology have developed further, and a series of high-tech industrial chains focused on the Internet, such as big data, artificial intelligence, cloud computing, Internet of Things and blockchain, have emerged. In recent years, these high-tech industries have gradually penetrated many traditional industries, bringing subversive changes and good development prospects to many traditional industries [2–4]. Digital transformation has a profound impact covering all sectors and socio-economic fields, increasing labor productivity, transforming operating and business models towards innovation, improving national competitiveness. "Digital economy", a core concept for future development [5]. The extensive application of information technology (IT) in all activities of the economy in a more optimal way has formed a borderless digital economy, bringing high value. This is also an inevitable trend of the global economy in the context of Industry 4.0 and traditional economic models are gradually saturated. The digital economy not only creates faster scale and growth, but also causes economies to change their production methods. Therefore, there is a need for strategic solutions to promote the sustainable development of the digital economy in Vietnam.

Promoting national digital transformation, digital economy and digital society development to create breakthroughs to improve productivity, quality, efficiency and competitiveness of the economy is one of the major views of the Party in the national development strategy. Recognizing the importance of digital

economy to the country's socio-economic development. The digital economy accounts for about 20% of GDP and by 2030, the digital economy accounts for over 30% of GDP [6].Continue to strongly innovate thinking, build and synchronously complete the country's sustainable development institutions; comprehensively and synchronously complete the socialist-oriented market economy development institution; strongly innovate the growth model, restructure the economy, industrialize and modernize the country, focus on innovation, promote national digital transformation, develop the digital economy and digital society [7]. However, the digital economy in Vietnam still reveals limitations such as: digital infrastructure is not synchronous; e-commerce and e-payments are not widespread; sharing economy development is not yet widespread; the startup and innovation ecosystem is not strong; The national digital transformation process is still slow and inactive. The reason is that the institutional and legal environment are not suitable; the policy has many shortcomings; human resources have not met 3 requirements; science - technology and innovation are not really the driving force of development; Ensuring network security remains challenging.

2. Rationale

2.1. Concept and fields of digital economy

The term "digital economy" first appeared in Negroponte's paper "Bits and Atoms" (1994). At the same time, Negroponte was the first scholar to assert that the basis of social production has undergone a transformation from processing atoms to bits, thereby outlining the salient features of the virtual reality business model [8]. This concept clearly states the scope of the core digital economy in the field of information and communication technology, the narrow scope of the Digital Economy and the wide scope of the Digital Economy. In which: (1) Core digital economy includes the production of hardware, information services, software and information and communication technology (ICT) consulting; (2) Digital economy adds digital services and platform economy to the core digital economy. Moreover, the narrow digital economy also includes part of the Sharing Economy; (3) Digital economy complements e-business, e-commerce, industry 4.0, precision agriculture, algorithmic economy, the rest of the sharing economy, the economy is loosely linked to the digital economy. The digital economy is a part of economic output derived solely or primarily from digital technologies with a business model based on digital goods or services [9]. Digital economy is the fusion of a number of common technologies and socio-economic activities through the Internet and related technologies including technical infrastructure (broadband lines and operations, routers), devices (computers, smartphones), etc applications (Google, Salesforce) and functions (Internet of Things, data analytics, cloud computing) [10]

2.2. Research overview

The D'Souza & Williams (2017) study provided a broad picture of the digital economy. They have noticed that digital-cloud computing, the Internet of Things (IoT), advanced robotics, big data analytics, AI and machine learning, social media, 3D printing, augmented reality, virtual reality, cryptocurrencies and distributed ledger are changing the way the economy works [11]. Research by N. D. Nam and U. T. N. Lan (2022) used quantitative, actional methods to measure the influence of factors on digital economy development. The research results have designed a research model that proposes 6 factors that positively affect the development of the digital economy including: State Policy; Human capital; Research & development and innovation; Digital infrastructure; Business environment and Information Security, in which the development of the digital economy is most strongly affected by the Digital Infrastructure variable, the weakest impact is the variable Business environment On the other hand, research contributes to high academic content, provide practical implications[12]. Research by Rahni (2018) has identified three factors that influence the development of the digital economy in the West of Sumatra, Indonesia: digital

transactions; Digital entrepreneurs and digital marketplaces. where the author has shown that the digital transaction variable has the strongest impact[13], investment in R&D and innovation shows that the ratio of investment to R&D in GDP is important [14]. Improving the predictable, minimalist, consistent, and straightforward regulatory environment in terms of public access to information and piracy is fundamental to the digital economy [15]. Research by Zhang & colleagues (2021), Zhong & Mao (2020) has shown 6 factors that have a strong impact and make differences between economic sectors in the development of the digital economy, including: economic development conditions, industrial structure, human capital, innovation capacity, IT infrastructure systems and information use [16], [17].

In general, the above studies have focused on an overview of the development of the digital economy, factors affecting the development of the digital economy in countries. However, no research has addressed the factors affecting the growth and development of the digital economy in Vietnam. The author chooses to analyze in this study

2.3. Research models and hypotheses

2.3.1 Research models

From the theoretical basis and overview of previous studies, the author proposes a research model of factors affecting digital economy development in Vietnam as follows: Legal environment, human resources, research & development, digital infrastructure, business environment, ensure network security.

2.3.2. Research hypothesis

In essence, the digital economy is a combination of traditional economy and technology, so it is influenced by many factors. In order to achieve the research objectives, the author summarizes an overview of relevant previous research works explaining important factors affecting the development of the digital economy in Vietnam, proposing the following 6 research hypotheses: (1) Legal environment, (2) Human resources; (3) Research and development; (4) Digital infrastructure; (5) Business environment; (6) Ensure safety.

Legal environment

Legal is the impact from the external environment to accelerate the construction and growth of sectors and sectors in the economy and is an important decisive factor for the development of the digital economy. Complete the legal system, create coherent mechanisms and feasible policies to build a digital economy towards sustainable development. The first hypothesis to emerge in this study.

Hypothesis H1: The regulatory environment affecting digital economy development

Human Resources:

Regions with high human resources can promote information and traditional technologies and attract a larger workforce due to positive external factors[18]. It is a key factor to ensure the efficiency of economic growth [19]. The second hypothesis proposed in this study

Hypothesis H2: Human resources affect digital economy development

Research and development

Research and development are key to digital economy development, especially in developed countries [20]. According to endogenous growth theory, research and development are the core factors promoting economic growth, development, scientific and technological progres [21]. The third hypothesis proposed in this study Hypothesis

H3: Research and development affect digital economy development

Digital infrastructure

To remain competitive in the global digital economy. Digital infrastructure is the foundation for all sectors of the industry, creating a solid basis for the production value chain in the context of digital transformation. Therefore, improving digital infrastructure is an important key to expanding opportunities for strong development of the digital economy, linking with opportunities to optimize production, improve service quality and create job opportunities for more workers [22].. The fourth hypothesis proposed in this study

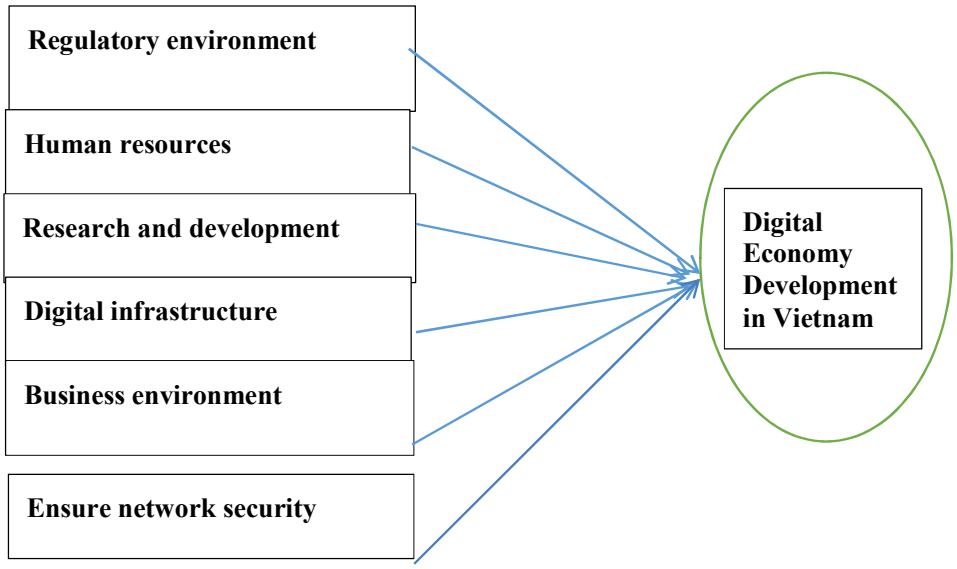
Hypothesis H4: Digital infrastructure affects digital economy development

Business environment

Factors of the business environment related to access to financial resources, human resources and infrastructure as well as the availability of conditions for business establishment and development [23]. Fiscal policy, monetary policy, and exchange rate have a clear positive impact on digital economy growth. The fifth hypothesis proposed in this study

Hypothesis H5: The business environment affects digital economy development

Figure 1: **Research model**



Security Assurance

Cybersecurity is one of the most important components determining the safety of the economy and general safety at all levels [24], the phenomenon of information leakage seriously affects the operations of businesses, so it is necessary to strengthen information security The sixth hypothesis is proposed in this study

In this study, all observed variables measure the factors influencing economic development

The number of cells in Vietnam used in the study is the Likert scale of 5 levels, these details are evaluated on a scale of 1-5. In which 1 is completely disagreeable, 2 is disagree, 3 is normal, 4 is agree, 5 is completely agree and shows that there are 5 groups of potential scales (with a total of 25 observed variables) affecting digital economy development (1 criterion scale represents variables dependent on digital economy development)

3. Research methodology

To assess the factors affecting digital economy development in Vietnam, the study was conducted in two steps: Qualitative research to develop survey questionnaires; Quantitative research to collect, analyze survey data, estimate and test research models.

3.1 Data sources

3.1.1. Secondary figures

Data collected from various information sources such as books, journal articles, proceedings, scientific conferences, research works have been published at home and abroad related to research issues.

3.1.2. Primary data

The data used for this study was on the exploratory factor analysis model. To achieve a reliable estimate for this method, the sample usually needs to be at least 50 in size, preferably 100, and the ratio of observations (items) 5:1, meaning that 1 measurement variable needs a minimum of 5 observations, preferably 10:1 meaning that 1 measurement variable needs a minimum of 10 observations. Thus, this study has 24 measurement variables, reasoning a ratio of 10:1, the sample size is 24 x 10 = 240 and is larger than the minimum sample size [25].

3.2. Analysis methods

Assessing the reliability of metrics using Cronbach's Alpha confidence coefficient this method allows to test the reliability of the scale by analyzing the reliability of Cronbach's Alpha coefficient is to determine the correlation of variables. The requirements for the scale to be accepted are variables with a correlation between the item and the sum greater than 0.3 and a Cronbach Alpha coefficient greater than 0.6 [26]. For EFA analysis, to meet the criteria for probe factor analysis, the sample size must be at least 5 times larger than the observed number [27].In this study, the sample size used was larger than the required sample size. Probing factor analysis (EFA) was performed with the main component extraction, the Varimax rotation matrix. However, before extracting factors, some testing should be used to assess the suitability of respondent data for factor analysis. These tests include Kaiser-Meyer-Olkin sampling completeness measurement (KMO) and Bartlett's Spherical Degree Test [18]. The KMO index ranges from 0 to 1, with 0.50 considered suitable for factor analysis. Bartlett's spherical degree test is significant ($p<.05$) for factor analysis accordingly.[19] The study used questionnaire-based data from 250 samples. The size and reliability of the observed variable are evaluated by Cronbach's Alpha coefficient and probe factor (EFA) analysis. The Likert scale with a value range of 1÷5 is used to measure respondents' feelings about factors influencing digital economy development. The proposed regression model is: architect = $\beta 0+ \beta 1MT + \beta 2NL + \beta 3RD + \beta 4HT + \beta 5KD + \beta 6BD$ (In which, architect is a dependent variable, representing Digital Economy Development in Vietnam; independent variables: Legal Environment, Human Resources, Research and Development, Digital Infrastructure, Business Environment, Ensuring Cybersecurity).

4. Research results and discussion

4.1. The study sample situation

The study surveyed 250 samples, with 36.8% female sex. The age of the survey ranged from 20 to 50, of which, the age group of 36-40 years accounted for 57.6% and 39.2% was 41-50. Education level: Undergraduate level accounts for 82%, postgraduate accounts for 14.4%. In terms of income, the majority have high incomes.

4.2. Reliability testing for independent variables and dependent margins

The results of Cronbach's Alpha reliability test show that 6 scale components for independent variables affect digital economy development, all achieve very good reliability, all Cronbach's Alpha value

coefficients, Total variable correlation greater than 0.4; the scale of representative variables: Legal environment, Human resources, Research and development, Technical infrastructure, Business environment, Cybersecurity assurance is 0.851, respectively; 0.823; 0.791; 0.867; 0.852, 0.796, 0.793. The scale reliability test results for the dependent variable showed that the observations all had a total variable correlation coefficient greater than 0.4 and Cronbach's Alpha confidence coefficient of 0.928, scales that satisfied the reliability assessment requirements to ensure use for subsequent analyses.

4.3. EFA Discovery Factor Analysis

4.3.1. EFA discovery analysis results for independent variables

The results of the survey factor analysis (EFA) were conducted with 25 observational variables for 6 independent factors affecting the dependent variable show that KMO = 0.886 satisfies condition 0.5<KMO<1 Sig test = 0.000 <0.005 of the Barttle test demonstrating that the observed variables are correlated in the overall cumulative frequency of the extracted variance value of 73.86% > 50% and the eigenvalue = 1.012>1, the study identified 6 factors influencing These factors explain 73.86% of the data variation of the 25 observed variables participating in EFA, all of which have factor load factors greater than 0.5. As such, the model using exploratory factor analysis is appropriate for actual data.

4.3.2. EFA discovery analysis results for dependent variables

The EFA analysis results for the dependent variable show that KMO = 0.861 test is suitable because it is within the range satisfying the condition 0.5<KMO<1 test Sig. = 0.000 <0.005 of the test Barttle There is one factor quoted at Eigenvalue equal to 4.433 > 1. This factor explains 73,880% > 50% meet the data variability criteria of the 6 observed variables participating in EFA.

4.4. Pearson's correlation analysis

Before linear regression analysis, the study should consider the degree of correlation between the observed variables to check for multidirectionality. Thus, the correlation matrix is calculated. The results of the Pearson correlation analysis between the independent variables and the dependent variable all had values Sig = 0.000< 0.05, which showed that the tests were statistically significant. The result of the Pearson correlation between 6 independent variables MT, NL, RD, HT, KD, AN and the dependent variable is less than 0.05. This means that the independent and dependent variables have a linear relationship. Together, the correlation coefficient between independent pairs of variables is less than 0.5, indicating that the likelihood of multivariate is very low.

Table 2. Correlation coefficient

		Regulatory environment	Human resources	Research and development	Infrastructure	Business environment	Ensure network security	Digital economy
Regulatory environment	correlation coefficient Pearson	1	.772**	.678**	.734**	.745**	.729**	.868**
	Sig. (2-tailed)		.000	.000	.000	.000	.000	.000
Human resources	correlation coefficient Pearson	.772**	1	.720**	.794**	.811**	.697**	.880**
	Sig. (2-tailed)	.000		.000	.000	.000	.000	.000
Research and development	correlation coefficient Pearson	.678**	.720**	1	.757**	.763**	.750**	.853**
	Sig. (2-tailed)	.000	.000		.000	.000	.000	.000

		Regulatory environment	Human resources	Research and development	Infrastructure	Business environment	Ensure network security	Digital economy
Infrastructure	correlation coefficient Pearson	.734**	.794**	.757**	1	.851**	.769**	.903**
	Sig. (2-tailed)	.000	.000	.000		.000	.000	.000
Business environment	correlation coefficient Pearson	.745**	.811**	.763**	.851**	1	.740**	.905**
	Sig. (2-tailed)	.000	.000	.000	.000		.000	.000
Ensure network security	correlation coefficient Pearson	.729**	.697**	.750**	.769**	.740**	1	.879**
	Sig. (2-tailed)	.000	.000	.000	.000	.000		.000
Digital economy	correlation coefficient Pearson	.868**	.880**	.853**	.903**	.905**	.879**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	

**. Correlation is significant at the 0.01 level (2-tailed).

b. Listwise N=250

4.5. Multivariate regression analysis

The results of regression analysis are an important step in identifying independent factors affecting dependencies. implemented by the author using the input method with SPSS 22 software. The regression results showed that 6 variables were statistically significant at 5%. Regulatory (MT), Human Resources (NL), Research and Development (RD), Technical Infrastructure (HT), Business Environment (KD), Cybersecurity Assurance (BD) reflect their impact on digital economy development. All variables have a positive relationship with the dependent variable. shows that Ensuring cybersecurity has the strongest impact on digital economy development. When the factor adds and other factors do not change. The revised R-factor is 0.978, showing that the model's variables explain 97.8% of the impact on the digital economy in Vietnam. The Durbin Watson coefficient = 1.645< 4 and the VIF coefficient is less than 10, indicating that the model has no first-order sequence correlation.

Table 3. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.989[a]	.978	.978	.060	1.645

a. Predictors: (Hăng sô), BD, NL, RD, MT, HT, KD

b. Dependent Variable: Digital Economy

The results of ANOVA analysis show that the statistical value F = 1806.376 with a value Sig = 0.000<0.005 is used to verify the suitability of the linear regression model as suitable for the data set and all variables are acceptable.

ANOVA[a]						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	Regression	39.398	6	6.566	1806.376	.000[b]
	Residual	.883	243	.004		
	Total	40.282	249			
a. Dependent Variable: KTS						
b. Predictors: (Constant), BD, NL, RD, MT, HT, KD						

Table 5. Regression analysis

Model		Unnormalized regression coefficient		Normalized regression coefficient	t	Sig	Collinearity statistics	
		B	Std. Error	Beta			Acceptance	VIF
1	(Constant)	-.089	.046		-1.960	.051		
	MT	.172	.014	.205	12.198	.000	.321	3.115
	NL	.156	.018	.164	8.758	.000	.257	3.884
	RD	.131	.015	.147	8.781	.000	.324	3.090
	HT	.161	.020	.169	8.172	.000	.211	4.732
	KD	.188	.021	.189	9.049	.000	.206	4.855
	BD	.211	.015	.236	13.805	.000	.309	3.236

a. Dependent Variable:Digital Economy

We have the following metabolic regression equation:

KTS =0,205* MT+ 0,164*NL+ 0,147*RD+ 0,169+0,189*KD+0,236*BD+ 0,46.

From the regression model results, it is possible to assess the degree of impact of 6 independent variables. The VIF coefficients of the dependent variable in the model are all less than 10, so it shows that there is no existence of linear multi-additiveness. The mean value = 7.06E is close to 0, the standard difference is 0.988 (close to 1) the residual distribution is approximately standard. We therefore conclude that the error of the regression model obeys the normal distribution law. The Normal probability plot of the digital economy in Vietnam shows that observations do not diverge far from the expected straight line. Percentile points in the distribution of concentrated residual. Thus, the assumption of the normative distribution of the residual is not violated. The regression model of this study does not suffer from variance. Therefore, the estimated results for the study are accurate. The percentile points in the distribution of the residual are concentrated into 1 diagonal, such that the assumption of the distribution of the excess is not violated . The SCATTER diagram shows the allocated normalized excess centered around the zero toss line, thus assuming linear relations are not violated.

4.6. Discussion

This study has not yet met expectations, there are still limited data due to the use of stratified sampling method, so the survey scope is still limited, the survey sample is not large enough, so the results are not guaranteed to be broad. The results of testing the research model show that there are 6 factors proposed by the model that have positively impacted on the development of the digital economy in Vietnam, including: Legal environment, Human resources, Research and development, Technical infrastructure, Business environment, Ensuring network security. This result is consistent with the study of N. D. Nam &; U.T.N. Lan (2022). As well as previous studies. However, there are some particularly noteworthy points in this study that highlight that the Cybersecurity Assurance factor has the strongest impact on digital economy development in Vietnam. Therefore, the author proposes to expand the research topic with a large enough survey sample to represent each section of citizens. Vietnam has just had an idea of digital economy development, but it does not yet have a digital economy up to international standards. There is much debate about evaluating efforts to approach digital economy development. The study has many breakthroughs looking for pillars affecting the development of digital economy development models from previous researchers.

5. Policy conclusions and implications

5.1. Conclusion:

The study carried out a quantitative analysis method, the study results have 6 hypotheses accepted in the study model. Relationships between the Regulatory Environment(0.205); Human resources (0.164);

Research and Development (0.147); Technical infrastructure(0.169); Business environment (0.189); The cybersecurity guarantee (0.236) has a positive impact on digital economy development in Vietnam. In which, the cybersecurity factor has the strongest impact, the Research and Development factor has the weakest impact on digital economy development in Vietnam.

Research contributes several practical and theoretical implications . The first implies the theory of complementarity and the development of the theoretical basis of the digital economy in some countries. Second, practical implications consider factors affecting the development of the digital economy in Vietnam The research results have provided academic and practical implications for the Government, policy makers and business producers to identify decisive factors for the development of the digital economy in Vietnam. Since then, the author has proposed a number of solutions to improve the level of digital economy development in Vietnam with a vision to 2045.

5.2. Policy implications

From the results of quantitative research on factors affecting the digital economy in Vietnam, the author proposes some governance implications for the Government and policy makers to. **First,** the cyberinformation security strategy plays an important role in digital economy development, data storage and processing to ensure information safety and security in the digital environment, protect and strengthen important technical infrastructure, supply chains as well as digital ecosystems. Develop a strategic plan on content to identify risks and challenges causing information insecurity.

Second, complete institutions and create a legal environment to promote digital economy development. Institutions need to be flexibly adjusted to update: New technologies, new products, new services, new models. Institutions and policies are the decisive factor, not the technology. The institutional and legal framework plays an important role in the digitization process. Reasonable policies on copyright, intellectual property rights and liberalization of the scientific research market will create a premise for breakthroughs for Vietnam to develop the digital economy. Adjust legal regulations for industries that are having many new business models such as e-commerce, digital banking, digital finance. Adjusting and supplementing the system of legal documents on information and communication technology. Building management mechanisms suitable to the digital business environment, adjusting new relationships arising in the process of digital economy development.

Third, the business environment needs to recognize the important role of digital transformation activities towards increasing productivity and business efficiency, changing thinking and perception in innovation, creativity and application of digital business models. application of science and technology, especially information technology to production and business activities.

Fourth, develop digital infrastructure, promote the use of IPv6 advanced generation internet protocol, access to high-speed internet, popularize cloud computing, disburse digital infrastructure investment projects towards synchronous infrastructure development. Ensure e-commerce activities, especially electronic payment systems.

Fifth, promote training and improve the quality of digital human resources, support forms of cooperation between domestic and international business organizations and schools and scientific research institutes to train digital transformation human resources. Building a network connecting experts with research scientists to share knowledge, digital transformation technology activities. The human resource training program aims to accelerate IT socialization. Encourage businesses to implement short-term training programs on digital transformation skills for employees

Sixth, promote activities to attract capital investment in R&D activities in the field of information technology and digital technology.

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