Journal of Business Management and Economic Development
E-ISSN 2986-9072 P-ISSN 3031-9269
Volume 2 Issue 03, September 2024, Pp. 1413-1439
DOI: https://doi.org/10.59653/jbmed.v2i03.1105

The state's role of digital economy and economic innovation in Vietnam

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Received: 15-07-2024 *Reviewed: 30-07-2024* *Accepted: 15-08-2024*

Abstract

This study investigates the role of the Vietnamese government in fostering the digital economy and economic innovation. Utilizing linear regression analysis through SPSS, the research analyzes data from various reliable sources to examine the intricate relationship between digital economy advancements and economic innovation trends, highlighting the mutual reinforcement between these factors. Key findings indicate that the government's involvement in establishing digital infrastructure, developing human resources, and creating supportive legal frameworks has significantly impacted the development of the digital economy. The integration of new technologies such as AI, IoT, and blockchain is pivotal, not only for generating new products and services but also for enhancing existing business processes, thereby driving digital economic growth. Human resources are crucial, necessitating government policies that facilitate continuous skill updates and support workforce adaptation to technological changes. Furthermore, government policies promoting business innovation through financial support and tax incentives are essential for maintaining competitiveness and economic development. Digital transformation, supported by robust ICT infrastructure and legal frameworks, is becoming an inevitable trend with profound impacts across various sectors. Environmental considerations and social welfare in the context of Industry 4.0 are also critical, requiring policies that balance technological advancements with sustainable practices and labor market adaptations. The study concludes that the Vietnamese government plays a vital role in shaping a conducive environment for the digital economy and economic innovation, emphasizing the importance of collaborative efforts between public and private sectors. These findings underscore the need for continued investment in digital infrastructure, education, and supportive policies to maximize societal and economic benefits.

Keywords: Industrial Revolution 4.0, Effectiveness of State, Innovation, Sustainable Development

Introduction

The digital economy and current economic innovation trends have a close relationship, promoting each other in the process of developing and transforming the global economy. Sectors such as e-commerce, financial technology (fintech), digital media and artificial intelligence (AI) have opened new opportunities for businesses and consumers, while promoting innovation. development of the global economy (OECD, 2019). New technologies such as AI, IoT and blockchain not only create new products and services but also improve existing production and business processes, thereby promoting digital economic development (Brynjolfsson & McAfee, 2014; Manyika et al., 2015; Tapscott & Tapscott, 2016).

First, human resources play a key role in this process. With profound changes driven by digital technology, automation and AI, the way businesses recruit, train and manage employees must also change. The state needs to create a favorable legal and policy environment to support the workforce in continuously updating new skills (Mosca, 2020; Yu & Jinajun, 2020). Specifically, updating education and training programs, data protection and workers' rights in a digital environment is essential (OECD, 2016; Personal Data Protection Commission, 2018). Furthermore, support policies such as unemployment insurance, job transition support and social security programs need to be implemented effectively to ensure labor security and help workers adapt to the technological change (Kochetkov, Zabavina, & Gafarov, 2021; Laker, 2021).

Innovation in businesses is a core factor in promoting economic development and maintaining competitiveness. The state needs to create a favorable environment for innovation through policies and financial support (World Bank, 2021). A stable and transparent legal framework is a prerequisite for businesses to easily access and deploy new technology. Tax incentives and financial support policies such as low-interest loans and venture capital funds are also very important to support businesses, especially small and medium-sized enterprises, in investing in innovation projects (OECD, 2020). Investing in education and training of high-quality human resources, along with cooperation between businesses and research institutes and universities, will promote technology transfer and research applied into practice (Grabowska & Saniuk, 2022).

Besides, digital transformation is increasingly becoming an inevitable and strong trend, with profound effects on all areas of life. Information and communications technology (ICT) plays an important role in promoting digital transformation (Schallmo & Williams, 2018). The state needs to invest heavily in ICT infrastructure to ensure that public services are accessible quickly and effectively, while also facilitating the development of the digital economy. Policies and legal frameworks supporting digital transformation need to be established to protect people's rights and personal information, as well as promote a smooth digital transformation process (Alvarenga et al., 2020). In particular, training and enhancing the digital skills of the workforce is necessary to ensure they can effectively use new technologies (Mergel et al., 2019).

In addition, environmental factors also need to be considered in the context of the digital economy and the 4.0 industrial revolution. Advanced technologies such as AI, cloud

computing, robotics, big data and blockchain have a major impact on the environment. AI helps manufacturing companies manage risks and make decisions through error detection, diverse data synthesis and early warning, thereby moving towards green production (Cioffi et al., 2020; Mao et al., 2019). Cloud computing helps reduce operational costs and physical resources, while promoting business opportunities (Chang et al., 2019). The application of robots in industry not only reduces production costs but also improves efficiency and promotes flexible production, while reducing electricity, gas, water consumption and CO2 emissions (Gadaleta et al., 2019). Blockchain technology supports sustainable production models by processing, monitoring and storing data on polluting activities, supporting management decision-making (Parmentola et al., 2022; Mora et al., 2022; Mora et al. al., 2021).

Finally, social welfare in the context of Industry 4.0 is an important issue that needs to be assessed. Industry 4.0 promises many benefits for the economy and society, but also raises concerns about negative impacts, especially on employment. The rise of machine learning, robotics, and digitalization could eliminate jobs at every skill level, leading to job losses and weakening the fundamentals of work and society (Brynjolfsson & McAfee, 2014). Industry 4.0 will also affect international trade and restructure global value chains (Tjahjono et al., 2017). The state needs to establish policies and legal frameworks to promote the development and application of new technology, while ensuring that labor and social welfare policies are adapted to changes in the labor market brought about by Industry 4.0 (Piketty, 2014). Retraining and upgrading the skills of the workforce, protecting workers' rights and ensuring fairness in the distribution of benefits from technological development are important tasks of the state (Joung et al., 2013; Khakurel et al., 2018).

In general, in the context of the digital economy and current economic innovation trends, the state needs to play an important role in promoting and managing influencing factors such as human resources and business innovation, digital transformation, environment and social welfare. Establishing supportive policies, investing in digital infrastructure and education, protecting worker rights, and promoting collaboration between the public and private sectors will help ensure that these changes take place. bringing maximum benefits to society and the economy.

The Vietnamese government plays an important role in promoting the digital economy through promulgating policies and investing in technology infrastructure. The Government has ensured its role in managing and regulating the digital economy by promulgating supporting laws and policies, creating a favorable legal environment and encouraging innovation (Pham Ngoc Quang, 2009; People's Army Newspaper, 2021). Furthermore, the government invests heavily in digital infrastructure and information technology, creating conditions for businesses to develop and improve competitiveness (Vocational Education Research Institute, 2022). Programs such as SMEDx have significantly supported small and medium-sized enterprises in digital transformation (Ministry of Information and Communications, 2022). The government also focuses on investing in education and training of human resources to support the sustainable development of the digital economy (State Management Journal, 2022). Thanks to these efforts, the state has created a favorable environment for the development of new business

models and promoted economic growth (Pham Ngoc Quang, 2009; People's Army Newspaper, 2021; Institute for Research Vocational Education Research, 2022).

To study the role of the state, especially the Vietnamese Government, in the interrelationship between the digital economy and current economic innovation trends, we can apply qualitative and quantitative methods through SPSS software. Qualitative methods will focus on collecting and analyzing data from documentary sources, scientific articles, and expert interviews, with special emphasis on the policies and measures of the Vietnamese Government in promoting the digital economy and economic innovation. This includes classifying and coding data to identify key topics such as startup support programs, investment in technology, and legal regulations related to the digital economy in Vietnam.

The quantitative method, in contrast, will use statistical tools in SPSS to process and analyze numerical data related to the policies and measures of the Vietnamese Government. We will collect data from surveys or domestic economic databases, then use analyzes such as linear regression and correlation analysis to determine the relationship and level of influence. The impact of state policies on the development of the digital economy and economic innovation in Vietnam. Results from both of these methods will provide a more comprehensive and in-depth view of the role of the Vietnamese Government in regulating, supporting, and promoting the digital economy as well as economic innovation trends. in the modern economic context.

Literature Review

Digital economy and current economic innovation trends

The development of the digital economy and contemporary economic innovation trends are closely linked, supporting and promoting each other in the process of change and development of the global economy. The digital economy, with prominent areas such as e-commerce, fintech, digital media and AI, has created many new opportunities for both businesses and consumers, while contributing to the growth of world economy (OECD, 2019). Advanced technologies such as AI, IoT and blockchain not only create breakthrough products and services but also significantly improve existing production processes and business operations, thereby creating momentum for strong development of the digital economy (Brynjolfsson & McAfee, 2014; Manyika et al., 2015; Tapscott & Tapscott, 2016). Furthermore, the digital economy creates a favorable environment for innovation and entrepreneurship, providing digital tools and platforms that help new businesses easily access global markets (Varian, 2010; OECD, 2019). The development of technologies such as fintech has changed the way financial services are provided, creating favorable conditions for startups (Schwab, 2016). In addition, the digital economy also promotes innovation in market structures and business models, allowing businesses to test and deploy new business models such as data-based business models and business models. platform (Brynjolfsson & McAfee, 2017).

The development of the digital economy has changed the way of work and social interaction. Technologies such as AI and IoT not only improve work efficiency but also create

flexible working methods, allowing workers to work remotely and connect with colleagues globally (Schwab, 2016). However, this also poses new challenges related to security and privacy, requiring innovation in management and policy (Cohen, 2016). In general, the relationship between the digital economy and current economic innovation trends is mutually supportive, in which technological innovations promote the development of the digital economy, and vice versa, the digital economy creating platforms and opportunities for economic innovation (Kane et al., 2015; Rifkin, 2011).

Factors affecting the role of the state in the digital economic context and current economic innovation trends

Human resources for the digital economy

In the context of the digital economy and the 4.0 industrial revolution, the role of the state in directing and supporting human resource development becomes extremely important. Factors such as digital technology, automation and artificial intelligence (AI) have profoundly changed the way businesses recruit, train and manage employees, while requiring the workforce to continuously update new skills to stay competitive (Mosca, 2020; Yu & Jinajun, 2020). The state needs to create a favorable legal and policy environment, including updating education and training programs, data protection and workers' rights in a digital environment (OECD, 2016; Personal Data Protection Commission, 2018). Specifically, digital transformation in human resource management (HRM) has created many opportunities as well as challenges. Technologies such as AI and IoT not only improve work performance but also help employees improve their skills and meet the increasing demands of the digital labor market. However, this also places high demands on adaptation and continuous learning on the part of employees. These technologies have changed the way employees are recruited, trained and evaluated, helping HRM become more flexible and effective in serving the internal needs of businesses (Boudreau & Strategy, 2015). The state needs to promote the combination of people and technology instead of pitting them against each other. Support policies such as unemployment insurance, job transition support and social security programs need to be implemented effectively to ensure labor security and help workers adapt to technological change. This not only helps protect the rights of workers but also encourages them to learn and develop new skills to suit the requirements of the digital labor market (Kochetkov, Zabavina, & Gafarov, 2021; Laker, 2021).

The development of the digital economy has created many new opportunities for workers, including increasing the ability to work remotely, developing digital skills and expanding the labor market. However, it also poses many challenges, especially inequality in access to employment opportunities and income between different labor groups. The state needs to have specific policies to ensure that all people have the opportunity to access and benefit from technological advances. Ensuring inclusiveness and enabling all people, including those in rural areas and disadvantaged groups, to access the opportunities that the digital economy offers is essential (Schneider & Kokshagina, 2021; OECD, 2017). One of the best examples of this is Singapore and Malaysia, where the government has specific policies to promote digital skills development and protect workers' rights in a digital environment. For example, Singapore has enacted the Personal Data Protection Act (PDPA) since 2012, ensuring

that workers' personal data is strictly protected (Personal Data Protection Commission, 2018). This not only helps protect workers' privacy but also creates trust for them when participating in the digital labor market. Besides, the state also needs to focus on investing in digital infrastructure. Developing digital infrastructure is a key factor in increasing access to technology and improving worker productivity. Countries such as Thailand and Malaysia have made great strides in developing digital infrastructure, with high indicators of mobile and fixed broadband subscriptions (OECD, 2016). This not only helps improve connectivity but also creates favorable conditions for workers to access and use new technologies.

Another equally important aspect is training and skill development for workers. The state needs to continuously update education and training programs to ensure that workers are equipped with the necessary skills to adapt to technological change. This includes training in basic digital skills as well as specialized skills in information and communications technology (ICT). Training programs need to be flexible and respond quickly to changes in the labor market (OECD, 2016). In addition, unemployment insurance policies and job transition support also need to be implemented effectively to ensure labor security. These policies not only help workers overcome difficult times when losing their jobs but also encourage them to participate in retraining courses to improve their skills and find new job opportunities. This is one of the effective ways to maintain labor market stability and ensure that workers can adapt to rapid technological changes (Kochetkov, Zabavina, & Gafarov, 2021; Laker, 2021).

In general, in the context of the 4.0 industrial revolution and digital economy, the state not only needs to ensure the development of technology but also must focus on human resource development to maintain sustainable development and improve people's quality of life. An effective combination of education, training and employee rights protection policies will help the workforce better adapt to changes in the digital labor market and maintain sustainable development (Schneider & Kokshagina, 2021; OECD, 2017). Investing in digital infrastructure, digital skills training and protecting workers' rights are key factors in ensuring that workers can take full advantage of the opportunities that the digital economy brings. again.

Businesses innovation

In the context of the digital economy and economic innovation trends, business innovation is not only a core factor promoting economic development but also an important key to maintaining competitiveness and sustainable development. Factors affecting innovation in businesses include support from the state, legal environment, finance, and technological development. The state plays an important role in creating a favorable environment for innovation through policies and financial support. A stable and transparent legal framework is a necessary condition for businesses to easily access and deploy new technology. Promulgating legal regulations related to data protection, cybersecurity and intellectual property is extremely important (World Bank, 2021). Tax incentives and financial support policies such as low-interest loans and venture capital funds are also very important to support businesses, especially small and medium-sized enterprises, in investing in new innovative projects (OECD, 2020).

Business innovation needs attention in terms of technology and digital infrastructure, which plays a key role in promoting innovation. Technologies such as artificial intelligence

(AI), Internet of Things (IoT) and automation not only optimize production processes but also enable remote control, helping minimize manual intervention and improve efficiency. Smart factories use automated monitoring and management systems, allowing quick and accurate responses to production problems, thereby significantly improving product quality (Bogers et al., 2019); Second, investing in education and training of high-quality human resources in fields related to digital technology is essential. This helps businesses effectively exploit and apply new technologies. Cooperation programs between businesses and research institutes and universities are also very important to promote technology transfer and applied research into practice (Grabowska & Saniuk, 2022); Finally, a favorable business environment, with support from government policies and cooperation between businesses, research institutes and financial institutions, will promote innovation and creativity in business. Open business models start with active participation in collaborative networks, universal access and inclusion, thereby promoting industry transformation and changing business practices (Moradi et al., 2021).

Innovation also faces many challenges and barriers. Information security risks, limited financial resources, and differences in development levels between regions are all significant obstacles. Understanding innovation correctly and fully is also a barrier when many businesses still do not have long-term plans for R&D activities and often innovate passively according to business situations (GSO, 2014). Most businesses innovate technology passively, situationally, due to needs that arise during the business process, without long-term planning and the most used method is imported technology sources (Henderson, 2017).

The state can promote innovation through financial support for research and development projects, encouraging cooperation between businesses and research organizations, and creating credit guarantee mechanisms used for businesses to easily access capital. Furthermore, organizing innovation contests, science and technology awards and technology forums are also effective measures to encourage innovation and entrepreneurship (Arnold, 2016). According to the World Bank's "Science, Technology and Innovation" Report, increasing the absorption and diffusion of technology and improving the quality of human resources are the keys to promoting sustainable economic growth. This report emphasizes that, to achieve the ambition of becoming a high-income economy by 2045, new drivers for economic growth are needed, and innovation will be the fundamental foundation in enhancing economic growth. increase income and improve growth quality (World Bank, 2021).

In the context of the 4.0 industrial revolution, adjusting and promulgating legal regulations related to data protection, network security and intellectual property is extremely important. Tax incentive policies for businesses investing in high technology, supporting the import of modern equipment and simplifying administrative procedures will help businesses quickly apply industry 4.0 solutions in their operations production and business (Bašić, 2023). In addition, the State needs to promote a creative and innovative environment by investing in education and training of high-quality human resources in fields related to industry 4.0 such as AI, IoT, and automation. Supporting cooperation programs between businesses and research institutes and universities is also important to promote technology transfer and applied research into practice (Moradi et al., 2021). Businesses innovation in the context of the digital economy and the 4.0 industrial revolution is a decisive factor in the sustainable development and

competitiveness of businesses. Support from the state, the development of technology and digital infrastructure, along with a favorable business environment, will be key factors to help businesses not only survive but also thrive in this new era (Grabowska & Saniuk, 2022). As a result, the quality of life is improved, workers work in a safer environment and consumers benefit from higher quality products.

Digital transformation

Digital transformation is increasingly becoming an inevitable and strong trend in today's era, with profound effects on all areas of life, including the role of the state in the digital economy. The factors influencing this process and the role of the state in the digital economy are being widely researched and discussed, reflected in current economic innovation trends. The development of information and communications technology (ICT) is an important factor driving the digital transformation process. ICT not only provides the necessary tools for digitizing processes and services, but also creates platforms for governments and businesses to connect and interact more effectively. According to Schallmo and Williams (2018), digital technology has changed the way business organizations operate and deliver services, and this also applies to government agencies. The state needs to invest heavily in ICT infrastructure to ensure that public services are accessible quickly and effectively, while also facilitating the development of the digital economy.

Another factor that cannot be ignored is the policy and legal framework supporting digital transformation. Governments have an important role to play in establishing regulations and policies that support the use of digital technology in administrative agencies and businesses. Alvarenga et al. (2020) emphasize that building a strong legal foundation not only helps protect people's rights and personal information, but also creates favorable conditions for a smooth digital transformation process. Financial support policies for new technology development projects are also an important part in promoting digital transformation.

Human resources and digital skills are indispensable factors in the digital transformation process. Digital training and upskilling of the workforce is needed to ensure that they can effectively use new technologies. Mergel et al. (2019) point out that a lack of digital skills is one of the biggest barriers to digital transformation in the public sector. Therefore, the state needs to invest in training and education programs to improve the digital capabilities of employees in administrative agencies as well as the general population.

Investment in technology and digital infrastructure is another important factor influencing the digital transformation process. The state needs to ensure that the information technology infrastructure is robust enough to support digital services. These investments include the development of high-speed Internet networks, modern data centers and advanced cybersecurity systems. These efforts not only help improve the operational efficiency of government agencies, but also promote the development of businesses in the digital economy.

Collaboration between the public and private sectors is an important factor in the digital transformation process. The state cannot carry out all digital transformation initiatives on its own but needs cooperation and support from businesses and private organizations. Schallmo and Williams (2018) emphasize that this collaboration can help take full advantage of the

potential of digital technology and create major benefits for both society and the economy. Public-private partnership (PPP) programs can be an effective tool to promote digital transformation.

The state has an important role in promoting and managing the digital transformation process. This role includes establishing policies and regulatory frameworks, investing in infrastructure and technology, and promoting collaboration between the public and private sectors. The state needs to ensure that legal regulations not only support the digital transformation process but also protect people's rights and personal information. In addition, the state also needs financial support for businesses and organizations participating in the digital transformation process. This may include providing grants and financial support for new technology development projects, as well as investing in IT infrastructure upgrades. Mergel et al. (2019) argue that it is important to encourage technological innovation through training and support programs for businesses and communities. The state also has an important role in improving the digital skills of the workforce. Training and education programs on digital skills need to be widely deployed to ensure that the workforce can effectively use new technologies. This not only helps improve the operational efficiency of government agencies, but also creates new opportunities for workers in the digital economy.

Currently, there are a number of economic innovation trends taking place strongly under the influence of digital transformation. First, the growth of digital platforms and online services is changing the way businesses and organizations operate. Digital platforms such as e-commerce, online financial services and mobile applications are becoming important tools to reach and serve customers. Second, the rise of big data and artificial intelligence (AI) is opening up new opportunities for businesses and organizations. AI technology and big data analysis can help businesses optimize operating processes, improve business efficiency and create new products and services. Third, the development of blockchain technology is changing the way transactions are performed and managed. Blockchain technology not only brings greater transparency and security to transactions, but also opens up new opportunities for the development of decentralized applications (dApps) and smart contracts. Finally, the rise of Internet of Things (IoT) technology is creating new opportunities for businesses and organizations. IoT technology allows devices and systems to connect and interact with each other, creating highly automated and intelligent systems.

Digital transformation is a complex and multidimensional process, deeply affecting all areas of life, including the role of the state in the digital economy. The state has an important role in promoting and managing this process through policies and legal frameworks, investing in infrastructure and technology, as well as promoting cooperation between the public and private sectors. Current economic innovation trends, including the growth of digital platforms, big data and AI, blockchain and IoT, are opening up new opportunities for businesses and organizations in the digital economy.

Environmental protection

Factors affecting the role of the state in the digital economy and current economic innovation trends do not stop at regulations and policies, but also include the impact of Industry

4.0, especially are artificial intelligence (AI), cloud computing, robotics, big data and blockchain. Although the connection between Industry 4.0 and environmental issues has not been extensively researched, these aspects can still be assessed through the impact of advanced technologies at businesses.

Artificial intelligence (AI) has become central to many industries, playing a vital role in collecting, processing and storing large amounts of data, creating core competitive advantages. AI helps manufacturing companies manage risks and make decisions through error detection, diverse data synthesis and early warning, thereby moving towards green production (Cioffi et al., 2020; Mao et al., 2019). One of the typical applications of AI is predictive maintenance, which helps optimize machinery and reduce energy consumption and waste (World Economic Forum, 2023). Cloud computing, with its networked systems that enable comprehensive data and information access, brings added value to organizations by reducing operational costs and physical resources, while boosting business association (Chang et al., 2019). Sustainable cloud computing applications help manage energy, virtualize and reuse natural resources, thereby helping the manufacturing industry save energy and meet sustainable needs (Deb et al., 2023)

The application of robots in industry has reduced production costs, improved efficiency and promoted flexible production, while reducing electricity, gas, water consumption and CO2 emissions (Gadaleta et al., 2019; Ogbemhe et al., 2017; Ajwani-Ramchandani et al., 2021; Yamamoto et al., 2020). This contributes to making the production process more sustainable (Mao et al., 2019).

Big data analytics, with its ability to quickly create and analyze large amounts of diverse data, helps manufacturing companies optimize resources, reduce waste and save energy. Big data analytics has shown a positive impact on green supply chains and sustainable production (Fosso Wamba et al., 2017). Big data supports accurate decision making, real-time monitoring, and effective risk management, thereby achieving sustainable competitive advantage (Feng et al., 2020).

Blockchain technology is also increasingly used in Industry 4.0, especially in supply chain management and technology integration. Blockchain can support sustainable production models by processing, monitoring and storing data on polluting activities, while also collecting real-time data on green activities, supporting decision-making management (Parmentola et al., 2022; Mora et al., 2021). However, traditional blockchain systems require high energy, cause large CO2 emissions, and require large infrastructure to accommodate servers, leading to deforestation and waste of natural resources.

The effectiveness of the state in managing and directing the application of these advanced technologies is extremely important. The state needs to establish clear legal frameworks and support AI tools to help manage risks, make decisions and move towards green production. Promoting the application of AI tools and methods for effective data mining and optimization of natural resources in production systems is an important task of the state.

In addition, the state also needs to promote cloud computing applications through the development and promulgation of policies to encourage the sustainable use of cloud computing, with the ability to manage energy, virtualization and reuse. use natural resources.

This will help the manufacturing industry save energy and meet sustainable needs. Policies supporting robot applications will help optimize production processes, reduce energy consumption and emissions, and ensure efficient use of resources. Developing big data analysis tools is also an important task of the state, to help companies make accurate decisions, real-time monitoring and effective risk management. This will help achieve a sustainable competitive advantage, contributing to the goals of resource efficiency, waste reduction and energy savings. Finally, the state needs to promote sustainable blockchain solutions and develop regulations that minimize environmental impacts, to protect natural resources and ensure sustainable development. This includes monitoring and storing data on polluting activities, collecting real-time data on green activities, and supporting management decision-making.

Social Welfare

During the 20th century, mass production and automation made great strides. However, recent technological breakthroughs such as advanced robotics, artificial intelligence (AI), big data analytics, virtual and augmented reality, Internet of Things (IoT) are profoundly changing the way we work and live (Pereira & Romero, 2017). These changes are part of Industry 4.0 concept, a program launched by the German Federal Government in 2011 to promote digital transformation in industry. This initiative has spread around the world, initiating the 4th industrial revolution. Industry 4.0 is characterized by the integration of digital technologies in production processes to increase efficiency and competitiveness. of businesses, creating the foundation for "smart factories" and a new model of production organization, contributing to improved productivity and more sustainable resource allocation (Schwab, 2016).

Industry 4.0 promises many benefits for the economy and society, but also raises concerns about negative impacts. One of the major concerns is the impact of Industry 4.0 on employment. The rise of machine learning, robotics and digitalization could eliminate jobs at every skill level, leading to large-scale job losses and weakening the fundamentals of work and society (Brynjolfsson & McAfee, 2014). Industry 4.0 will also affect international trade and restructure global value chains (Tjahjono et al., 2017). Digital technologies are expected to extend beyond the factory floor to transform supply chain logistics through machine learning, enabling real-time production and marketing management over long distances. The differential capacity of regions and countries to implement these technological changes in value chains could have a major impact on the international division of labor and employment growth both in Europe and across Europe. Europe with the rest of the world (Tapscott, 2014).

Social welfare in the context of Industry 4.0 is also an important issue that needs to be assessed. According to Joung et al. (2013), social welfare includes safety, health and human rights promotion activities. AI can contribute to social sustainability by increasing work efficiency, reducing working hours, improving workers' physical and mental health, automating routine tasks, and promoting social and ethical action (Khakurel et al., 2018). However, most studies on the impact of cloud computing in Industry 4.0 have not fully considered the social sustainability aspect. Cloud computing can promote the sustainability of manufacturing companies through the collective processing of data and information, as well as the simulation of innovation projects (Rifkin, 2011).

Socially, robots in manufacturing industries can improve human working conditions by reducing monotonous work, improving workers' skills, and promoting socially sustainable practices. However, the deployment of robots can also lead to job losses and increased unemployment rates (Benedikt Frey & Osborne, 2017; Lloyd & Payne, 2019). Automation and AI technologies have the potential to increase workforce flexibility and productivity, but they also pose major challenges in reskilling and upskilling the current workforce. Additionally, blockchain technology has contributed to promoting social sustainability in manufacturing industries by improving working conditions, protecting human rights, and increasing social participation (Khanfar et al. al., 2021). Blockchain can track and monitor safety standards, health, human rights and working conditions, contributing to the sustainable development of the industry (Venkatesh et al., 2020). Blockchain also has the ability to ensure transparency and traceability in production processes, thereby enhancing trust among consumers and supply chain stakeholders.

In this context, the role of the state in the digital economy and current economic innovation trends is extremely important. The state needs to establish policies and legal frameworks to promote the development and application of new technology in industries (Piketty, 2014). This includes investing in digital infrastructure, supporting technology research and development, and facilitating business digital transformation. The state also needs to ensure that labor and social welfare policies are adjusted to accommodate changes in the labor market brought about by Industry 4.0, including retraining and upskilling. capacity for the workforce, protecting workers' rights and ensuring fairness in the distribution of benefits from technological development.

Materials and methods

The research is carried out from March 2024 to May 2024 and applies the following specific methods: Qualitative research through synthesizing theories and results of previous researchers related to the role of the state in the context of the digital economy and economic innovation in Vietnam, thereby proposing hypotheses and building a research model in the direction of adjusting, supplementing, and ensuring compatibility with the context of the digital economy and economic innovation in Vietnam; Afterwards, the author conducted discussions with 10 experts (managers and researchers at universities and research institutes) to calibrate and supplement measurement scales and research models accordingly more realistic in the research context. Quantitative research was conducted by the author through basic analyzes such as statistics, Cronbach's alpha reliability assessment, EFA factor analysis, linear regression models from survey data of 241 subjects. Subjects are civil servants whose job positions are related to research criteria on State agencies in the context of the digital economy and economic innovation in Vietnam, including central and local levels and collected 241 valid samples with data collection period from May 2024 to June 2024.

Table 1. Summary of survey samples

No	Area	Number of survey form issued	Number of valid survey forms
1	Nothern	80	77
2	Central	80	78
3	Southern	90	86
	Total	250	241

Source: Compiled by author

The quantitative research results specifically reflect the factors affecting the role of the state in the context of the digital economy and economic innovation in Vietnam. The size of the sample applied in the study is based on the requirements of exploratory factor analysis (EFA). According to research by (Hair J.F., 1998), according to (Trong. H., 2008) from (Bollen K.A., 1989) study, the sample size must be at least 5 times the number of variables in factor analysis. With the number of observed variables being 25, the minimum sample size must be 125. With the expectation that a valid sample will have a proportion greater than 50% of the total number of samples collected, the study chose a sample size of n = 250. The research sample was conducted randomly, mainly based on relationships. The study took data from education sector officials in 08 provinces and cities; 10 major universities and 05 preschools and high schools.

The study sent out 250 questionnaires (200 online and 50 in person), resulting in 241 responses (191 online and 50 in person). The income survey form was checked for validity and reliability to eliminate unsatisfactory answer sheets, including blank answer sheets, inappropriate respondents, and answer sheets with only 01 answers to most questions... For online answer sheets, the study used statistical functions on Excel software to select. With answer sheets directly on paper, selective research is done using the manual ballot counting method. After screening, the remaining answer sheets were 241, coded and analyzed using SPSS 20 software.

The study took random data, evenly distributed on gender variables: female (47.7%) and male (52.3%). Regarding educational level, the data focuses on bachelor degrees (43.6%) and postgraduate degrees (49.8%). Regarding age, the data shows that the majority of people surveyed are long-time workers with a lot of experience, focusing on the age group from 25 to 35 years old (29.9%) and the age group from 35 to 45 years old (25.7%). Regarding workplace, there is an equal distribution of survey questionnaires at state management agencies related to research criteria on State effectiveness in the context of science, technology and innovation in Vietnam. Commune-level local government (People's Committee) account for the highest proportion (34.9%).

Table 2. Descriptive statistical results

Variable	Content	Frequency (person)	Rate (%)
Gender	Female	115	47.7
	Male	126	52.3
Academic level	College Degree	16	6.6
	Bachelor Degree	105	43.6
	Post graduate	120	49.8
Age	Under 25	58	24.1
	From 25 to 35	72	29.9
	From 35 to 45	62	25.7
	Over 45	49	20.3
Workplace	Central government (Ministry)	45	18.6
	Provincial-level Local government (Department)	52	21.6
	District-level Local government (Division)	60	24.9
	Commune-level local government (People's Committee)	84	34.9

Source: SPSS 20 analysis results

Table 3 below presents the results of the scale of factors in the research model, based on the criteria presented in the theoretical overview of the research, including: Human Resources Digital Economy, Businesses Innovation, Digital Transformation, Environmental protection and Social Welfare.

Table 3. Scales of factors in the research model

No	Factor	Encode	Scale	Source
1	Digital Economy Human Resources	DH1	The state plays an important role in orienting and supporting the development of human resources in the context of the digital economy.	Mosca, 2020; Yu & Jinajun, 2020
		DH2	Digital technology, automation, and artificial intelligence have profoundly changed how businesses recruit, train, and manage employees.	OECD, 2016; Personal Data Protection Commission, 2018
		DH3	The state needs to create a favorable legal environment and policies to develop human resources in a digitalized environment.	Kochetkov, Zabavina, & Gafarov, 2021; Laker, 2021
		DH4	The development of digital infrastructure is a key factor in enhancing access to technology and improving worker performance.	OECD, 2016
		DH5	Unemployment insurance policies and job transition support need to be	Schneider & Kokshagina,

No	Factor	Encode	Scale	Source
			effectively implemented to ensure labor security in the context of the digital economy.	2021; OECD, 2017
2	Businesses Innovation	BI1	The state plays a crucial role in creating a favorable environment for innovation through policies and financial support.	World Bank, 2021
		BI2	The development of digital infrastructure and technology is key in promoting corporate innovation.	Bogers et al., 2019
		BI3	Investing in education and training high-quality human resources in digital technology fields is essential for effective utilization of new technologies.	Grabowska & Saniuk, 2022
		BI4	The state should support financial assistance for R&D projects, encourage collaboration between businesses and research organizations, and create credit guarantee mechanisms.	Arnold, 2016
		BI5	Adjusting and enacting legal regulations related to data protection, cybersecurity, and intellectual property are crucial in the context of the Fourth Industrial Revolution.	Bašić, 2023
3	Digital Transformation	DT1	ICT development is a crucial factor in driving digital transformation.	Schallmo & Williams, 2018
		DT2	The government plays an important role in establishing policies and legal frameworks to support digital transformation in administrative agencies and businesses.	Alvarenga et al., 2020
		DT3	Training and enhancing digital skills for the workforce is necessary to ensure effective use of new technologies.	Mergel et al., 2019
		DT4	The government needs to invest heavily in ICT infrastructure to ensure that public services are quickly and efficiently accessible, fostering the development of the digital economy.	Schallmo & Williams, 2018
		DT5	Public-private partnerships (PPPs) are an effective tool to promote digital transformation by leveraging the potential of digital technology and creating significant benefits for both society and the economy.	Schallmo & Williams, 2018

No	Factor	Encode	Scale	Source
4	Environmental Protection	EP1	AI plays a crucial role in managing risks and making decisions through fault detection, data synthesis, and early warnings, leading to green production.	Cioffi et al., 2020; Mao et al., 2019; World Economic Forum, 2023
		EP2	Cloud computing provides added value to organizations by reducing operating costs and physical resources while fostering business opportunities.	Chang et al., 2019; Deb et al., 2023
		EP3	The application of robotics in industry reduces production costs, improves efficiency, and promotes sustainable production by lowering energy and resource consumption.	Gadaleta et al., 2019; Ogbemhe et al., 2017; Ajwani-Ramchandani et al., 2021; Yamamoto et al., 2020
		EP4	Big data analytics optimizes resources, reduces waste, and saves energy, positively impacting green supply chains and sustainable production.	Fosso Wamba et al., 2017; Feng et al., 2020
		EP5	Blockchain technology supports sustainable production models by processing, monitoring, and storing data on pollution and green activities.	Parmentola et al., 2022; Mora et al., 2021
5	Social Welfare	SW1	Artificial intelligence (AI) can contribute to social sustainability by increasing work efficiency, reducing working hours, and improving workers' physical and mental health.	Khakurel et al., 2018
		SW2	Cloud computing can enhance the sustainability of manufacturing companies through collective data and information processing, as well as innovation project simulations.	Rifkin, 2011
		SW3	Robots in manufacturing can improve human working conditions by reducing monotonous tasks and enhancing workers' skills.	Benedikt Frey & Osborne, 2017; Lloyd & Payne, 2019
		SW4	Blockchain technology can track and monitor safety, health, human rights, and working conditions standards, contributing to the industry's sustainable development.	Khanfar et al., 2021; Venkatesh et al., 2020
		SW5	The state needs to establish policies and legal frameworks to promote the	Piketty, 2014

No	Factor	Encode	Scale	Source
			development and application of new technologies in industries.	
6	Role of State	RS1	The state needs to invest heavily in ICT infrastructure and establish policies to support digital transformation to ensure that public services can be quickly and efficiently accessed.	Schallmo & Williams, 2018; Alvarenga et al., 2020
		RS2	Training and enhancing digital skills for the workforce is necessary to ensure they can effectively use new technologies in the context of the digital economy and Industry 4.0.	Mosca, 2020; Yu & Jinajun, 2020; Mergel et al., 2019
		RS3	The state needs to establish policies and legal frameworks to promote innovation in businesses while protecting rights and social welfare in the context of Industry 4.0.	Piketty, 2014; World Bank, 2021; Khakurel et al., 2018; Benedikt Frey & Osborne, 2017

From the theoretical basis mentioned, the author offers the research model as follows:

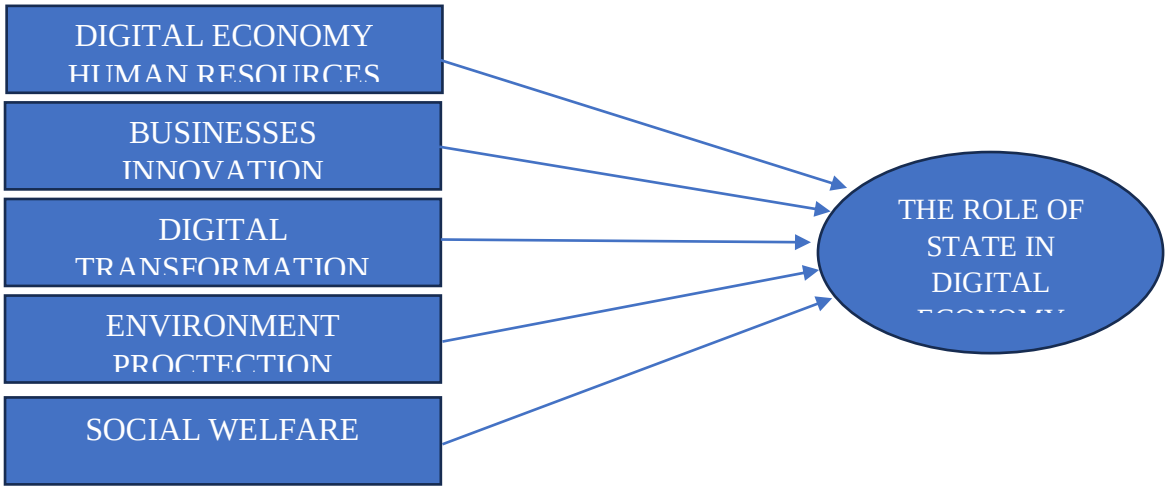

Figure 1. Research model

Results and discussion

Assessing the reliability of Cronbach's alpha is the first step in implementing a linear regression model, with 28 variables of 6 factor groups included in the analysis, including: DH (Digital Economy Human Resources), BI (Businesses Innovation), DT (Digital Transformation), EP (Environmental Protection), SW (Social Welfare) and RS (the role of State in the context of digital economy and economic innovation in Vietnam), all variables

meet the requirements (total variable correlation coefficients are greater than 0.3). Along with that, all Cronbach's Alpha coefficients are 0.6 or higher.

Table 4. Summary of Cronbach's alpha coefficient

Factor	Number of initial variables	Cronbach's alpha coefficient	Number of valid variables
Digital Economy Human Resources	5	0.807	5
Businesses Innovation	5	0.846	5
Digital Transformation	5	0.836	5
Environmental Protection	5	0815	5
Social Welfare	5	0.850	5
Role of State	3	0.660	3

Source: SPSS 20 analysis results

Thus, after evaluating the reliability of Cronbach's alpha, the study had 28 suitable variables belonging to 6 factors to include in the EFA factor analysis to explore the scale structure of 05 independent factor groups, namely DH (Digital Economy Human Resources), BI (Businesses Innovation), DT (Digital Transformation), EP (Environmental Protection), SW (Social Welfare) and 01 dependent factor is RS (the role of State in the context of digital economy and economic innovation in Vietnam). However, in the process of processing EFA factor, the author found that the model running results with 06 components, this shows that there are not standard data. After checking the research data, the detection existed badly EM1, of the EM (Environment Prptection). Therefore, the author has carried out the type of EM1 variable from the model. After eliminating the EM1 variable, the model meets the standard EFA factor with 05 components. Results of EFA factor analysis of variables belonging to independent factors with KMO coefficient reaching 0.740, greater than 0.5; this confirms that the EFA results of the variables belonging to the independent factors are completely suitable for exploring the structure of the scales; along with that, Barlett test with Sig coefficient less than 5%, showing that the results of EFA factor analysis of variables belonging to independent factors are completely statistically significant.

Table 5. Results of EFA analysis of variables belonging to independent factors

	Component				
	1	2	3	4	5
WF5	.881				
WF1	.880				
WF2	.788				
WF4	.747				
WF3	.601				
BN2		.844			
BN3		.798			
BN5		.761			

BN4		.756			
BN1		.755			
DT2			.838		
DT1			.778		
DT5			.773		
DT3			.768		
DT4			.698		
HR4				.821	
HR1				.817	
HR2				.768	
HR3				.732	
HR5				.607	
EM5					.808
EM4					.804
EM2					.778
EM3					.764
KMO = 0.734; Bartlett's Test of Sphericity = 2787.501; Sig. = 0.000					
Eigenvalues	4.257	3.019	2.788	2.548	2.272
Variance (%)	17.739	12.579	11.616	10.616	9.465
Cumulative (%)	17.739	30.318	41.934	52.550	62.015

Source: SPSS 20 analysis results

Besides, the results of EFA factor analysis of variables belonging to independent factors show that the breakpoint is at the 5th line with an eigenvalue of 2.272 greater than 1, this confirms that the variables included in the analysis are arranged into 5 groups of factors and the cumulative in the 5th line is 62.015%, greater than 50%; shows that the variability of the data is explained up to 62.015%. Not only that, the factor rotation results show that 24 variables belonging to the independent factors included in the analysis are specifically arranged into 05 factor groups DH (Digital Economy Human Resources), BI (Businesses Innovation), DT (Digital Transformation), EP (Environmental Protection), SW (Social Welfare) in Table 5.

Table 6. Results of EFA analysis of variables belonging to the dependent factor

	Component
ES1	.836
ES2	.810
ES3	.682
KMO = 0.625; Bartlett's Test of Sphericity = 120.856; Sig. = 0.000	
Eigenvalues	1.819
Cumulative (%)	60.645

Source: SPSS 20 analysis results

Along with that, the results of EFA factor analysis of variables belonging to RS (the role of State in the context of digital economy and economic innovation in Vietnam) in table 6 show that the KMO value is 0.625, greater than 0.5; This confirms the KMO value, ensuring the appropriateness of exploratory factor analysis and the meaningfulness of the data included in factor analysis. The Chi-Square statistic of the Bartlett test has a value of 120.856 with a significance level of Sig. = 0.000 is less than 0.05, this shows that the KMO test results are completely statistically significant at the 5% significance level.

The analysis of the cumulative for the dependent variables shows that the cumulative reaches a value of 60.645%, this value is nearly average (reference value, not conclusions), so 60.645% of the variation in the data is explained by 01 factor, measurement scales were derived and accepted. The stopping point when extracting factors at the first factor with Eigenvalues is 1.819. The factor loading coefficients of the component variables ES1, ES2, ES3 are respectively 0.836; 0.810; 0.682 is greater than 0.5; This shows that the component variables of the entrepreneurial intention factor warrant inclusion in data analysis.

Based on the results of correlation analysis of factors in Table 7, we see that the dependent factor of entrepreneurial intention has a positive same direction correlation with the independent factors, specifically, the Pearson correlation value of the factors DH (Digital Economy Human Resources), BI (Businesses Innovation), DT (Digital Transformation), EP (Environmental Protection), SW (Social Welfare) with RS (the role of State in the context of digital economy and economic innovation in Vietnam) are respectively 0.138; 0.320; 0.401; 0.362; 0.317 is greater than 0 and the coefficients Sig. of the factors are all less than 0.05. This ensures that the correlation between factors is statistically significant for the author to conduct linear regression model analysis.

Table 7. Results of Pearson correlation analysis

		DH	BI	DT	EP	WS	RS
Digital Economy Human Resources	Pearson Correlation	1					
	Sig. (2-tailed)						
Businesses Innovation	Pearson Correlation	.043	1				
	Sig. (2-tailed)	.502					
Digital Transformation	Pearson Correlation	-.012	.100	1			
	Sig. (2-tailed)	.854	.120				
Environmental Protection	Pearson Correlation	.063	.117	.127*	1		
	Sig. (2-tailed)	.334	.070	.048			
Social Welfare	Pearson Correlation	.030	.115	.189**	.085	1	
	Sig. (2-tailed)	.642	.074	.003	.187		

Role of State	Pearson Correlation	.138*	.320**	.401**	.362**	.317**	1
	Sig. (2-tailed)	.033	.000	.000	.000	.000	

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).
Listwise N=241

Source: SPSS 20 analysis results

The results of the regression model analysis in Table 8 show that factors affecting the role of the effectiveness of State in industrial revolution 4.0, including: DH (Digital Economy Human Resources), BI (Businesses Innovation), DT (Digital Transformation), EP (Environmental Protection), SW (Social Welfare), these variables affect RS (the role of State in the context of digital economy and economic innovation in Vietnam) in the same direction. And R square is 0.374; this result shows that the model's suitability is 37.4%, or in other words, 37.4% of the variation in the role of State in the context of digital economy and economic innovation in Vietnam is explained by 05 factors: DH (Digital Economy Human Resources), BI (Businesses Innovation), DT (Digital Transformation), EP (Environmental Protection), SW (Social Welfare). Using the F test in ANOVA analysis of variance shows that the F value is 20.946 with a significance level of Sig. is 0.000 less than 0.05; This shows that the combination of five independent factors in the model can explain the change in the role of State in the context of digital economy and economic innovation in Vietnam.

Table 8. Results of linear regression analysis

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
Model	B	Std. Error	Beta			Tolerance	VIF
1 (Constant)	.441	.261		1.690	.092		
Digital Economy Human Resources	.077	.037	.108	2.089	.038	.994	1.006
Businesses Innovation	.154	.035	.229	4.373	.000	.969	1.032
Digital Transformation	.205	.036	.306	5.762	.000	.947	1.056
Environmental Protection	.184	.036	.271	5.173	.000	.967	1.034
Social Welfare	.139	.036	.207	3.906	.000	.952	1.051

R square = 0.374; Adjusted R square = 0.361; F = 28.127 (Sig. = 0.000); Durbin Watson = 1.625
Dependent Variable: Role of State.

Source: SPSS 20 analysis results

Thus, the regression analysis model is implemented as follows:

$$RS = \beta_0 + \beta_1 DH + \beta_2 BI + \beta_3 DT + \beta_4 EP + \beta_5 SW + \varepsilon$$

The unstandardized regression equation shows the relationship between factors affecting ES (the effectiveness of State in industrial revolution 4.0) as follows:

$$\mathbf{RS = 0.441 + 0.77*DH + 0.154*BI + 0.205*DT + 0.184*EP + 0.139*SW + \varepsilon}$$

The regression equation according to the standardized coefficient Beta shows the relationship between factors affecting ES (the effectiveness of State in industrial revolution 4.0) as follows:

$$\mathbf{RS = 0.108*DH + 0.229*BI + 0.306*DT + 0.271*EP + 0.207*SW + \varepsilon}$$

Based on the standardized Beta coefficient, we can see that the highest level of influence on RS (the role of State in the context of digital economy and economic innovation in Vietnam) is Digital Transformation factor (DT has Beta = 0.306; influence in the same direction), when Digital Transformation factor is better (increased by 1 unit), the role of State in the context of digital economy and economic innovation in Vietnam increases to 0.306 units. Next, Environmental Protection factor (EP has Beta = 0.271; same direction effect), when the Environmental Protection factor is better (increased by 1 unit), the role of State in the context of digital economy and economic innovation in Vietnam increases to 0.271 units. Businesses Innovation factor (BI has Beta = 0.229; influence in the same direction), when the Businesses Innovation factor (increases by 1 unit), the role of State in the context of digital economy and economic innovation in Vietnam increases by 0.229 units. Social Welfare factor (SW has Beta = 0.207; influence in the same direction), when Social Welfare factor is better (increased by 1 unit), the role of State in the context of digital economy and economic innovation in Vietnam increases to 0.207 units. Finally, there is Digital Economy Human Resources factor (DH has Beta = 0.108; influence in the same direction), when Digital Economy Human Resources factor is better (increased by 1 unit), the role of State in the context of digital economy and economic innovation in Vietnam increases to 0.108 units.

Along with that, the results show that the VIF coefficient of the factors DH (Digital Economy Human Resources), BI (Businesses Innovation), DT (Digital Transformation), EP (Environmental Protection), SW (Social Welfare) are respectively 1.006; 1.032; 1.056; 1.034; 1.051 is within the allowable level (less than 2), showing that the model does not suffer from multicollinearity. And the value d (Durbin Watson) = 1.625 is in the acceptance range (from 1.5 to 2.5), meaning the model does not have autocorrelation at lag 1.

Conclusions

This study focuses on clarifying the factors affecting the role of State in the context of digital economy and economic innovation in Vietnam at present. Thereby, the author has presented relevant foundational theories. Based on the results of previous studies, the author has synthesized measurement scales and proposed a research model, and used SPSS 20 statistical software to conduct qualitative research, adjust scales and model to suit the real context.

The results of the study show the factors affecting the effectiveness of State in industrial revolution 4.0 in Vietnam, including: (1) Digital Economy Human Resources, (2) Businesses Innovation, (3) Digital Transformation, (4) Environmental Protection and (5) Social Welfare.

Based on the results of the research model, the author proposes the following recommendations to promote the role of State in the context of digital economy and economic innovation in Vietnam:

1. Developing human resources for the digital economy: The State needs to update education and training programs, including basic digital skills and specialized skills in information and communications technology (ICT). Employee support policies such as unemployment insurance, job transition support and social security programs also need to be implemented effectively to ensure labor security and encourage learning and development. new skills. Investing in digital infrastructure is key to increasing access to technology and improving worker productivity.
2. Business innovation: The state needs to create a favorable environment for innovation through policies and financial support such as tax incentives, low-interest loans and venture capital funds. Encourage businesses to invest in technologies such as artificial intelligence (AI), Internet of Things (IoT) and automation to optimize production processes and improve performance. Promoting cooperation between businesses and research institutes and universities to transfer technology and apply it into practice is also an important factor.
3. Digital transformation: The state needs to invest heavily in information and communications technology (ICT) infrastructure to ensure public services can be accessed quickly and effectively. Establish regulations and policies supporting the use of digital technology in administrative agencies and businesses, protecting people's rights and personal information. At the same time, invest in training and education programs to improve the digital skills of employees and residents, ensuring they can effectively use new technologies.
4. Environmental protection: Industry 4.0 brings enormous opportunities for environmental protection through the application of advanced technologies such as artificial intelligence (AI), cloud computing, robotics, big data and blockchain. The state needs to establish clear legal frameworks and support AI tools to help manage risks, make decisions and move towards green production. Accelerating the adoption of AI tools and methods for effective data mining and natural resource optimization in manufacturing systems is an important task. In addition, the state also needs to promote sustainable cloud computing, robotics and blockchain applications, ensure energy management, resource reuse and monitoring of polluting activities to protect the environment.
5. Social welfare: In the context of Industry 4.0, the State needs to adjust labor and social welfare policies to suit changes in the labor market, including retraining and improving skills for the workforce, protecting workers' rights and ensuring fairness in the distribution of benefits from technological development. Promote the application of technologies such as AI, cloud computing, and blockchain in improving working conditions, protecting human rights and enhancing social welfare.

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