DOI: 10.56794/VSSR.4(210).18-30

Impact of Fourth Industrial Revolution on Production Forces and Suggestions for Vietnam

Lý Hoàng Mai*

Received on 17 June 2022. Accepted on 8 July 2022.

Abstract: The emergence of the Fourth Industrial Revolution has changed the mode of production of many industries and sectors in the economy, turning science and technology into direct productive forces and creating material premises that make productive forces experience remarkable development. Thus, a creative application of the appropriate laws of production with the nature and level of development of the productive forces and the fundamental laws of the development of human society is essential. The article presents views on the Fourth Industrial Revolution, its influence on the development and transformation of the productive forces and proposes some recommendations for Vietnam, including building institutions for science and technology to lead the process of economic restructuring; establish mechanisms and policies so that human capital becomes a key factor in transforming growth models; and taking advantage of the demographic dividend period, and information and communication technology (ICT) infrastructure.

Keywords: Fourth Industrial Revolution, productive forces, Vietnam.

Subject classification: Economics

1. Introduction

The history of humankind has witnessed three industrial revolutions, associated with the appearance of steam engines in the second half of the 18th century, electric power in the late 19th century, and electronic equipment and the internet in the 1970s. These three revolutions led to changes in the development of the productive forces of humankind.

Every industrial revolution has been characterised by a qualitative change in production and this change is brought about by breakthrough advances in science and technology. So far, humanity has experienced three industrial revolutions and is in the Fourth Industrial Revolution aka Industrial Revolution 4.0 or IR 4.0.

* Vietnam Institute of Economics, Vietnam Academy of Social Sciences.

Email: lymaivkt@gmail.com

The Fourth Industrial Revolution was first mentioned at the Hannover Technology Expo in 2011 and then was included in the "High-tech Strategic Action Plan" by the German government in 2012. Many other countries such as the US, the UK, Japan and France also recognised this revolution.

The theme of the World Economic Forum held 20-23 January 2016 was "Mastering the Fourth Industrial Revolution". More than 2,500 delegates attended this conference, representing more than 100 countries around the world. They agreed on the view that the world is in the development stage of the Fourth Industrial Revolution, paving the way for breakthrough changes in science and technology, changing the economic, cultural, and social life of humankind.

The Fourth Industrial Revolution has so far changed the mode of production and promoted the development of productive forces. This brings about opportunities and challenges for Vietnam, a developing country with a middle-low income level.

2. Fourth Industrial Revolution and productive forces

2.1. Fourth Industrial Revolution

The term revolution refers to radical and breakthrough changes. Industrial revolutions are a way of expression for the development of science and technology to a degree that can change the mode of production of humankind in a more positive direction.

The First Industrial Revolution lasted from 1760 to 1840 with the content of building railways and inventing the steam engine, contributing to the development of mechanical production. The Second Industrial Revolution began at the end of the 19th century and lasted until the beginning of the 20th century, leading to the emergence of power generation and the introduction of the assembly line. The Third Industrial Revolution began in the 1960s, using electronic and information technology (IT) to automate production. The Fourth Industrial Revolution appeared after the third nearly half a century when the first computers and electronic devices were born in the 1970s and the internet officially appeared in the 1990s.

According to Prof. Klaus Schwab, President of the World Economic Forum, IR 4.0 is an umbrella term covering a wide range of modern automation technologies, data exchange trends, smart manufacturing and production. By expanding the technology of artificial intelligence (AI), the Fourth Industrial Revolution creates a world in which flexible physical and virtual production systems interact with each other on a global scale. This ensures full adaptation of products and creates new models of production operations (Schwab, K., 2016).

Industry 4.0 is the current automation and data exchange in manufacturing technology. It includes physical networks, internet of things, and cloud computing.

Industry 4.0 creates favourable conditions for the creation of smart factories with diverse and flexible structures, where cyber-physical production systems (CPPS) will monitor processes, creating a virtual copy of the physical world. With the internet of things, these real-virtual production systems interact with each other and with people in real-time; then, through the internet of services, users will be able to participate in the value chain through the application of these services. Through this connection, businesses will create smart networks throughout the value chain that can control each other automatically, thereby helping to blur the boundaries between the domains of physics, digitalisation, and biology.

The Fourth Industrial Revolution has the following four main characteristics:

Firstly, it is the vertical link between smart production systems. Smart factories are at the core of IR 4.0 and they cannot function independently of each other. Therefore, it is necessary to connect smart factories, smart products, and other production systems (Gilchrist, A., 2016).

The essence of vertical networking stems from the use of CPPS, in which smart products are full of sensors that tell machines how they need to be handled; processes will have autonomy in a hierarchical modular system. Embedded smart devices work together wirelessly or through the cloud. This makes it possible for factories and manufacturing plants to react quickly and accurately to each variable, such as changes in demand, inventory levels, machine failures, and unexpected obstacles. Networking and interconnection are also relevant to smart logistics and marketing services of an organisation as well as its smart services, because manufacturing follows the personalised and specifically customer-oriented path.

Secondly, it is the horizontal link through new global value chain networks. Links will facilitate the establishment and maintenance of networks that create and add value. The first relationship when we talk about horizontal links is the relationship between business partners and customers. However, it also refers to the links of new business models across countries, even across continents, creating a global network (Gilchrist, A., 2016). These new value creation networks are optimised networks that operate in real-time, enable transparency, provide high flexibility for faster response to issues and failures, and facilitate global optimisation (Deloitte, 2014).

Thirdly, the entire value chain depends on through-engineering technology, emphasising the entire life cycle of a product from production to degradation. People often focus only on the production process and pay little attention to the output. IR 4.0 has covered both the production process and the entire product life cycle.

Fourthly, the effects of exponential technologies can be seen as accelerators or catalysts enabling personalised, flexible, cost-effective solutions in industrial processes.

IR 4.0 requires automation solutions for greater awareness and autonomy. One of the famous exponential technologies is 3D printing. The ability to print anything, anytime,

anywhere has overcome the disadvantages of producing single products and has been taking them everywhere. As such, 3D printing has fueled IR 4.0 and made it more flexible (Deloitte, 2014).

The speed of the current breakthroughs is unprecedented in history; it is calculated as the speed of the exponential function rather than the linear speed. Moreover, the sphere of influence of this revolution is also very wide, from changing the way of communication and management of governments and state management agencies, changing the way businesses interact, and changing the way people live.

In addition, it creates a complete transformation both internally and externally in all the systems of the country, of each business and of society at large (Schwab, K., 2016).

2.2. Productive forces

The concept of productive forces was first used by Karl Marx in the work *German Ideology*. Then, through some of his other works, such as *The Poverty of Philosophy*; *Employed Labour and Women's Capital*; *Wages, Prices and Profits*; and especially the *Capital* series, the content of the concept is clarified more clearly.

The productive forces can be understood as the total means of production and workers along with certain production experience and skills. The development level of these productive forces speaks to the level of human's conquest of nature. The level of development of the productive forces is an important criterion for the development of human society.

Among all factors of productive forces, the worker is the most basic and decisive one. According to Karl Marx, each generation of people receives the productive forces created by the previous generation and uses them as means of new production activities. Marx concluded, "The social history of man is always merely the history of the individual development of human beings" (K. Marx and F. Engels, 1995, Vol. 27, pp.657-658).

The means of production consist of two basic factors, namely the object of labour and the means of labour. The object of labour is what labour acts on, transforming it into a useful item. Means of labour are objects that people use to influence the object of labour. There are two types of means of labour: The type that directly affects the object of labour is called the tool of work, and the type that affects the object of labour indirectly is called the means of production.

Among the parts of the means of labour, the tool of labour plays a particularly important role because it increases the limited capacity of human activity, and the tool of labour is the one to differentiate the differences among economic eras.

Assessing the development of economic eras is not judging what products were produced in those eras, but evaluating with what tools those eras produced products. "The economic

eras differ not in what they produce, but in how they produce, with what means of labour" wrote Marx (K. Marx, 1973, Vol. 1, p.388).

In the productive forces, if the worker is the most important factor, then the tool of labour is the most dynamic factor. The fundamental change in the tools of labour makes a decisive contribution to the change of economic eras.

3. Impact of Fourth Industrial Revolution on productive forces

Before the Fourth Industrial Revolution, people mainly used the means of production which were natural resources and machines to produce products. However, the Fourth Industrial Revolution changed the mode of production and had a strong influence on all constitutive elements of the productive forces. The productive forces in the era of the Fourth Industrial Revolution have become modern productive forces led by science, high productivity, and efficiency. The knowledge contained in each product accounts for an increasing proportion. This has led to a drastic change in the level of modern productive forces. Modern productive forces are not only present in newly emerging production industries, but they also spread, renovate and renew old production industries of the economy. The more efficient and faster the promotion and exploitation of the existing knowledge store and the generation of new knowledge, the higher the economic growth.

There are many changes in the labour forces under the impact of Industrial Revolution 4.0. While in agricultural civilisation, the main object of labour was land, the labour object of the mechanical civilisation period was expanded, in addition to land, to include raw materials (such as coal, fuel, oil, and gas) and materials needed for industries (such as iron, steel, yarn, textiles, and automobiles). The object of labour in today's era is mainly information.

Besides this, thanks to the application of technology in the Fourth Industrial Revolution, resources and fuels have become richer, many of which contain more knowledge. If based on the inputs of the industrial economy based on natural resources, natural resources are increasingly scarce and exhausted due to overexploitation by humans. However, the rapid development of science and technology has helped people discover many new properties of natural resources, many things that were previously thought to be useless have become great useful things and many valuable properties are multiplied with the appearance of many new production industries, thus helping to create new rich objects of labour. For example, the advent of nuclear fusion has brought the energy industry that previously used fossils (coal, oil, and natural gas) in danger of being depleted, into a new energy technology (thermonuclear energy), using the mineral resources on earth containing lithium for humanity to generate energy for another 1,500 years. If lithium can be recovered from seawater, it can meet the needs in 10 million years from now (Cao Quang Xứng, 2007). Cell technology, microbiological technology,

and gene technology have helped create new varieties of plants and animals that nature does not have with many new features.

Concerning means of labour (i.e., tools of labour and means of production), the Fourth Industrial Revolution creates many new tools of labour and leads to the gradual replacement of traditional means of labour with modern means of labour based on the achievements of modern science and technology, focusing on biotechnology, new materials, and information technology. The IR 4.0 creates new labour tools and production means with machines that consume less fuel and energy, emit less waste, and do not pollute the environment, creating an efficient production base for sustainable development.

In smart factories, machines are connected to the internet and linked together through a system that can visualise the entire production process by itself and make decisions that will gradually replace previous production lines. While previous technologies only achieved saving physical strength, human muscles or enhancing the efficiency of using energy sources such as natural resources, material resources, then new technologies, especially information technology, have realised the partial replacement of the function of the human brain. Therefore, the main means of production will shift from mainly material to immaterial, that is, the advantage of natural resources and the low cost of unskilled labour will increasingly be lost, and production will trend towards shifting from countries with a lot of unskilled labour and natural resources to countries with a lot of highly specialised labour and close to the consumer market. Enterprises that know how to take advantage of new technologies with non-physical means of production of the IR 4.0 also will see great achievements. For example, China's Alibaba Group is considered the most valuable retailer in the world but has no inventory; or Airbnb, the world's largest provider of rental accommodation without any real estate (Tom Goodwin, 2015).

For workers, the Fourth Industrial Revolution has had a strong impact, changing human functions in production as they gradually cease to be an element of manipulation in the engineering system but turn to the creation and adjustment of that process. This impact is shown in four points as follows:

First, it changes the content and nature of labour. In terms of content, labour is gradually shifting from manual and mechanical labour to information and intellectual labour. In terms of nature, labour is changing towards becoming increasingly socialised.

Second, the Fourth Industrial Revolution affects the number of jobs through the replacement of labour power with machines, robots, AI, and the application of IT to a number of industries and occupations, with rapid penetration of the workplace in the labour market. The impact of IR 4.0 on employment will be the shift from labour-intensive production to one that uses more knowledge and technology.

Third, it affects the quality of human resources to meet the requirements of the Fourth Industrial Revolution. In addition to the hard requirements of technical skills (medium and

high level), including specialised knowledge and skills to perform specific jobs, workers need to have soft or core working skills such as the ability to think creatively and proactively at work, skills in using computers and the internet, foreign languages, problem-solving skills, time management skills, and many more.

Fourth, a digital technology platform that integrates all information about technology, processes, production methods, industry needs, occupations, skills, and so forth, especially the ability to connect and share worldwide through technological devices will change the connection between supply and demand in the labour market. The Fourth Industrial Revolution has removed the hard border of the labour market between countries in the region, making the labour market more vibrant, and promoting job creation for each country. However, due to the uneven development level, the specialised and skilled labour forces will have more opportunities while low-skilled and unskilled workers will face the risk of unemployment as the impact of the Fourth Industrial Revolution is deepening.

People are the most important factor in modern productive forces. Production experience and labour skills that people accumulate include not only the folk knowledge accumulated by each person in life but also scientific knowledge. The worker is increasingly evident as the factor that plays the most important and decisive role in the modern productive forces. Workers create modern working tools, new objects of labour, increasingly advanced means of production, and constantly improve their qualifications, skills and knowledge.

4. Suggestions for Vietnam

4.1. Vietnam's challenges

As the Fourth Industrial Revolution is affecting and spreading to all aspects of economic life, creating great changes in the productive forces and social division of labour, Vietnam still occupies a very small position on the world's economic map. Currently, there are three barriers that make Vietnam face challenges when seizing the opportunities of the Fourth Industrial Revolution.

The first challenge is a barrier of science and technology. Science and technology are key factors in transforming the mode of production and promoting the development of productive forces, but Vietnam's science and technology still lag behind some countries in the world. The country's technological readiness ranks only 79th, the level of technology absorption of enterprises ranks 100th, and the ability to access new technologies ranks only 71th out of 137 countries (Trần Thị Vân Hoa, 2018).

Besides this, Vietnam's innovation ability is more limited than that of some countries in the region as the number of patents, including those applied for commercialisation in

Vietnam, is lower than those in other countries. Investment in research and development (R&D) activities of Vietnam is still quite limited. According to calculations, spending on R&D activities of Vietnam in 2018 was only about 0.4% of GDP compared to 3.3% of Japan's GDP, 2.2% of Singapore's GDP, and 2.1% of China's GDP. In South Korea, spending on R&D activities now accounts for 4.2% of GDP, the number of patents applied for brands exceeds that of Japan with 4,378 inventions per one million people (Trần Thị Thu Trang, 2020).

The second challenge is a barrier to labour productivity. Labour productivity is a measure of the development of one socio-economic form compared to another, but Vietnam's labour productivity growth has not been fast enough to narrow the gap with labour productivity of other countries. Vietnam's labour productivity growth rate in 2020 was recorded at 5.4%, a fairly high level when compared to that of other countries in the region, but its labour productivity was recorded at only VND 117.9 million per year, equivalent to USD 5,081 per worker in 2020. This was 1.5 times lower than that of the Philippines; four times lower than that of Malaysia, 1.6 times lower than that of China, and 10 times lower than that of Singapore. Vietnam also lags about 40 years behind Malaysia and 10 years behind Thailand (Tô Trung Thành, 2021).

The third challenge is a barrier to the quality of human resources. The quality of Vietnam's human resources has not kept pace with economic restructuring, although the percentage of trained workers has increased, but the growth rate is very slow. From 2011, this rate was 15.4 %, by 2020, the proportion of trained workers only reached 24.1%, with an average growth rate of about 5% per year for the period. Meanwhile, if compared with countries right in the region, this rate in Indonesia is 42% and in Malaysia up to 66.8% (UNDP, 2021). The labour level of Vietnam is only approximately equal to that of Indonesia, but lower than that of Japan, South Korea, Singapore, China, Malaysia, Hong Kong, Thailand, and the Philippines. This has led to other limitations such as poor ability to apply science and technology, as well as low labour productivity.

According to international organisations, most of Vietnam's human resource indicators are low. The report of the World Economic Forum indicates that Vietnam belongs to the group of countries that are not ready for IR 4.0. In terms of human resource index, Vietnam ranks 70 of 100. In terms of highly skilled labour index, Vietnam ranks 81 of 100. In terms of vocational training quality index, Vietnam ranks 80 out of 100 countries (Ninh Thị Hoàng Lan, 2022).

4.2. Some favourable conditions of Vietnam

Firstly, it is the determination of the Party and the State of Vietnam to transform the digital economy. This is one of the very favourable premises for applying the achievements of IR 4.0 into practice. The Party and the State have issued many preferential policies to

attract capital and multinational and domestic corporations to implement the Fourth Industrial Revolution.

Secondly, the geopolitical factor is favouring Vietnam. The supply chain shift, the global supply chain disruption due to COVID-19, and the US-China trade war, as well as the situation in Ukraine, have caused unpredictable consequences for global politics and the economy. Multinational corporations are looking to minimise the negative effects of putting all their resources into China, leading to their passive supply, as shown in the pandemic. With the advantage of deep integration into the supply chain, abundant human resources, and cheap labour, Vietnam becomes a safe and potential destination for multinational corporations, as well as an increasingly important partner on the economic and political chessboard of the region and the world. More and more factories of multinational corporations are built and operated here.

Thirdly, with an open economy, the opportunity to integrate with the world's digital economy is huge. Vietnam's productive forces are adapting very quickly to the advancement of science and technology and the structure of industries is always changing rapidly. For example, the delivery force (shippers) is one of the most noticeable changes in urban Vietnam today, as these teams can be seen almost anywhere, at any time of the day. Unskilled workers from rural areas come to urban areas, and people are switching from other occupations to participate in the delivery team. Owning large, dynamic, and creative productive forces, the opportunity for Vietnam to take advantage of the achievements of the Fourth Industrial Revolution is promising.

4.3. Some suggestions for Vietnam

The Fourth Industrial Revolution is a revolution of knowledge, development, and innovation of science and technology, replacing the traditional role of capital and labour factors. At present, science and technology have become direct productive forces and are the direct cause of qualitative changes in the mode of production.

The Fourth Industrial Revolution is the development achievement of human civilisation, so Vietnam must consider the Fourth Industrial Revolution as an opportunity to narrow the development gap and accelerate the industrialisation process, modernisation, and successful implementation of the country's development goals as set out in the Documents of the 13th Party Congress.

To seize the opportunity of the Fourth Industrial Revolution, Vietnam needs to remove barriers in the development process, which are science and technology, labour productivity, and quality of human resources. To do this, Vietnam should focus on the following issues:

Firstly, it is necessary to build institutions for science and technology to become productive forces leading the process of economic restructuring in the following directions:

- There are policies to promote the development of Vietnam's science and technology market towards integration and improved labour productivity.

- The State should give more autonomy to state-owned enterprises and research institutes in science and technology activities, increase the proportion of state budget investment in science and technology, and encourage the private sector to invest in science and technology.

- It is important to devote adequate capital and investment resources to develop key technology industries on the basis of the Fourth Industrial Revolution, such as electronics and telecommunications, information technology, new materials, and new energy.

Secondly, it is necessary to establish mechanisms and policies so that human capital becomes a key factor in transforming growth models by:

- Establishing a mechanism for fostering and promoting talents, creating motivation for all economic entities to constantly innovate, and start up innovative businesses.

- Developing policies that favour high-quality human resources as the main productive force of society. It is advisable to revisit the Marxist theory of the productive forces; the view that workers are always the most basic and decisive productive forces is still a view that has a scientific value at any time. Schultz (1961) has suggested that an increase in human capital can increase productivity and thereby lead to an increase in income.

- It is important to invest more in human resource development in science and technology. The more rational investment and allocation of investment resources for science and technology development is also an important channel to promote human resource development.

- It is necessary to raise awareness for authorities and businesses about the role of science and technology human resources in the viability and development of enterprises as well as the country's socio-economic development.

- It is important to reform the teaching content at all levels in the direction of shifting from an education that is heavy on equipping learners with knowledge and skills to an education that helps develop capacity and promotes innovation and creativity for learners.

Programmes from vocational to university training need to be closely linked to the realities of society's needs and establish effective institutions and policies to create high-quality science and technology human resources and promote R&D activities.

B. Abersek (2017) believes that one of the requirements to prepare for the Fourth Industrial Revolution is to improve human capital to be able to meet the constantly changing knowledge and skills requirements in the new working environment. This sets out for education and training a great mission to prepare human resources to meet the development requirements of the country. Education needs to simulate and prepare learners for real life as much as possible as technology has made access to knowledge so easy that knowledge no longer has the meaning of insurance for the future of learners (FICCI, 2017).

Thirdly, it is necessary to take advantage of the demographic dividend period.

Vietnam's population in 2021 reached 98 million people, of which 50.5 million people are in working age. Vietnam needs to promote the advantages of a country in the demographic dividend period to take advantage of the opportunities brought about by the Fourth Industrial Revolution by preparing a young workforce in the field of digital technology. Vietnamese people are industrious, intelligent and hardworking. The young Vietnamese generation has the ability to access new technologies very quickly, many young people have successfully started up their businesses in the technology field, creating application software from the digital technology platform.

Therefore, the State should have priority policies in education and training activities for young human resources in the field of digital technology. They will be skilled and highly qualified people capable of working and adapting to the changes of the Fourth Industrial Revolution.

Fourthly, it is important to bring into play the advantages of information and communication technology infrastructure.

ICT is an essential infrastructure of the Fourth Industrial Revolution. Vietnam has advantages in this field. This is because Vietnam has a good infrastructure for IT, such as the number of smartphone users in Vietnam is increasing rapidly, free wifi systems are widely provided in big cities, and 4G and 5G service charges in Vietnam are among the cheapest in the world.

Large corporations such as Viettel, FPT, and VNPT have made strong investments in the internet and technology infrastructure over the years, creating prosperity in this field. Vietnam needs to promote this advantage with key investment policies, priority resources, and specific orientations for new industries. It is necessary to consider the IT and communication industry as one of the leading industries of the country.

5. Conclusion

In short, the Fourth Industrial Revolution is the inevitable development trend of the times. This revolution has been taking place at different speeds in countries around the world. The speed and exponential increase of this revolution has changed all aspects of the mode of production in the common global economic playing field. As a member of that common playground, Vietnam needs to have a proactive attitude, smart policies, and the necessary resources to seize development opportunities. If all of the above factors are fully met, Vietnam will successfully attain the country's development goals as set out in the Documents of the 13th Party Congress: "By 2025, Vietnam will be a developing country, have a modern industry, and overcome the middle-low income level. By 2030, Vietnam will be a developing country with a modern industry and a middle-high income level" (Electronic Newspaper of the Communist Party of Vietnam, 2021).

Note: Translator: Lương Quang Luyện. Language editor: Etienne Mahler.

References

1. C. Mác (1973), *Tư bản*, q.1, t.1, Nxb Sự thật, Hà Nội. [K. Marx (1973), *Capital*, Truth Publishing House, Book 1, Vol. 1, Hanoi].
2. C. Mác và Ph. Ăng-ghen (1995), *Toàn tập*, t.27, Nxb Chính trị quốc gia, Hà Nội. [K. Marx and F. Engels (1995), *Complete Works*, Vol. 27, National Political Publishing House, Hanoi].
3. Trần Thị Vân Hoa (2018), *Cách mạng công nghiệp 4.0, vấn đề đặt ra cho phát triển kinh tế - xã hội và hội nhập quốc tế của Việt Nam*, Nxb Chính trị Quốc gia - Sự thật, Hà Nội. [Trần Thị Vân Hoa (2018), *Industrial Revolution 4.0, Issues for Vietnam's Socio-economic Development and International Integration*, National Political Publishing House, Hanoi].
4. Cao Quang Xứng (2007), "Kinh tế tri thức với phát triển lực lượng sản xuất mới", *Lý luận chính trị và Truyền thông*, số 6. [Cao Quang Xứng (2007), "Knowledge Economy with Development of New Productive Forces", *Political Theory and Communication*, No. 6].
5. Abersek, B. & Flogie, A. (2017), "Evolution of Competences for New Era or Education 4.0", *The 25th Conference of Czech Educational Research Association (CERA/CAPV) Impact of Technologies in the Sphere of Education and Educational Research*.
6. FICCI (2017), *Leapfrogging to Education 4.0*, Student at the core, FICCI-EY Future of Skills and Jobs in India Report.
7. Gilchrist, A. (2016*), Industry 4.0 - The Industrial Internet of Things*, Apress Media LLC, New York, pp.199-200.
8. Rifkin, J. (2016), *The 2016 World Economic Forum Misfires with Its Fourth Industrial Revolution Theme*, Industry Week.
9. Schultz, T. W. (1961), "Investment in Human Capital", *American Economics Review*, Vol. 51.
10. Schwab, K. (2016), *The Fourth Industrial Revolution*, Kindle Edition, 194 pages.
11. UNDP (2021) *Annual Report 2020*.
12. Báo Điện tử Đảng Cộng sản Việt Nam (2021), "Những mục tiêu phát triển đất nước được thông qua tại Đại hội XIII của Đảng", https://tulieuvankien.dangcongsan.vn/van-kien-tu-lieu-ve-dang/gioi-thieu-van-kien-dang/nhung-muc-tieu-phat-trien-dat-nuoc-duoc-thong-qua-tai-dai-hoi-xiii-cua-dang-3741, truy cập ngày 20 tháng 5 năm 2022. [Electronic Newspaper of the Communist Party of Vietnam (2021), "National Development Goals Approved at the 13th Party Congress", https://tulieuvankien.dangcongsan.vn/van-kien-tu-lieu-ve-dang/gioi-thieu-van-kien-dang/nhung-muc-tieu-phat-trien-dat-nuoc-duoc-thong-qua-tai-dai-hoi-xiii-cua-dang-3741, retrieved on 20 May 2022].
13. Ninh Thị Hoàng Lan (2022), "Giải pháp phát triển nguồn nhân lực trong bối cảnh nền kinh tế số tại Việt Nam", Tạp chí *Công thương*, https://tapchicongthuong.vn/bai-viet/giai-phap-phat-trien-nguon-nhan-luc-trong-boi-canh-nen-kinh-te-so-tai-viet-nam-89049.htm#:~:text=2.,so%20v%E1%BB%9Bi%20t%E1%BB%95ng%20d%C3%A2n%20s%E1%BB%91), truy cập ngày 20 tháng 5 năm 2022. [Ninh Thị Hoàng Lan

(2022), "Human Resource Development Solutions in Context of Digital Economy in Vietnam", *Industry and Trade Magazine*, https://tapchicongthuong.vn/bai-viet/giai-phap-phat-trien-nguon-nhan-luc-trong-boi-canh-nen-kinh-te-so-tai-viet-nam-89049.htm#:~:text=2.,so%20v%E1%BB%9Bi%20t%E1%BB%95ng%20d%C3%A2n%20s%E1%BB%91), retrieved on 20 May 2022].

14. Tô Trung Thành (2021), "Điểm sáng kinh tế và nỗi quan ngại về chất lượng tăng trưởng", Đại học Kinh tế quốc dân, https://www.neu.edu.vn/vi/thong-tin-kinh-te/diem-sang-kinh-te-va-noi-quan-ngai-ve-chat-luong-tang-truong, truy cập ngày 20 tháng 6 năm 2022. [Tô Trung Thành (2021), "Economic Highlights and Concerns about Growth Quality", National Economics University, https://www.neu.edu.vn/vi/thong-tin-kinh-te/diem-sang-kinh-te-va-noi-quan-ngai-ve-chat-luong-tang-truong, retrieved on 20 June 2022].
15. Trần Thị Thu Trang (2020), "Khoa học và công nghệ - Thành tựu và thách thức trong phát triển kinh tế - xã hội", Tạp chí *Con số và sự kiện*, https://consosukien.vn/khoa-hoc-va-cong-nghe-thanh-tuu-va-thach-thuc-trong-phat-trie-n-kinh-te-xa-hoi.htm, truy cập ngày 20 tháng 5 năm 2022. [Trần Thị Thu Trang (2020), "Science and Technology - Achievements and Challenges in Socio-economic Development", *Numbers and Facts Magazine*, https://consosukien.vn/khoa-hoc-va-cong-nghe-thanh-tuu-va-thach-thuc-trong-phat-trie-n-kinh-te-xa-hoi.htm, retrieved on 20 May 2022].
16. Andreja Rojko (2017), "Industry 4.0 Concept: Background and Overview", http://online-journals.org/ index.php/i-jim/article/viewFile/7072/4532, retrieved on 01, June 2022.
17. Deloitte (2014), "Industry 4.0 Challenges and Solutions for the Digital Transformation and Use of Exponential Technologies", Deloitte, Switzerland, p.7, https://www2.deloitte.com/content/dam/ Deloitte/ch/ Documents/manufacturing/ch-en-manufacturing-industry-4-0-24102014.pdf, retrieved on 01 June 2022.
18. Tom Goodwin (2015), "In the Age of Disintermediation the Battle Is All for the Consumer Interface", TechCrunch, March, http://techcrunch.com/2015/03/03/in-the-age-of-disintermediation-the-battle-is-allfor-thecustomer-interface/, retrieved on 01 June 2022.