Digital Technology Evolution of the Industrial Revolution From 4G to 5G in the Context of the Challenges of Digital Globalization

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Abstract **– The development of a new generation of information technologies and engineering equipment directly affects the path of scientific research and innovation. As a result of these processes, new trends are developing, such as information technology, AI, digital education and medicine, etc. The 4th Industrial Revolution is the result of digital transformation. These processes are the basis for the evolution from the 4th to the 5th industrial revolution. The article analyses the fifth generation of 5G mobile telecommunication systems, which is a new wireless communication standard that will bring significant improvements in the data transfer speed of connecting many devices simultaneously.**

Keywords **– Digital technologies, smart manufacturing, technological innovations, 4G, 5G.**

1. Introduction

The Fourth Industrial Revolution and its Impact on the Development of the High-Tech World.

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Today, a new phase of the scientific and technological revolution is coming with the relocation of the world's industrial, manufacturing and scientific centers. The Fourth Industrial Revolution, which includes three areas, such as information, physics and biology, is changing its shape. Technological innovations include global collaboration, digital capabilities and acceleration, and use of basic research facilities and equipment. The 2030s will require a strong scientific and technological nation and scientific and technical talent, which will be expanded with new discoveries, technologies, scientific and technical talent that are more diversified and internationalized in the context of the development of digital transformation of e-education in the European Union [1]. The concept of the Fourth Industrial Revolution, which is already evolving to 5G, has extremely significant and far-reaching implications. In recent years, technological advances such as next-generation information, new materials, new power, and life sciences have continuously given rise to emerging industries, and transformative sectors such as artificial intelligence and blockchain have developed rapidly. The concept of the Fourth Industrial Revolution has been increasingly recognized by all segments of society and has also gradually gained attention. The Fourth Industrial Revolution affects technological innovation, social progress and economic development in a comprehensive manner, and the talent demand, especially scientific and technological ones. The new conditions of globalization, modernization and internal contradictions of the knowledge and technology system are giving rise to a new round of scientific and technological revolution characterized by environmental friendliness, intelligence and omnipresence. As a result of these processes, there is a profound expansion - information technology, biotechnology, new material technologies, and new power technologies are contributing to the emergence of new digital innovations.

The Fourth Industrial Revolution is the embodiment of the scientific and technological revolution in its industrial transformation, which is evolving into the Fifth. Dominant technologies are emerging in the form of technology clusters, including next-generation information technologies, new energy technologies, low-carbon green technologies, and life sciences. Interdisciplinary integration and development are affecting people's cognitive structure and working methods. Major breakthroughs in interdisciplinary issues require new demands on systems thinking and teamwork. The frontier fields are constantly expanding, and materials science is evolving towards micro-depth, macro-extension, and extreme conditions. Digital breakthroughs are occurring in major scientific fields such as the structure of matter, the evolution of the universe, the origin of life, and the nature of mind, which require the development of smart education and smart business [2]. The development of a new generation of information technology and equipment industry directly affects the way of scientific research and innovation. The development of neurocognitive science contributes to a deeper understanding of cognitive models, which has a positive impact on the progress and breakthroughs in other areas. The actual needs of the ecological civilization are contributing to major breakthroughs in many fields of technology. A significant part of people's quest for a better life is the desire for a better ecological environment. Previous scientific advances and technological revolutions have brought human progress to unprecedented heights, but also caused many deep-rooted environmental problems. A significant part of creating a new stage of the scientific and technological revolution is to meet the real needs of improving the ecological environment, to achieve harmonious coexistence between humans and nature, which will be one of the important components of the current stage of the digital revolution.

The research aims to develop directions for the evolution of digital technologies from the Fourth Industrial Revolution 4G to 5G.

Research objectives: 1) to analyze the Fourth Industrial Revolution as a digitally-centric integration of empowerment; 2) to clarify the nature and directions of artificial intelligence development as a factor in the development of society and digitalization of education; 3) to identify areas of Big Data development as a strategic resource and innovative element of digital production. The subject of the study is digital technologies of the Fourth Industrial Revolution from 4G to 5G. The object of the study is the socio-economic patterns of digital technologies evolution from the Fourth Industrial Revolution 4G to 5G.

2. Literature Review

The British historian of science Bernard put forward the concept of the technology and scientific activity Center. Japanese historian of science Yuasa Mitsutomo conducted a statistical study of scientific activity and believed that a "scientific center" can be called a country whose scientific achievements over a certain period exceed 25% of the world's scientific advances in the conceptualization of smart philosophy as a postmodern project of non-linear development in the 21st century [3]. Since the sixteenth century, the centers of world science have been moving from Italy to England, France, Germany, and the United States. These countries have produced major breakthroughs and great scientists that have influenced the development of world science and technology, and the periods during which they have maintained their status as world science centers range from 60-70 years to more than 100 years. Today, the United States is still an important scientific center in the world, but the world is already in a new phase of major changes and adaptations.

The work "Global Trends 2030: A Different World", written by the National Intelligence Council of the United States, notes that a new round of the scientific and technological revolution will lead to major changes in the international industrial division of labor, change the structure of global competition and the global scientific and technological innovation power will begin to shift from industrialized to developing countries [5]. The share of global R&D investment in the United States fell from 37% to 30% between 2001 and 2011, and in Europe from 26% to 22%. Emerging economies such as China, India, and Brazil have become active areas for technological innovation, and their contribution to global technological innovation has grown rapidly. In the next 20-30 years, the three global science and technology centers in North America, East Asia, and the European Union will come together and dominate the global innovation landscape. Klaus Schwab noted that the use of Big Data is essential for decision-making. Big data can predict the future. Today, informatization has evolved from a tool for increasing efficiency to the basis and support of social development. New generation information technologies, such as cloud computing, Big Data, and the mobile Internet, have overcome initial technical barriers and formed a new model of industrial intelligent development. Lowering the barrier to innovation can create a fairer, more transparent and open market environment while promoting data as an important means of production.

The use of big data analytics can summarize experience, identify patterns, predict trends, facilitate decision-making, and fully release and exploit the enormous potential contained in massive data resources. In this paper, we analyze the works of V. Voronkova, O. Kyvliuk, V. Nikitenko, and R. Oleksenko, which present the development of digital technologies at the present stage. The Club of Rome is pleased to observe the methodological evolution from the simple computer model World3 from "Limits to Growth" 1972 to Jorgen Randers' model 2052 40 years later [8].

3. Research methodology

General philosophical methods such as analysis and synthesis, interconnection, abstraction and transition from the concrete to the abstract and vice versa, historical and logical, comparison, institutional analysis, helped to bring all the disparate empirical data to a coherent concept of developing directions for the evolution of digital technologies from the Fourth Industrial Revolution 4G to 5G. One of the methods is the Agile method, which tries to explain big data that can predict the future, which is supposed to be adaptive, stable, and efficient. The Supernova era has introduced new categories - information, big data, data mining, creative digital technologies, digital societies, characterized by the intensification of human communication capabilities in the realm of of informatization [4]. To promote data freedom, it is essential to clarify the purpose of technology, ensure transparency, comply with data security rules and usage principles, and establish that data belongs to users or consumers.Big Data technology is designed to extract valuable information from various types of data using new processing modes to achieve deep insights, sharp discoveries, and accurate decision-making. A social diagnosis of digital technologies from the Fourth Industrial Revolution and the evolution from 4G to 5G was conducted using the Action research method. This scientific and practical approach employs various methods of scientific knowledge (e.g., survey, observation, diagnosis, and expertise) and active intervention (e.g., change, transformation, and improvement) to study the evolution of digital technologies from the Fourth Industrial Revolution to 5G and their practical application in management activities. Agile methodology as a theoretical basis of the innovative component in promoting flexible approaches to the use of the digital aspect of modern management, a flexible, creative and innovative element that should be implemented in all management and administration structures based on the principles of sustainable development.

4. Results and discussion

The evolution of the Industrial Revolution from 4G to 5G includes a number of significant changes in communication technologies that have brought improvements in data transfer speeds, reaching speeds of up to several gigabytes per second. This evolution opens up great opportunities for high quality video streaming, virtual reality and other advanced applications. It facilitates the development of real-time applications such as autonomous cars, virtual reality and remote surgery. 5G has higher capacity, allowing more devices to be connected to the network at the same time. New features: 5G introduces new capabilities, such as scalable communication networks, the use of cloud services, which can stimulate the development of new digital technologies.

1. The Fourth Industrial Revolution as a Digital-Centered Integration of Empowerment

The digital revolution is closely related to the emergence of the technological revolution and the geographical distribution of scientific and technological activities. The term "Industry 4.0" refers to the fourth industrial revolution in human history, which builds upon the achievements of previous industrial revolutions.The first industrial revolution was the mechanization of factories using water power and steam engines from the 1860s to the mid-19th century; the second industrial revolution was the widespread use of electricity from the second half of the 19th century to the early 20th century; the third industrial revolution was the automation of production processes based on programmable logic controllers (PLCs), which appeared in the second half of the 20th century. The first industrial revolution achieved little standardization, and the organization of production began to change from decentralization to centralization. The Second Industrial Revolution achieved widespread standardization, making large-scale centralized production a source of competitive advantage for enterprises. The third industrial revolution achieved large-scale standardization. In general, the fourth industrial revolution will significantly increase productivity, promote changes in production methods and human development processes. Every time an industrial revolution takes place, the competitive position of countries in the world changes. The first industrial revolution was initiated by the United Kingdom in the "steam era," the second industrial revolution was dominated by the United States and Germany in the electric era, and the third industrial revolution was led by the United States.

The Fourth Industrial Revolution has a profound impact on the world, mainly revolving around a new generation of information technology [6]. The Fourth Industrial Revolution 4.0 is positioned as a technological innovation that consists in the transition to scale economies through data flow automation techniques and the creation of a heterogeneous and customized industry with homogeneous and large-scale costs. This is essential for the restructuring of industry. Industry 4.0 is starting a new round of industrial revolution, its main feature is Internet technology, which reduces the information asymmetry between production and sales, and accelerates the interconnection and feedback between them. Therefore, a new consumer-oriented business model was born, and Industry 4.0 has emerged as a key link to implement the model. Industry 4.0 represents Internet + manufacturing intelligent production, which gives rise to a large number of new business models and can truly realize the C2B2C business paradigm. In the future trend of automating the data flow, the world's leading powers incorporate different views. A typical example is the "Industrial Internet" promoted by General Electric (GE), which pays more attention to the intelligence of the product itself.

The Fourth Industrial Revolution is a new round of industrial transformation characterized by the deep and comprehensive application of a new generation of information technology, the integration of new energy, new materials and biotechnology, and digital technology as a key element. The Fourth Industrial Revolution has begun in many countries simultaneously, a comprehensive and coordinated change in technology, management, information system and concepts. This change will ultimately lead to an organizational structure of production, a new way of business operation, and a paradigm of industrial competition. Scientific and technological activities are usually active in regions with developed societies and prosperous cultures. Under this trend, and under pressure, developed countries have taken advantage of their dominant position to continually increase their attractiveness to scientific and technological talent by relaxing technical immigration policies, opening up national education, creating joint research projects, and providing generous salaries. Developing countries with economic achievements have introduced various innovative policies and talent development plans to actively participate in the global competition for scientific and technological resources and outstanding talent.

The concept of Industry 4.0 is the Fourth Industrial Revolution, which is dominated by intelligent manufacturing, or a revolutionary method of production. Digital strategies are aimed at transforming the manufacturing industry into an intelligent one by fully utilizing the combination of information and communication technologies and the virtual system of cyberspace. The Industry 4.0 project is mainly divided into three main areas.

The first area is Smart Factory, which focuses on the research of intelligent production systems and processes, as well as the implementation of networked distributed production facilities. The new generation of information technology is developing rapidly, with major breakthroughs in computer chip processing, data storage, network communication, analytical and quantum computing. Emerging technologies such as artificial intelligence, big data, cloud computing, the Internet of Things, mobile Internet and virtual reality, 3D printing, industrial robots, next-generation intelligent manufacturing, energy storage, renewable energy sources, and nanotechnology have profoundly affected production models. Biotechnology technologies are shaping biological breeding and biomedicine, gene editing, and the introduction of stem cells.

The second area is "intelligent manufacturing," which basically involves managing the production and logistics of the entire enterprise, human-computer interaction, and the use of 3D technologies in industrial production. Intelligent manufacturing will pay special attention to attracting the participation of small and medium-sized enterprises, and will try to make them the beneficiaries of a new generation of intelligent manufacturing technologies, creators and suppliers of advanced industrial production technologies.

The third direction is "smart logistics", which integrates logistics resources mainly through the Internet, the Internet of Things and logistics networks, gives full advantage to the efficiency of logistics resource suppliers, while the demand party can quickly receive relevant services and logistics.

Thanks to the implementation of the Industry 4.0 strategy Germany has become a supplier and a leading market for a new generation of industrial production technologies (cyber-physical systems), which will allow it to increase its global competitiveness.

On a social basis, Germany's perfect democratic legal system and intellectual property protection are a strong support for the innovative development of German industry, as well as a real weapon for reducing the costs of social production and increasing efficiency. Industry 4.0 has a key point, i.e., "raw materials (substance)" means "information". In particular, the raw materials purchased at the factory are "labeled" as product XX produced for customer A, and to be precise, "raw materials" containing information are used in smart factories, where "raw materials (substance)" means "information" and the manufacturing industry as part of the information industry [7].

Business models are essential for smart manufacturing. So, in the era of Industry 4.0, the business model of a certain manufacturing industry is to solve customers' problems. Therefore, in the future, manufacturing companies will not only sell hardware, but also gain more added value by providing after-sales service and other follow-up services. This is soft manufacturing: the system with the function of "informing" has become the new core of hardware products, which means that personalized demand and small scale customized production will become a trend. Entrepreneurs in the manufacturing industry should increase the added value of products in the manufacturing process as much as possible, expand services, offer better solutions, meet individual customer needs, and soften production, modeling the limits of growth in the work "30 Years Later" [8]

"Industry 4. 0" Qingdao, consisting of German Industry 4.0 research institutes, Chinese-related institutes, and Chinese and German companies, has become the first Industry 4.0 alliance in China. The China-Germany Qingdao Ecological Park is an ecological, smart and open community of interest established by China and Germany jointly, and the establishment of the China-Germany Ecological Park Alliance to promote Industry 4.0 is of great significance here. "Industry 4.0" is the improvement and modernization of the combination of intelligence and industrialization of enterprises against the backdrop of the big data revolution, cloud computing, and the mobile Internet era. It is an important way for Chinese enterprises to improve and develop.

After the establishment of the China-Germany Industry 4.0 Alliance, the Qingdao West Coast New District will invest 100 million yuan to implement pilot projects for some enterprises in the region and gradually realize the modernization of Industry 4.0 in the future.

Industrial automation is one of the important prerequisites for the start of Industry 4.0 in Germany, mainly in the fields of mechanical and electrical engineering. An "embedded system", which is currently widely used in the German and international manufacturing industry, is a special computer system developed for specific applications that completely integrates mechanical or electrical components into a controlled device. Some experts predict that the ongoing advancement of Industry 4.0 will bring a large number of orders to some German machine and electrical equipment manufacturers, as well as many small and medium-sized enterprises.

Industry 4.0 is a concept proposed by the Germans, who believe that the manufacturing industry can only create value through intelligent production in the future, meaning that production itself creates value. The United States proposed the Industrial Internet, introduced by General Electric (GE), focusing on improving production efficiency and creating a future digital industry through machine connectivity, software, and big data analysis. Industry 4.0 is the use of intelligence to create more flexible production procedures, support innovation in manufacturing, and better serve customers represents a change from the centralized manufacturing model. Intelligent manufacturing process and industrial production is not a simple production process, but a connection between the product and the machine, where the product tells the machine what to do. Intelligent manufacturing is possible in the future: the combination of factories, products, and intelligent services will be quite normal in the new manufacturing era in the world. Industry 4.0 is a gradual process that involves many different businesses, departments, and areas and is developing at different speeds. Cross-industry and cross-departmental cooperation is becoming inevitable, as exemplified by Germany and China [9].

Table 1. Theories of the digital economy and digital technologies of the Fourth Industrial Revolution

Theory or concept name	Positive consequences	Negative consequences
1. The theory of " Big Data " (exponential increase in information)	Improved decision-making; most decisions will be made in real time; new types of work will emerge.	Workplace loss; concerns about the confidentiality of private data; algorithmic clashes
2.The theory of artificial intelligence	Cost reduction; productivity improvement; removing obstacles barriers to innovation; new opportunities for small businesses; and multi-tasking in large organizations.	Automation of professions, loss of jobs; work only for white-collar workers; disclosure of financial information; risk
3. Theories of robotics	Simplification of supply chain and logistics systems; more free time; greater access to materials; " re-shoring" - replacing foreign workers with robots.	Loss of jobs; responsibility and accountability; 24/7 service; hacking and cyber threats.
4.Bitcoin and blockchain theories	Increased financial inclusion in markets; elimination of intermediation by financial institutions; dramatic increase in tradable assets; depository or software-driven smart contracts; increased transparency.	Anyone can view the balance and transaction history of any bitcoin address. Bitcoin should be treated as a high-risk asset and you should never store funds in bitcoin that you cannot afford to lose. Some untrustworthy users may deceive or defraud others through transactions, which also means taking some risks in unverified transactions.
5. Theories of the shared consumption economy	The sharing economy is divided into: travel, accommodation, food, clothing, loans, education, treatment, travel, production; physical goods are shared; all parties receive economic benefits; better use of assets; creation of secondary economies; turning crises into opportunities and growth of new business models.	Poorer ability to recover from job losses; reduced ability to measure potentially shadow economy; less investment in system development.
6. Theories of 3D manufacturing	The use of a variety of materials : plastic, aluminum, steel, ceramics; accelerated product design; shortened the cycle between development and production; and the emergence of new industrial products for the supply of printing materials.	Increased amount of production waste for utilization and negative impact on the environment; piracy; potential for immediate copying of any innovative development.

On the background of the Fourth Industrial Revolution, artificial intelligence is an important variable for future digital development, and its impact on future demand for human talent will be the most far-reaching. The cultivation of talent brought about by the Fourth Industrial Revolution will affect the future society. Artificial intelligence works through deep machine learning, a learning process that involves identifying and memorizing a large amount of existing knowledge.

This is a challenge for the education system, which focuses on knowledge transfer. Of course, despite the fact that artificial intelligence brings convenience to the development of society, it can have certain negative consequences. It requires the introduction of scientific and technological talent ethics into artificial intelligence technology so that it can better meet the needs of people and the progress of society. In a society equipped with AI technology, all citizens should be able to read, understand, and communicate with data, and participate in discussions about AI-related policies. Computer science has become a "new basic skill". This requires the integration of artificial intelligence, data science, and related fields with the national education system. If artificial intelligence is widely used in services, manufacturing, transportation, healthcare, science and technology, and other areas, a large number of workers will be excluded, which will be a serious problem for future skills education. During the digital revolution, the nature of small economic enterprises that create knowledge and turn it into profit or contribute to social welfare activities has become more social than individual. More than 80% of the value of the S&P 500 companies is "dark matter," or intangible factors. Compared to these "intangibles," the share of tangible assets and cash flows attributable to the company is less than 20%.

Among this "dark matter," a significant share is occupied by intangible experience, including corporate culture, incentive systems, and management knowledge, which are crucial for modern enterprises [10].

To be precise, the key to a successful company in the future is to have a set of processes for collecting, processing, and responding to information that contribute to the company's development and are difficult to be copied. The development of artificial intelligence will transform the way we train talent. Artificial intelligence improves the quality of talent training by facilitating the digitalization of education.

Improving the quality of learning in the classroom

Thanks to Big Data technology, teachers can accurately understand the level of knowledge of each student, using image recognition technology to monitor student concentration in learning.

Increasing the efficiency of teachers

In the future, every teacher can have an AI teacher assistant that will help teachers assess work, plan lessons, create curricula using knowledge graphs, provide big data-based decision-making and learning management suggestions. 3. Artificial intelligence technology can reduce the cost of education and provide a large number of educational and training opportunities outside the classroom. For example, Stanford University plans to create an "open-cycle university" to increase the duration of training and relax age restrictions. 4. Artificial intelligence technology can transform knowledge into intelligent products [11].

Artificial intelligence has a profound impact on the social structure, scientific and technological innovation, and scientific and technological talent. By the middle of the 21st century, scientific and technological power will have a number of characteristics: science and technology will become more prominent as the main supporting force for national prosperity, and the demand for scientific and technological talent will be greater.

Artificial intelligence and machine learning enable manufacturing companies to leverage vast amounts of information. Artificial intelligence and machine learning can provide information that enables the automation of operations and business processes. Using the data collected from these assets can help companies to perform predictive maintenance based on machine learning algorithms, increasing efficiency. Artificial intelligence (AI) and machine learning refer to the ability of machines to learn and act intelligently, they can make decisions, perform tasks, and predict future outcomes based on what they have learned from data.

Artificial intelligence will change our world and our way of life. Artificial intelligence is already present in our daily lives, from Google searches to Amazon product recommendations, personalized recommendations on Netflix and Spotify, and in the process of securing fraudulent credit card use. Artificial intelligence and machine learning are fundamental to the development of other technological trends. AI enables machines to perform a variety of tasks, such as seeing (facial recognition), writing (chatbots), and talking (Alexa). As machines become more capable of acting intelligently, artificial intelligence will penetrate all aspects of our lives.

Table 2. Artificial intelligence (AI) as a factor in society's development and global digitalization: advantages and disadvantages

The content of the artificial intelligence (AI) function	Advantages of artificial intelligence	Disadvantages of artificial intelligence
1.Artificial intelligence as high work efficiency	High efficiency, reliability, replacement of people for more dangerous work	High efficiency, reliability, replacement of people for more dangerous work
2. Artificial intelligence is good at tedious mechanical work	AI is highly reliable, less likely to make mistakes than humans, and more efficient	In the area of innovation, due to the lack of fixed measurement standards and output models, artificial intelligence does not cope well with innovation
3.The value of artificial intelligence	The cost is relatively low in the long run, it can significantly save labor costs, as less physical labor and more intellectual labor is required.	The cost is too high for ordinary businesses and the threshold for use is too high.
4.Use of artificial intelligence	The key issue is data mining to help businesses make smart decisions	Artificial intelligence as a threat to humanity's existence
5.Improving workplace efficiency with AI	People will be surrounded by IoT devices that can speed up complex tasks and perform everyday tasks.	AI systems can fail
6.Artificial intelligence as a means of providing many automated services for people	These services can be smart, improving the human environment. AI can be used to automate services, create virtual assistants or chatbots that can answer user questions, provide information about products or services, solve problems, and provide 24/7 support.	The ability of artificial intelligence machines to process large data sets quickly and accurately is crucial for many intelligent technologies and environment
7. Artificial intelligence for decision-making in the workplace	The speed and effectiveness of some AI programs make them attractive to executives looking to gain more business advantage	The use of artificial intelligence to manage employees will lead to the fact that the work of managers will become increasingly isolated, destroying human functioning
8.The future of workplaces	Artificial intelligence will actually lead to long-term job growth.	Decision-making software causes some concerns
9. Artificial intelligence can truly eliminate human error in the process	AI saves time and labor costs, and thus reduces human error	The greatest disadvantage of artificial consciousness is that it will completely destroy human functioning

Big data has become an important factor in production. From the advent of Watt's steam engine in the 1860s to around 1850, along with the Industrial Revolution, machines created the "muscle" as a system for the economy, and now a "nervous" system is tuned for it. The rapid development of a new generation of information technology has more effectively improved the ability to acquire, store, and analyze data in the course of economic activity, making large amounts of information about people, things, and activities digitized. New mutations of massive data are becoming more and more serious and necessary. It is evident that data has become an important factor of production and an important nerve element of current economic development, giving a new impetus to the new digital economy, digital philosophy as an integral factor of economic development of society [12].

In the context of the Fourth Industrial Revolution, the new round of the scientific and technological revolution is accompanied by the trend of digitalization, and technological innovations represent the characteristics of multidisciplinary cooperation and interdisciplinary integration, including changes in speed, scale and scope. The speed of development of the Fourth Industrial Revolution has shown exponential growth, and the velocity and breadth of the latest technologies and innovative achievements in various fields far exceed the three previous industrial revolutions. Innovation is becoming more intense as the pace of development and diffusion is faster than ever before. The steam engine is a symbol of the first industrial revolution. It took 120 years for it to come into the world, but it took less than 10 years for the Internet to spread around the world. As networking and informatization are the main characteristics of the Fourth Industrial Revolution, information and data will become the most valuable resource in the future. All people and countries will have a "data dependency" and if data is in the hands of a few people, it can lead to a data dictatorship. The issue of regulating data ownership will be linked to the future of people and future lives. Electronic means and social media can monitor people, and data privacy is facing great challenges. At the same time, data can be used to measure people's thoughts, manipulate emotions, and even influence individual decisions. Governments and companies share the responsibility for data security, and digital governance is unprecedentedly complex. In the digital era, rules and standards need to be formulated to ensure the responsible use of artificial intelligence and prevent data information from being used for illegal activities. At the moment, the big data industry has gradually matured and needs to be used in all aspects of life.

The problem of "information islands" is an important issue that many countries face in the development of the big data industry. This means that information is stored, processed and used in separate, sometimes inaccessible systems or organisations. One of the main problems with information islands is that different organisations or institutions use different standards, protocols and systems to store and process data. It makes it difficult to share information between organisations and combine data from different sources for analysis. To overcome the problem of information islands, several measures need to be taken: data standardisation, establishing common standards and protocols for storing, transmitting and processing data; creating common platforms for data exchange and collaboration; and legal and regulatory measures that facilitate data sharing between organisations.

The inter-agency and inter-industry data exchange is still not complete, valuable public information resources and commercial data are not open to the public, are basically at a standstill, and cannot operate smoothly. The deep integration of the new generation of information technology and various fields of the economy and society has caused an explosive growth in data volume, making data resources an important strategic resource and a core innovation element of the country. The development of big data will have a revolutionary impact on economic and social development and even on people's thinking and concepts, and can create strategic opportunities for national development, the impact of informatization on the values of the individual [13].

As economic development returns to the mainstream, big data will play an increasingly important role in stabilizing growth, facilitating reforms, adjusting structure, and improving livelihoods. It will play a fundamental, strategic, and leading role in economic and social development, which will become more visible. At the same time, big data will also reconstruct the information technology system and industrial structure, and provide great opportunities for the development of the information technology industry. In fact, the competition around the development of big data will not only determine the structure of the international information industry, but also profoundly affect national security and comprehensive competitiveness. Promoting the development of Big Data and enhancing the overall strength and competitiveness of Big Data technology development, industrial development, security, personnel training are key to promoting economic growth, transformation and modernization in the context of social, economic and educational transformation in the digital era [14].

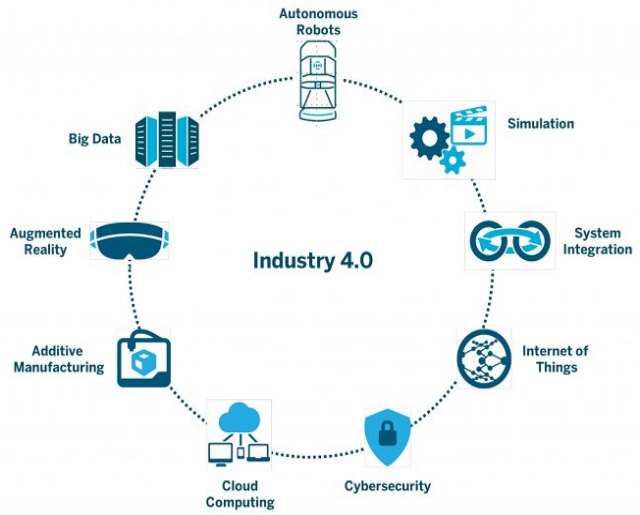

Figure 1. Evolution of the Fourth Industrial Revolution. (Researchers' th Industrial Revolution: Essay & Important Notes Source: https://studiousguy.com/4th-industrial-revolution-essay-important-notes/)

Big data is a continuation of the development of informatization, and the concept of big data is closely related to everyday life. Whether it is government agencies, business operations or shop production, logistics and transportation, large amounts of data are generated every day. When data from all areas of life accumulates to a certain scale, new technologies such as data storage, management, mining, and application can help to better understand the present and also to forecast the future.Telecommunications operators rely on Big Data technology to open up new avenues for traditional businesses, such as intelligent transportation, public opinion analysis, precision e-commerce marketing, and accurate advertising. So-called Big Data technology is designed to extract valuable insights from various types of data quickly using new processing modes to achieve deep insights, sharp discoveries, and accurate decision-making. The Big Data industry includes three parts: hardware, software, and services. In terms of Internet companies, which are leading by leaps and bounds at the forefront of Big Data technology, the level of Big Data innovation consists of three steps. The first stage is represented by Google, which occupies the absolute leading position in Big Data technology; the second stage is a large number of Internet companies such as Yahoo, Facebook and Twitter; Based on improvements, it is closely integrated with industry applications of the system to quickly form commercial products that can be directly used by general enterprises. The overall development of the global Big Data industry is still in its infancy. However, there may be gaps in the development of different industries and regions. At present, governments are guiding the development of the Big Data industry and applications in Beijing, Shanghai, Guizhou, Guangzhou, Shaanxi, and other places.

These places were the first to try and actively explore and achieve initial results. For example, the government supported and approved the Guiyang Guian Big Data. The establishment of industrial agglomeration zones has achieved significant results in the implementation of industrial support policies, data exchange transactions, laws and regulations, etc. In addition, thanks to the joint efforts of all parties, Big Data in China is developing rapidly. The scale of the industry continues to expand, breakthroughs have been made in some key technologies, and a number of backbone enterprises have emerged. Cloud computing and Big Data itself are also contributing to the creation of large amounts of data that provide important resources for innovation, which serve as Smart technologies [15].

China has created the Zhuoshu platform for Big Data trading. The platform currently has 19 categories of data, has collected almost 8000 transaction users, and more than 20,000 users use the data online. In terms of using cloud computing and Big Data to promote business model innovation, many governments have taken the lead in demonstration and made fruitful research attempts. The Shandong provincial government has combined the credit data of 46 units to build a provincial-level public credit information system. So far, nearly 10 million data items have been collected, providing open services to government departments and third-party credit agencies, and connecting the data to credit China. Local governments have very rich data resources and need to use Big Data to improve management efficiency. By opening up data to the public, strengthening cooperation with social enterprises and data organizations, and purchasing services from the public, the Chinese government is promoting the integration and comprehensive application of Big Data in key areas such as environmental protection, healthcare, education, and transportation to improve the efficiency of government affairs and public services. Society has not yet formed an objective and scientific understanding of the laws of Big Data development, and some people mistakenly view the construction of data centers as centers of Big Data development, pursuing investment in hardware, and underestimating the ability to collect, accumulate, process, and apply data resources. Our world is more data-rich than ever before. The more data we have, the easier it is to gain new insights and even predict what will happen in the future. By analyzing large amounts of data with the help of intelligent algorithms, previously unknown patterns and connections can be discovered [16].

Table 3. Big Data as a strategic resource and innovative element of digital globalization

No. in order	Role of global data	Development area
1.	Big Data as both explosive growth and massive accumulation	To build a digital economy with data as a key element, to make the digital economy bigger and stronger and to expand new space for economic development
2.	Big Data as a new type of production factor	A factor of production, reflecting the fact of accelerating digital transformation of economic activity
3.	Big Data as a new development impulse	Use of data as a key element to promote digital industrialization and the digitalization of industry
4.	Big Data as a factor of competitive advantage	The economy is favorable for seizing opportunities, grabbing the commanding heights of future development and creating new advantages in national competition.
5.	Big Data as a decisive role in the market	Contribute actively to the development of data resources, elements and marketing, and ensure that data resources are optimal.
6.	Big Data as a crucial role for production	Develop strategic resources and the innovative element of digital globalization

5. Conclusions

At present, the global scientific and technological structure, shaped by the emergence of a new round of the scientific and technological revolution and the relocation of world scientific centers, is being restructured and at the same time accompanied by the arrival of the fourth industrial revolution. In view of this, the basis for creating a global scientific and technological power is the support of relevant scientific and technological talents. Based on the characteristics of a technologically powerful country in the new era, the future demand for scientific and technological talent can be analyzed in terms of quality, scale, and structure.

From the perspective of quality, future science and technology talents should have scientific sense, strategic thinking, original ability, and new scientific research ability.

The Fourth Industrial Revolution is not only about changing production methods through digital technology, but will also bring about changes in the entire social system. The government must adopt effective strategies to avoid exacerbating social inequality and the dictatorship of data, create a modern governance system that adapts to the characteristics of the digital age, and accelerate the transition to a science and technology-based development model. The main feature of the Fourth Industrial Revolution is the integration of physical space, cyberspace and biological space, driven by many new innovative technologies, driven by digital technologies represented by the Internet of Things, Big Data, artificial intelligence, blockchain and robots. The mode of social production includes the main content of the following four aspects.

The fourth industrial revolution is a deep integration of digitization, networks and intelligence.

The innovation and interconnection of resources created by the Internet will profoundly affect the way global resources are allocated and will include changes in countries, companies, industries, and all systems of the entire society. More important than the technology itself is the system that creates wealth and value.

Through the cooperation of government agencies, businesses, and research and development units, we can jointly promote the application of new technologies and contribute to a more efficient social system. Understanding the characteristics of the Fourth Industrial Revolution as a systemic change is useful for assessing the social changes brought about by the Fourth Industrial Revolution at the macro level and for exploring areas where different technologies can create value that has anthropological and axiological characteristics.

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