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O. Экономическое развитие, научно-технологический прогресс и рост
O. Economic Development, Innovation, Technological Change, and Growth

ЦИФРОВАЯ ТРАНСФОРМАЦИЯ СОЦИАЛЬНО-ЭКОНОМИЧЕСКИХ СИСТЕМ (НА ПРИМЕРЕ КИТАЯ)

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Рассмотрены ключевые аспекты теории цифровой трансформации социально-экономических систем. Представлены мнения ученых и сотрудников крупных институтов о цифровой экономике и теории совместного создания ценностей. Содержание теории динамических возможностей показано в элементарном, процессном и структурном аспектах. Исследованы история развития и особенности функционирования цифровых платформ как инструментов цифровой трансформации. На примере Китая проанализирована структура цифровых платформ.

Ключевые слова: информация; цифровая трансформация; цифровая экономика; платформа; теория совместного создания ценностей; динамические возможности.

DIGITAL TRANSFORMATION OF SOCIO-ECONOMIC SYSTEMS (ON THE EXAMPLE OF CHINA)

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In the article were considered the key aspects of the theory of digital transformation of socio-economic systems. Different scholars and major research institutions were presented which have interpreted the connotation of the digital economy from different focuses and the connotation of value co-creation theory. Then the research content of dynamic capability theory was shown in the aspects, one is the element aspect, the second is the process aspect, and the third is the structure aspect. The development and influence of digital platforms as tools for digital transformation are investigated. China's digital platforms structure example was analysed.

Keywords: information; digital transformation; digital economy; platform; value co-creation theory; dynamic capability.

Today the study of the development process and the mechanisms of action of digital transformation is a popular research area for scientists from various scientific fields. At the same time, strengthening digital

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cooperation between China and Belarus is one of the priority areas of state policy. Therefore, the analysis of the development process and the mechanism of action of China's digital transformation, the definition of connotation is of great importance for further enrichment and improvement of the digital transformation theory. This will enable scientists to deeply understand and accurately predict the impact of digital transformation not only on the economy, but also on the social sphere.

In this unprecedented change, we are not just bystanders and witnesses, but participants and practitioners of this new industrial revolution great practice. In the 1980s, the international community put forward the concept of intelligent manufacturing. With the application and practical exploration of new technologies, the connotation and extension of intelligent manufacturing have been constantly evolving in the past fourty years. In 2012, the industrial Internet proposed by the international community has increasingly become the focus of attention from all walks of life. Intelligent manufacturing and industrial Internet are solutions based on the technological system, demand structure and competition pattern of different eras in the face of the needs of manufacturing transformation and upgrading. There are differences. From intelligent manufacturing to industrial Internet, it is the migration of information technology systems from traditional architecture to cloud architecture, the evolution of manufacturing resources from local optimisation to global optimisation, and the expansion of business collabouration from within the enterprise to the industrial chain, and it is a competition model. The upgrade from single-enterprise competition to ecosystem competition is the deepening of industrial division of labour from product-based division of labour to knowledge-based division of labour, but the internal logic is the same solving the uncertainty of complex systems with the automatic flow of data.

Key aspects of the theory of digital transformation of socio-economic systems. The fear of uncertainty exists in any era, and the three-step process to resolve the fear of uncertainty is to understand, predict and control the objective world. Only by deeply understanding uncertainty can we truly understand informatisation. The development of human society has always been accompanied by the pursuit of certainty. Certainty is the premise that behaviour can be predicted and the source of our sense of security. The fear of uncertainty and the pursuit of certainty have always accompanied the development and evolution of human society. With the upgrading of technology and the rapid upgrading of market demand, the uncertainty problems faced by manufacturing enterprises are more complicated. The essence of intelligent manufacturing is to resolve the uncertainty of complex manufacturing systems with automatic data flow and optimise the efficiency of manufacturing resource allocation. Accurately predicting the future is the basis for decision-making. In the cognitive system of human society, philosophy, science, and economics have all carried out the basic proposition of uncertainty. It is human nature to reduce cognitive uncertainty, risk aversion, and seek certainty, which requires people to continuously improve the ability and level of information acquisition.

For example, the Internet of everything means that people, things, data and applications are connected through the Internet to achieve the interconnection between people and people, people and things, and things and things reconstructs the production tools, production methods and life scenarios of the entire society. From the perspective of the Internet of everything, informatisation means that physical devices continue to become network terminals and trigger the entire process of social change. The ultimate goal of information technology development is to realise the ubiquitous connection of devices based on the Internet of things platform, develop various applications, and provide a variety of data support and services. All products will become intelligent products that can be monitored, controlled, optimised and autonomous.

In the digital space, the most important actors are Internet companies represented by companies, such as *Google*, *Apple*, *Facebook*, *Tencent*, and *Alibaba*. With the continuous innovation, penetration and diffusion of a new generation of information and communication technologies, a new round of industrial revolution is emerging on a global scale. The interconnection of all things, data-driven, software-defined, platform support, organisational restructuring, and intelligent leadership are building a new system of manufacturing, which has also become the commanding height of a new round of global industrial competition. According to the analysis of the «White paper on China's digital economy development (2020)» on the impact of the fourth industrial revolution on the supply chain, digital transformation can reduce costs by 17.6 % and increase benefits by 22.6 %[1]. Digital transformation has become an important leading force in driving innovation, providing important development opportunities for China and developing countries [1].

The manufacturing industry is entering a new stage of system restructuring. In the context of a new round of industrial revolution, a new generation of information and communication technology and manufacturing represented by the Internet, big data and artificial intelligence the industry is accelerating the integration and

[1]White paper on China's digital economy development (2020) [Electronic resource]. URL: http://www.caict.ac.cn/english/research/whitepapers/202007/t20200706_285683.html (date of access: 05.08.2022).

development, and is reconstructing the new system of manufacturing efficiency, cost and quality control, and reshaping the production subject, production object, production tool and production method of the manufacturing industry in an all-round way. Computing technology has entered a period of ternary integration of human, machine, and object, and virtual reality has become an important support for this. Virtual reality is a profound change in display technology and is regarded as another general technology platform after computers and smart phones. TV screens, computer screens, and mobile phone screens display two-dimensional images without exception, but virtual reality provides us with a display screen of three-dimensional images, bringing great changes to the way humans understand and transform the world. To realise the effective interaction between virtual reality and real reality, high-speed transmission technology, recognition technology, computing technology and other technologies need to be effectively cooperated.

Blockchain can form a decentralised, reliable, transparent, secure, and traceable distributed database through encryption technology, promote the transformation of Internet data recording, dissemination and storage management methods, greatly reduce credit costs, simplify business processes, and improve transaction efficiency, reshape the existing industrial organisation model and social management model, improve the level of public services, and realise the transformation of the Internet from information dissemination to value transfer. Therefore, blockchain technology is also known as the trust machine, the new business infrastructure. In the past five years, blockchain technology has been popular in the capital market and has been rapidly applied in many fields. Many countries have issued corresponding policies specifically for blockchain.

Digital technology has a huge impact on the employment structure and the number of jobs. The World Economic Forum estimates that 65 % of children in primary school today will end up in entirely new occupations that do not exist today, and current trends will lead to disruptive changes in the labour market to 2025. There are four possible impacts of digital technology on the number of jobs, namely the creation of new job opportunities, the transformation of jobs, the internationalisation of jobs, and the reduction of jobs. Among the digital technologies that have the greatest impact on employment is artificial intelligence. According to research by the World Economic Forum, increased automation and the introduction of artificial intelligence into the workforce will cost 7.1 mln jobs in 15 major economies over the next years, while technological advances will bring only 2.0 mln new jobs. In 2013, Oxford University researches examined the computing power of 702 occupations and found that 47 % of occupations in the USA could be replaced by automation. Follow-up research noted that 35 % of occupations in the UK were replaced, compared with 49 % in Japan. Other studies suggest that by 2030, 90 % of the jobs we know today will be replaced by intelligent machines. As a result, economists worry about the risk of occupational polarisation, where mid-level skilled jobs are disappearing while lower and higher jobs expand.

Since the 1990s, enterprises have generally carried out business process optimisation and organisational reengineering, and continuously promoted the integration of informational technology and operational technology. However, the change of organisation and management is a systematic project involving many factors, and not all enterprises can succeed. According to research by international consulting firm *McKinsey*, 50 % of businesses that attempt to digitally transform will fail. The government's digital transformation process is also inseparable from business optimisation and organisational management changes. This process has both successes and failures, and requires systematic design and careful arrangements.

Conceptual connotation and interpretation of the digital economy and dynamic capability theory. Different scholars and major research institutions have interpreted the connotation of the digital economy from different focuses. Among them, the more representative viewpoints include, from the perspective of the nature of the digital economy, an economic activity in which goods and services are traded in digital form. From the perspective of digital technology, M. Kotarba defines the digital economy as an economic system that widely uses information and communications technology, including infrastructure, *e*-commerce, and electronic transactions [2]. From the perspective of digitalisation, He Xiaoyin defines the digital economy as knowledge-based, a new economic form in which the manufacturing, management, and circulation fields are catalysed in the form of digitisation [3]. This article's understanding of the connotation of «digital economy» is based on documents issued by China's official authorities, and selects the method of defining the concept of «digital economy» in the latest «Statistical classification of digital economy and its core industries» released by the National Bureau of Statistics of China[2]. Thus, «digital economy» refers to a series of economic activities that take data resources as key production factors, modern information networks as an important carrier, and

[2]Statistical classification of digital economy and its core industry [Electronic resource]. URL: http://www.stats.gov.cn/english (date of access: 03.08.2022).

the effective use of information and communication technology as an important driving force for efficiency improvement and economic structure optimisation.

The researches D. J. Teece, G. Pisano, and A. Shuen put forward a theoretical framework of dynamic capabilities, and analysed the sources and methods of creating and acquiring wealth in an environment of rapid technological change [4]. The dynamic capabilities formed by the organisation in this situation can coordinate the static resources of the organisation, break through the static constraints of traditional resources, promote the enterprise combination of knowledge assets and complementary assets that are difficult to trade within the organisation, maintain the stability of market demand, and maintain the stability of scarce resources. Non-replicability and non-imitation enable the organisation to form a unique competitive advantage. Dynamic capability theory emphasises the dynamic nature of organisational process capabilities, which can be reflected in product development procedures and processes, and in making strategic decisions [5]. According to the S. G. Winter the dynamic capability theory is structural and hierarchical [6]. Organisational dynamic capabilities include general business operation capabilities and high-level dynamic capabilities. The former can help enterprises achieve basic survival, while the latter can help enterprises to constantly revise their daily operations. The hierarchical dynamic capability theory can not only help enterprises to track corporate social value and formulate social responsibility strategies through perception ability, intelligent response ability and rapid execution ability [7], but also help enterprises by changing, adjusting, and expanding their static resources.

The research content of dynamic capability theory can be divided into three aspects, one is the element aspect, the second is the process aspect, and the third is the structure aspect. Elements mainly focus on resources, knowledge, technology, etc. Processes mainly focus on organisational processes, business activities, and learning processes, etc. And structures mainly focus on the structure and dimensions of capabilities. Resources are enterprise-specific assets that are difficult to imitate, such as trade, certain specialised production facilities, and engineering experience. These assets are difficult to transfer between firms due to transaction costs and transfer costs, as assets may contain tacit knowledge [4].

The process aspect of dynamic capability theory focuses on the dynamic evolution process of the organisation, and regards dynamic capability as a systematic process that guides the evolution of enterprise resource integration and allocation, and does not exist independently. Dynamic capabilities may exist in the process of developing new products, formulating digital processes, organising learning processes, matching digital economic opportunities with digital technologies, deploying digital technologies, and formulating digital processes [8], which always runs through the entire operation process of the organisation.

The structural aspect of dynamic capability theory mainly focuses on the structural dimension of dynamic capability. Compared with the general organisational capabilities of enterprises, most scholars believe that dynamic capabilities are a relatively high-level capability [9]. General capabilities can help organisations focus on current benefits and obtain short-term financial performance, while high-order dynamic capabilities have structured functions of expansion, creation, modification, and evolution, and through this series of functions, they can empower ordinary capabilities to help enterprises make corresponding organisational changes according to changes in the external environment.

The global outbreak of the epidemic in 2020 has forced the digital transformation of all industries, and the development of Chinese enterprises is difficult. The platform model is the main way to quickly achieve organisational transformation, helping organisations to break through the highly dynamic and uncertain external dilemma. At this point, dynamic capability theory becomes a more appropriate theoretical perspective to deeply explore the development process of platform companies building competitive advantages [10]. According to J. Karimi and Z. Walter, digital platform capabilities are dynamic, and platform companies rely on internal digital platforms to integrate key shared knowledge, utilise internal resources, and reconfigure internal and external resources to better respond to highly volatile markets, organisational skills required [11].

Connotation of value co-creation theory. The interaction between enterprises and users is becoming the centre of value creation. With the transfer of value to experience, the market is becoming a forum for dialogue and interaction between user groups and enterprises. It is should be noted that S. L. Vargo and R. F. Lusch proposed a value co-creation theory based on service-dominant logic, arguing that value co-creation is based on service exchange, emphasising that all economic exchanges are value exchanges corresponding to services [12]. Researchers put forward ten assumptions of service-dominant logic, such as users and suppliers are the co-creators of enterprise value, and the value co-creation process is interactive [13]. These subjects, as a resource, participate in the production of enterprises, and through in-depth interaction with enterprises, create more for enterprises value. They put their knowledge, skills, experience, and other things into the value creation process. Suppliers can provide raw materials, resources and channels for the development of key enterprises to achieve co-creation of value. This is value co-creation an important premise. The emerging service dominant logic is different from

the traditional commodity-centered dominant logic, which is mainly reflected in the main unit of exchange, the role of the commodity, the role of the user, the determination and meaning of value, the interaction between enterprises and users, and the source of economic growth. In terms of the role of commodities, the emerging service-dominant logic emphasises that commodities are the transmitters of operational resources (embedded knowledge), and they are intermediate products, while the traditional commodity-centered dominant logic emphasises that commodities are operational resources and final products. In terms of user roles, the emerging service-dominant logic emphasises that both users and suppliers are services. The traditional commodity-centric dominant logic emphasises that users are the recipients of goods. In terms of sources of economic growth, the emerging service-dominant logic emphasises that wealth is obtained through the application and exchange of professional knowledge and skills. The traditional commodity-centered dominant logic emphasises surplus tangible resources and goods. In this paper, the value co-creation theory applies the scenario value co-creation theory to explain the key role of multi-agent co-creation of value on organisational activities, and emphasises the core role of enterprises, users and suppliers. Co-creation provides a better perspective.

Digital platforms as tools for digital transformation. A platform is a virtual space that connects multiple participants based on Internet information technology. The network information platform has gone through three stages. The first stage is a portal platform characterised by communication of information, such as *Sina* and *Sohu.* The second stage is an *e*-commerce platform characterised by buying and selling products, such as *Taobao*, *JD.com*, and *Pinduoduo*. The third stage is the industrial Internet platform, with knowledge payment as a typical feature, and the digital model and application of Internet industrial knowledge is the focus of platform transactions. *Bridge*, the industrial Internet platform, has become a new arena for competition among the world's leading companies, a new field of business layout, and a new focus of competition among manufacturing powers. Since the global financial crisis, multinational giants, such as *Bosch*, *General Electric*, *Siemens*, etc., have been continuously promoting their strategic transformation around the model of manufacturing intelligence, networking and digitisation, through a series of model innovations, business restructuring, mergers, and transformations.

Platform economy is an important component of the concept of digital economy, belongs to the second level. The «White paper on China's digital economy development (2020)» points out that the digital economy is a new economic form that accelerates economic development and governance[3]. At the same time, the paper clarifies the framework of the four modernisations (digital industrialisation, industrial digitisation, digital governance and data value) of the digital economy, and points out that data integration and platform empowerment are the key to promoting the development of industrial digitalisation[4] (fig. 1). According to R. Bukht and R. Heeks combing the concept of digital economy, the platform economy should belong to the second level of the concept of digital economy[5]. In the era of digital economy, the rise of digital platform companies is a worldwide phenomenon. Among the top ten companies by global market capitalisation, there are seven typical digital platform companies (such as *Microsoft*, *Apple*, *Amazon*, etc.)[6]. As of 31 December 2020, the market values of China's digital platform companies *Tencent* and *Alibaba* were 4.55 trln yuan and 4.20 trln yuan, respectively.

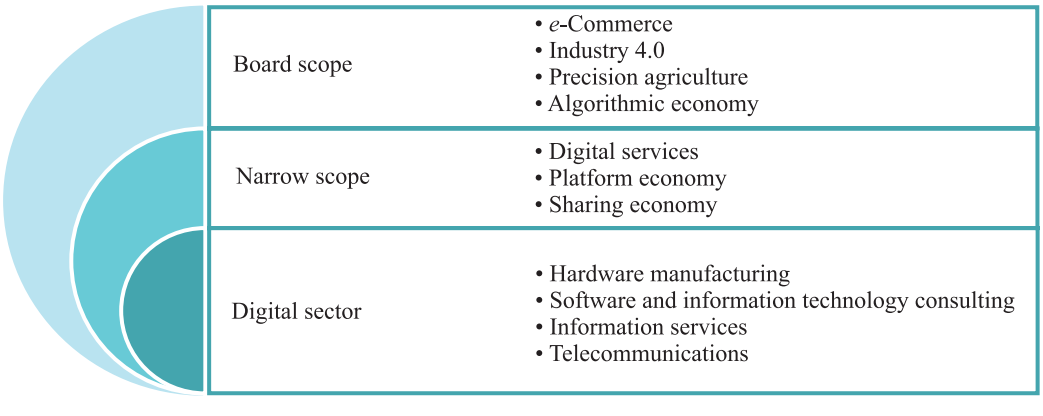

Fig. 1. Framework of digital economy

[3]White paper on China's digital economy development (2020) [Electronic resource]. URL: http://www.caict.ac.cn/english/research/whitepapers/202007/t20200706_285683.html (date of access: 05.08.2022).

[4]Ibid.

[5]*Bukht R., Heeks R.* Defining, conceptualising and measuring the digital economy [Electronic resource]. URL: https://diodeweb.files.wordpress.com/2017/08/diwkppr68-diode.pdf (date of access: 05.07.2022).

[6]Global ranking of the top 100 public companies by market capitalisation [Electronic resource]. URL: https://www.pwc.com/gx/en/services/audit-assurance/publications/global-top-100-companies.html (date of access: 05.07.2022).

The market value of digital platform companies, such as *Meituan* and *Pinduoduo*, has also grown rapidly, ranking among the top ten in China. At the same time, the Chinese government attaches great importance to the rise of digital platform companies. On 7 February 2021 «Anti-monopoly guidelines of the Anti-monopoly Commission of the State Council on Platform Economy» was issued to guide operators in the platform economy to operate in compliance with laws and regulations and to promote the platform economy is developing in a standardised, orderly, innovative and healthy manner[7]. Today, digital platform companies have begun to dominate the development of business and affect social life in every aspect.

Reasons for the rise of digital platform companies. The development of Chinese digital platform companies can be traced back to the end of the 20th century, when China was greatly affected by the Internet boom in the USA. There were many Internet companies established at that time: *Alibaba* in the *e*-commerce industry, *Tencent* in the social networking industry, *51job.com* in the online recruitment industry, *Ctrip* in the online travel industry, the online medical industry, and *China Insurance Information Network* in the online insurance industry. Some of them gradually developed into digital platform companies in the next twenty years and became leading companies in various subsectors.

First, the convenience of financing is the premise of the rise of China's Internet industry, and it is also the premise of the rise of China's digital platform enterprises. On the one hand, digital platform companies are one of the investment hotspots in the 21st century, which enables to raise a lot of capital. Since 1999, both in China and overseas, the Internet economy was developing rapidly, and a large amount of capital poured in rapidly. Investment hotspots in the 21st century include industries where a large number of digital platform companies gather, such as *e*-commerce, social networking, live broadcasting, and cloud services (fig. 2). On the other hand, under the design of the variable interest entities structure, a large number of Chinese Internet companies (especially digital platform companies) went public in the USA. Many of them were not profitable at the time of listing, but the funds raised through the listing have enabled substantial subsidy activities to grow their businesses. For example, digital platform company *Pinduoduo* used the funds raised by listing on the *Nasdaq Stock Market* and the *London Stock Exchange* to spend 6.968 bln yuan in net profit in 2019 to attract users. According to its 2019 annual report, *Pinduoduo* sales and marketing expenses increased by 102 % year-on-year, of which 13 bln yuan was used for advertising expenses, promotions and coupons to build brand awareness, drive platform user growth, and improve platform user engagement.

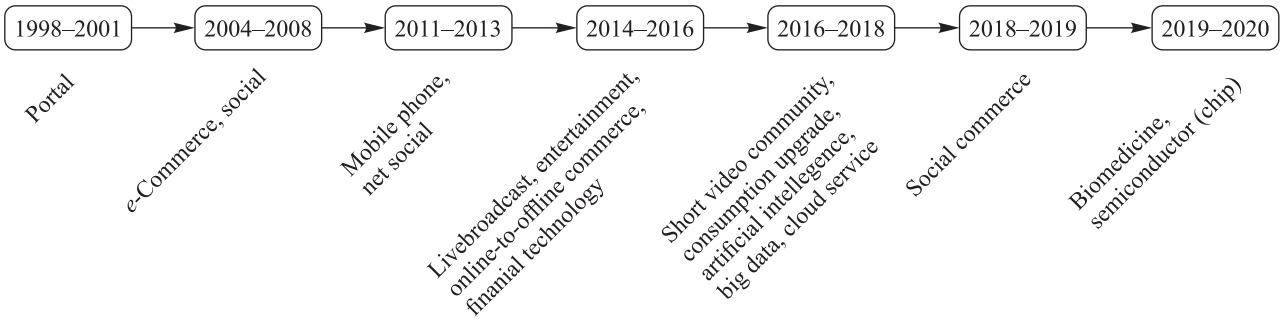

Fig. 2. Investment hotspots from 1998 to 2020

China is considered an example of a thriving platform economy. First, this is mainly because some industries in developed countries, such as the USA are already very mature, with high switching costs and low operational flexibility, giving latecomers opportunities to catch up in certain fields. For example, according to *eMarketer* and *China Securities*, China's mobile payment usage rate far exceeds that of developed countries, such as the USA[8] (fig. 3 and 4). Secondly, the support of upstream and downstream industries also plays an important role in the development of digital platform enterprises in China. For example, in the early stage of the development of the *e*-commerce industry, the express delivery market in developed countries has the characteristics of oligopoly, while the concentration of China's express delivery market is relatively low. This enables China's express delivery industry to adapt more flexibly to the development needs of the *e*-commerce industry. Low service prices in the express delivery industry, point-to-point network services, and flexible franchise models have provided conditions for the explosive growth of *e*-commerce digital platform companies. In addition, the logistics and distribution industry also support the development of digital outsourcing platform enterprises.

[7]Anti-monopoly guidelines of the Anti-monopoly Commission of the State Council on platform economy released [Electronic resource]. URL: https://www.allbrightlaw.com/EN/10531/b3e2abc9161d4ee6.aspx (date of access: 19.08.2022).

[8]Global payments report: trends in global payments [Electronic resource]. URL: https://www.paymentscardsandmobile.com/global-payments-report-trends-in-global-payments (date of access: 19.08.2022).

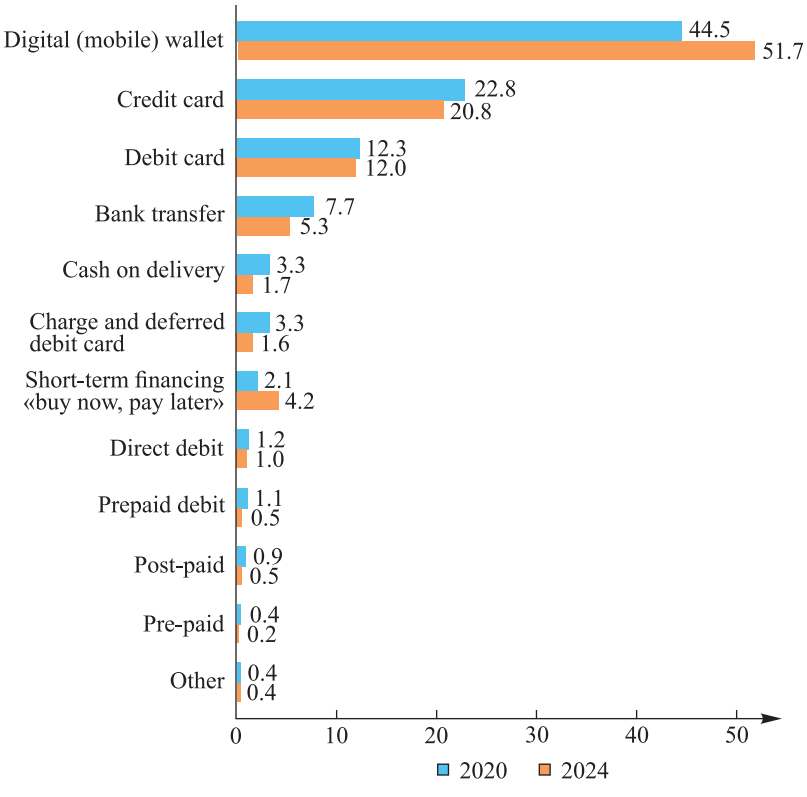

Fig. 3. Proportion of transaction volume by global *e*-commerce payment methods in the world in 2020 and forecast for 2024, %

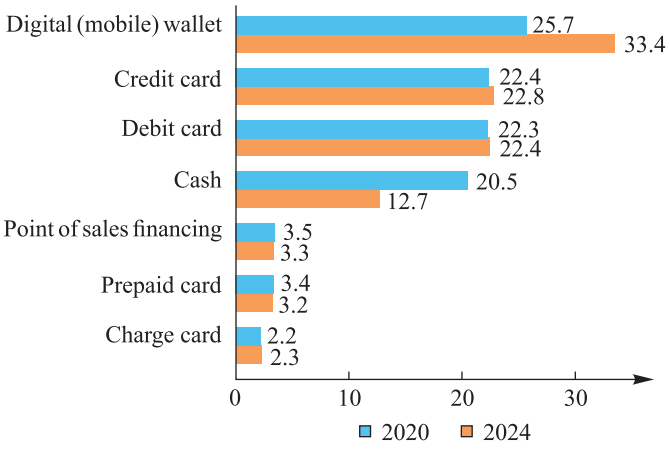

Fig. 4. Proportion of transaction volume by global point of sales payment methods in the world in 2020 and forecast for 2024, %

Digital platform enterprises influence business development. Digital platforms can be divided into third-party platforms and self-operated platforms. There are three types of digital platform companies that place equal emphasis on third-party platforms and self-operated platforms. The industries mainly include the online travel industry, online recruitment industry and Internet medical industry mainly based on third-party platforms, the manufacturing industry mainly based on self-operated platforms. The online live broadcast industry, cross-border *e*-commerce industry and Internet insurance industry that are equally important to self-operated platforms.

Third-party digital platform companies and self-operated digital platform companies have different business logics. For third-party digital platform enterprises, the scale of the demand side is the basis for their survival, and traffic is the most important wealth of the enterprise. For example, the *Online Travel Agency* in the online travel industry obtains C-side (the enterprise B-end, the consumer C-end) traffic through a large number of marketing activities, and recovers the initial investment cost on the B-side through later value-added services, turn flow into cash. For self-operated digital platform enterprises, the construction, management and operation of

their platforms serve the main business of the enterprise, and play an auxiliary role in the overall development of the enterprise for the purpose of improving the efficiency and quality of products or services. In addition, in industries such as webcasting, cross-border *e*-commerce, and Internet insurance, third-party digital platform companies and self-operated digital platform companies coexist, and the two types of business logic also coexist.

Digital platform companies shorten the industrial chain, make the value chain change from a pipeline structure to a platform structure, and make industry information more transparent. They break the geographical and industry boundaries of economic activities, making it easier to achieve economies of scope, and the market tends to converge. And they have shifted the supply economics of scale of commerce to demand economics of scale, and enterprises have shifted from inward-focused to outward-focused.

Digital platform enterprises affect social life. The impact of digital platform companies on the world is not only limited to business, but also reflected in social life. First, from the perspective of supply and demand, the relationship between consumption and supply is reconstructed by digital platform companies. Secondly, from the perspective of employment, the employment structure, employment relationship and working methods have also changed with the rise of the platform economy.

From the perspective of employment structure, while traditional manufacturing employees gradually flow to low value-added service industries, employment in intermediary channels is also changing to employment in terminal services. The first is the transformation of employment in manufacturing to employment in the service industry. After the economic crisis in 2008, digital platform companies undertook a large number of redundant manufacturing labour, and emerging occupations, such as food delivery workers and live broadcasters, continued to emerge. The second is the transition from intermediary channel employment to terminal service employment, because the original intermediaries failed to provide differentiated services, and they were gradually replaced by digital platform companies. As digital platform companies shorten the industrial chain and suppliers no longer reach consumers through multi-level intermediaries, intermediaries from all walks of life cannot provide more jobs. For example, traditional travel agencies or other agents in the tourism industry are gradually being replaced by digital tourism platform companies, which have suffered a huge impact on their business conditions and reduced tourism jobs.

Digital platform companies have broken away from the shackles of traditional employment relationships and created a large number of jobs. In platform-based employment, practitioners establish business contacts with the platform, breaking through the limitations of time and space, increasing the flexibility and autonomy of employment. For example, *Alibaba* has 117.6 thsd employees, but in fact it has created more than 10 mln jobs.

At present, the overall coverage of 4G in developed countries, such as South Korea, Japan, the UK, France, and Germany, is relatively high. Compared with 4G, 5G has higher speed and wider bandwidth, which can meet consumers' demand for higher network experience, such as virtual reality and ultra-high-definition video. It is should be noticed that 5G also has higher reliability and lower latency, which can better meet the application needs of autonomous driving, intelligent manufacturing and other industries, realise the interconnection of everything, and more strongly support the innovation and development of the economy and society. With the gradual development of broadband strategies in various countries, the coverage and speed of broadband networks have been effectively improved. However, the population in remote areas is relatively sparse and the construction cost is relatively high, and their broadband networks are still relatively backward, and the gap is larger than that of cities.

By applying Internet of things technology to traditional infrastructure and adding a digital layer (an embedded, networked sensor layer) you can obtain service data that was difficult to quantify before, so that relevant departments can provide a better foundation for the public facility services. For example, through sensors embedded in the transportation system, city managers and planners can know whether the transportation system is meeting the needs of commuters and make the planning of infrastructure more efficient. Digital parking systems can help city managers understand whether there are enough parking spaces and whether there are situations where parking spaces are not being used effectively. The new-generation air transportation system can provide more flight paths for aircraft, so that the aircraft can fly in a straight line between airports, and the distance between take-off and landing is shorter, thereby greatly shortening the travel distance and time, and reducing the corresponding crude oil cost.

It is difficult to understand the real-time operating status of traditional infrastructure, while digital infrastructure can greatly improve economic benefits and public safety through data collection and early warning. For example, bridge collapses are often the result of continued deterioration of the bridge structure for a variety of reasons, changes that are difficult to observe with the naked eye. The installation of networked sensors can measure these changes and take protective maintenance measures in time, thereby reducing maintenance costs, avoiding huge casualties and property losses, or minimising losses through early warning of digital systems. In another example, sensors in water can alert in time before the nitrogen and phosphorus levels in the water reach critical values.

Digital infrastructure makes service prices more accessible through real-time monitoring, allowing supply and demand to be matched more closely and dynamically. For example, analog electricity meters cannot read electricity consumption in real time, but smart electricity meters can, so that power suppliers can set different electricity prices according to different time periods of peak and low electricity consumption, and can also monitor electricity leakage according to electricity consumption data. Vehicles can charge different fees in different areas and times where passersby travel, so as to greatly improve the efficiency of the transportation network. Network service providers often formulate differentiated network fees based on network bandwidth and user usage.

With the improvement of the role of the communication industry in social development, the business based on the power communication network is no longer just the original program-controlled voice networking, dispatching control information transmission and other narrowband services, but gradually developed to carry the customer service centre, marketing system, geographic information system, human resource management system, office automation system, video conferencing, Internet protocol telephony and other data services.

Problems existing in the development of digital platform enterprises and suggestions for improvement. Although the platform has increased consumer welfare, it has caused various social problems at the actual operation level and the emerging business models in the Internet age have brought various potential challenges to the traditional economic system which have far-reaching economic and social implications. For example, *Google* digital platform for information search or *Facebook* digital platform for social networking, which use user data for profit while offering free services to users, users and society as a whole use these digital platforms long before they feel the data privacy-related issues negative external influences.

At present, the development of digital platform enterprises has a Matthew effect (the strong get stronger, and the weak get weaker), and it is easy to form a monopoly; the inaccurate role positioning of digital platform companies makes them evade their social responsibilities. The data usage of digital platform enterprises needs to be regulated. Suppliers and platform practitioners are too reliant on platforms. Digital platform companies have an adaptive competition and cooperation relationship with most enterprises, and a certain degree of confrontational competition and cooperation relationship with a large number of intermediaries. And they usually have a high substitute for middlemen, which has a greater impact on the operation of a large number of middlemen, and the two are highly competitive. However, compared with traditional business models, digital platform companies exhibit a more obvious Matthew effect, and it is easier to form monopoly.

Traditional enterprises lack the conditions and thinking to systematically apply big data, and the massive data accumulated on the platform has become an important competitiveness of digital platform enterprises. Digital platform companies can more easily accumulate massive amounts of data. In the era of big data, these data are like new oil resources. Digital platform companies can make effective use of them through in-depth analysis, and ultimately convert them into corporate profits. For example, after cleaning and visualising job seeker information, online recruitment digital platform companies can analyse the skills that users lack, and accurately push job-seeking training courses to them, so as to directly address the pain points of job seekers. In addition, digital platform companies can also provide big data services to external sources.

The monopolistic tendency of digital platform companies brings the following risks. First of all, the monopoly of digital platform enterprises is against the enthusiasm of small and medium-sized digital platform enterprises to innovate. Since digital platform companies often have cross-network externalities, both companies and users are willing to choose large-scale platforms. However, small and medium-sized digital platform companies and potential entrants lack a traffic base, making it difficult to profit from economies of scale. Coupled with the high fixed cost of technology research and development, enterprises (especially small and medium-sized enterprises) lack the motivation to carry out innovative research and development. Secondly, the monopoly of digital platform enterprises damages the legitimate rights and interests of consumers. Finally, the monopoly of digital platform enterprises is prone to the risks of network security. The huge amount of user data on the platform increases the difficulty of security management.

At present, most digital platform enterprises lack the role of social person, do not need to face the main business restrictions like state-owned enterprises, and at the same time can enjoy monopoly profits as the core of the enterprise community. In response to the problems of data protection, circulation, and utilisation, government departments need to standardise and improve the data asset property rights system, personal information collection and protection system, and transaction system.

Government departments should establish a data asset property rights system to clarify the ownership of data assets rights and responsibilities. In terms of rights, government departments should determine the rights boundaries of digital platform companies over data assets, and provide legal basis for companies to collect, mine and trade data. Especially for group data that has been cleaned and modelled, government departments should legally grant digital platform companies the right to use and trade. They can establish data security protection standards, confirm the attribution of data protection responsibilities and specific protection methods during and after the transaction, and ensure that data collectors and users assume no less than previous data asset protection responsibilities.

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