

Research on the Development Trend of Automobile Industry in the Digital Economy 3.0 Era

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Abstract: As a new integrated economic ecosystem, digital economy has become a new driving force to accelerate the transformation and upgrading of economic structure. With the deep integration of the digital economy and the automobile industry, the economic benefits and business type changes brought by the digital process and results of each link have also become the current core issues. By studying the concept, connotation and development characteristics of digital economy, this paper analyzes the core tasks of the automobile industry in different stages of digital economy development, summarizes and analyzes how the automobile industry adapts to the wave of digital economy, systematically combs the development trend of the automobile industry in the digital economy 3.0 era, aiming to promote the digital transformation process of the automobile industry by building an all-round and multi-dimensional automobile industry platform economy.

1. Digital Economy

1.1. Interpretation of the Concept of Digital Economy

In December 2019, the Central Economic Work Conference made it clear for the first time that "we should vigorously develop the digital economy" [1]. Digital economy refers to a series of economic activities that take digital knowledge and information as key production factors, modern information network as an important carrier, and the effective use of information and communication technology as an important driving force for efficiency improvement and economic structure optimization [2-4].

The digital economy takes data as the key production factor [5], mainly focusing on five levels, namely, the foundation layer, platform layer, software layer, data layer, and application services, which run through the whole life cycle of big data including data collection, data analysis, data governance, data application and other stages (Figure 1). In the era of digital economy, the modern information network is an important carrier, and the more secure and high-density modern information network is a new digital infrastructure (i.e., the basic layer) to promote connectivity and support the digital economy to give play to the optimal input-output effect; As the driving force, all

factor digital transformation and ICT integration application correspond to the platform layer and software layer respectively, and promote the transformation and upgrading of traditional industries driven by digital and integration applications such as large platforms and software [6]; As a key factor of production, data resources (i.e. data layer) can be copied, shared, and supplied indefinitely, breaking the restriction of limited supply of traditional factors of production on economic growth, becoming a breakthrough in scientific and technological innovation, empowering traditional industries, and improving the inclusiveness of the digital economy; As a new engine and innovation paradigm (i.e. application service layer), AI services have advantages such as scalability, availability, low cost, and huge market scale potential. Promoting the deep integration of big data, AI and the real economy has become an important supporting foundation for the development of the digital economy.

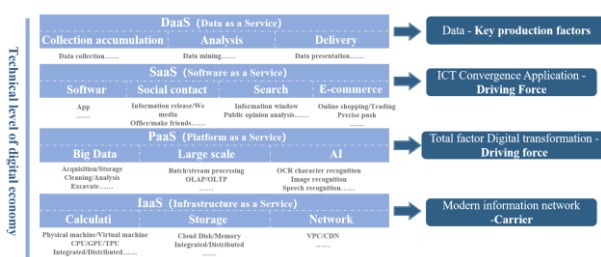


Figure 1: Concept of digital economy

On the whole, the digital economy has five development concepts of innovation, coordination, green, openness and sharing, including new digital infrastructure, new large platforms and software, new data systems and new application services. The deep integration with traditional industries is the cornerstone of the modern economic system and the general trend.

1.2. Development Stage of Digital Economy

At present, the digital economy has developed from the "information" driven 1.0 era, through the "platform" driven 2.0 era, to the "intelligent" driven 3.0 era (Figure 2). This also means that the core technology in the digital economy era is transforming from IT (information technology) to DT (data processing technology) to ET (artificial intelligence technology), The traditional storage and terminal devices such as desktop computers, laptops, disks and mobile hard disks are also gradually replaced by smart phones, on-board intelligent terminals, virtual clouds, and large platforms. New technologies such as cloud computing [7], blockchain [8], and the Internet of Things [9] are changing with each passing day. New business formats such as intelligent driving, sharing economy, and new retail have caused a research boom. New development models such as data, platform, intelligence, ecology, personalization and sharing have become increasingly prominent in the digital economy era, and the digital economy has become a new driving force for economic growth [10].

The essence of the development of the digital economy is to focus on solving the problem of supply and demand matching. With the rapid development of the digital economy from the 1.0 era to the 2.0 era to the 3.0 era, its core concepts, main features, technical forms, etc. are also constantly updated and iterated. On the demand side, its characteristics have changed from relative certainty to individuality, and its main demands have also changed from improving operating efficiency to intelligent decision support; On the supply side, its core concept has evolved from internal efficient management to meeting the personalized needs of mass users, and its technical system has also moved from closed to open and spread; Supply and demand match. In the digital economy 1.0 era, the delivered value is more oriented to solutions, and the current intelligent operation and governance system is becoming the focus of attention.

In the era of digital economy 3.0, intelligent technology, as the core driving force, with data

mining, the Internet of Things, and post deep learning as the core, is about to open the harvest period after the embryonic and development period of the digital revolution, and spawn a series of new products, processes, services, scenes, models, etc., to accelerate technological innovation and inject new vitality into economic development.

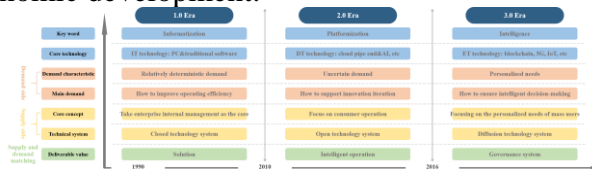


Figure 2: Development stage of digital economy

1.3. Main Features of the Digital Economy 3.0 Era

The digital economy 3.0 era is a new economic form based on "data & computing power & algorithm", which uses the automation of data flow to resolve the uncertainty of complex systems, realize the optimal allocation of resources, and support high-quality economic development. Influenced by the four laws of Metcalfe's Law, Moore's Law, Bell's Law, and Davydo's Law, it mainly presents the following six characteristics.

(1) Data information resources have gradually become the new key element resources. The operation paradigm with the core of "data & algorithm & computing power" has been widely applied. In the era of digital economy 3.0, data will play a greater role and become the core competitiveness of enterprises in digital transformation and upgrading.

(2) Digital technology innovation is the source power of sustainable development of digital economy. In the era of digital economy 3.0, following the rapid development of cloud computing, distributed storage, deep learning and other technologies, big data emerging technologies represented by 5G, blockchain, edge computing and IoT gradually rise in the form of clusters and serve as the technical support for the bottom layer of the digital economy.

(3) Platformization is the main industrial organization form of digital economy. In the digital economy 3.0 era, the platform will continue to provide services from the four levels of description, diagnosis, prediction and decision-making, but its service mode will be more immediate and accurate, and the overall trend of platform will be more intelligent and open.

(4) Industrial integration is the main form of digital economy. In the era of digital economy 3.0, digital industrialization and industrial digitalization go hand in hand to create a more automatic, collaborative, accurate and international industrial governance model. On the basis of the challenges and opportunities brought by the current digital transformation, industrial integration will pay more attention to the optimization of resource allocation efficiency and promote the intelligent and high-quality development of the industry.

(5) Multi governance is an inevitable governance requirement in the digital economy era. In the era of digital economy 3.0, the efficient collaboration and accurate matching between the to B end and to C end have become a new economic form, and the organizational system, process system, technical system, standard system and other development models will all evolve in the C2B direction.

(6) Cyberspace has become a key force driving the transformation of the physical world. As an important carrier of the digital economy, cyberspace will achieve leapfrog development in the digital direction in the information infrastructure construction in the digital economy 3.0 era. At the same time, how to solve the problem of cyberspace governance and reconstruction will become a new challenge.

2. Automobile Digital Economy

In the era of digital economy, the digital transformation of manufacturing industry has become a key field of industrial development. As a capital intensive industry, the automotive industry, despite its large size, multiple types, complex technology and long process cycle, has made significant progress in transformation faster than the labor-intensive industry. In the 3.0 era driven by intelligence, the automotive industry should seize the opportunities facing the new demand side requirements of high-quality development and the new supply side technologies of explosive development, Deepen the path of digital upgrading.

2.1. The Automobile Industry is in the Development Stage from the 2.0 Era to the 3.0 Era

In the era of digital economy, the automobile industry, as one of the important fields of manufacturing industry, should play a more important role. How to adjust and optimize the industrial structure in the era of digital economy and accelerate the conversion of new and old kinetic energy is a major research topic of industrial upgrading (Figure 3). With the development of the digital economy era, the automobile industry has changed mainly in the following four aspects.

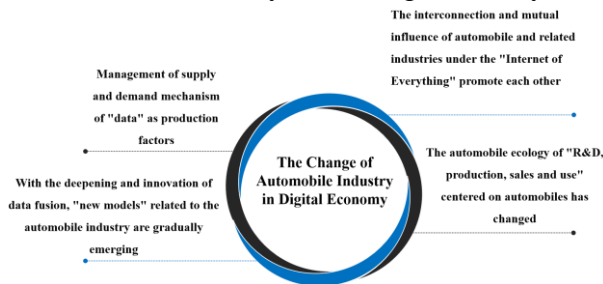


Figure 3: The change of automobile industry in digital economy

- (1) Data as the supply and demand mechanism management of production factors.
- (2) With the deepening and innovation of data fusion, "new models" related to the automobile industry are gradually emerging.
- (3) The interconnection and mutual influence of automobile and related industries under the "Internet of Everything" promote each other.
- (4) The automobile ecology of "R&D, production, sales and use" centered on automobiles has changed.

2.2. The Automobile Industry in the 2.0 Era Focuses on "Data & Algorithm & Computing Power"

As the three elements of platform, data, algorithm and computing power have developed rapidly in the era of digital economy 2.0, and together constitute the core competence facing the era of digital economy. The in-depth development of informatization has also brought about great changes in the automotive industry.

In terms of computing power, the traditional general-purpose computing (CPU) has gradually upgraded to the technical architecture of CPU+GPU, TPU, FPGA, etc. in the 2.0 era, while continuously deriving new AI chips that can be used for intelligent applications such as automatic driving, Internet of Vehicles, sensors, etc., and new applications such as smart cars, shared travel, etc. have become new concerns and research and development points in the automotive industry.

In terms of data, data processing is constantly optimized on the basis of data collection, cleaning, extraction, annotation and other links, enriching big data governance with data storage and data

mining as the deepening direction, and integrating data into the platform to achieve data visualization. With a new round of information technology revolution and industrial transformation, under the background of highly interconnected business change demand and user experience demand, auto enterprises have accelerated the application of auto intelligence through real-time intelligent processing of big data. The demand for big data storage and computing, asset management, analysis and mining is growing day by day. Data group management and control has become the future trend. The rapid development of big data further promotes the continuous innovation of algorithms, and puts forward higher requirements for computing power.

In terms of algorithm, the early stage mainly focused on reasoning algorithms, expert systems, intelligent agents and other primary algorithms. With the in-depth development of the digital economy, algorithm innovation, as an important driving force, has gradually become a highland of innovation, and machine learning algorithms represented by supervised learning, reinforcement learning, and migration learning are rising. As a subset of machine learning, deep learning focuses on R&D and application in the field of auto driving, such as automatic parking assistance, automatic emergency braking, lane keeping assistance, driver fatigue alarm, high-speed autonomous cruise, V2X and other intelligent services, so as to improve vehicle perception, accelerate AI application, and promote the digital transformation of the automobile industry. With the upgrading of algorithms from machine learning and deep learning to post deep learning, it will also lead artificial intelligence to move forward from perceptual intelligence to cognitive intelligence, and accelerate the pace of digital economy development.

2.3. In the 3.0 Era, the Automobile Industry Will Take Data As its Core Competitiveness

The three elements of "data+algorithm+computing power" will be transformed into data as the key element in the era of digital economy 3.0. The next step can be to build a systematic competitive advantage based on the platform, improve the platform inclusiveness, and gradually integrate competitive advantages or merge competitive products under the platform architecture system.

As a new stage in the development of digital economy, the 3.0 era, driven by "electrification, networking, intelligence and sharing", has witnessed the rapid evolution of the automobile industry towards intelligent networking, automatic driving, shared travel, lightweight and other intelligent directions. Intelligent decision-making and intelligent operation with the core of "data+algorithm+computing power" will rely more on data, and the value of big data resources will become increasingly prominent. The large-scale construction and application of pan automobile industry ecological data with operation data, circulation data, product data, development data as the core has become the future research trend.

The construction of the data system will also accelerate the transformation of the production and service mode of the automobile industry. With data resources as the core driving platform competition mode, the construction of the automobile big data platform has gradually become the new core competitiveness of automobile enterprises. The digital economy era has entered a new stage of digital intelligence development. After the completion of the automobile big data platform, it can cover and open up the full data of the eight major links of the whole life cycle of the automobile, namely "product planning - R&D design - test verification - production and manufacturing - market sales - use and maintenance - replacement and circulation - scrap recycling", and promote the digital governance of the automobile industry.

2.4. In the 3.0 Era, the Automobile Industry Should Pay More Attention to the Construction of Ecological Competition

In the era of digital economy 3.0, we should promote the integration and development of digital economy and real economy. Based on data, we should build a new ecological competition of the automobile industry with "people, vehicles and environment" as the main body, enable all links of the automobile industry chain, bring new markets, new models and new technologies, and promote the intelligent operation of the automobile industry.

In the digital economy 3.0 era, the automobile industry will form a new business model, that is, from the linear thinking centered on the development and manufacturing of cars to the ecological thinking centered on the service operation of people, meeting the personalized needs of mass consumers will become the pursuit direction of the commercial value of automobile enterprises, and the low-cost, high-quality real-time service capability will also become the basic capability of automobile enterprises. In the automotive industry chain, product planning, R&D design, test verification and production manufacturing are all to B, and marketing, use and maintenance, replacement circulation and scrap recycling are to C. The integration of to B and to C is the trend in the 3.0 era of digital economy. The service mode of the automotive industry will gradually evolve from to B single wheel drive to to B to C dual wheel drive. On the one hand, a group level collaborative office platform will be established to build a supportive digital infrastructure, To make business operation more agile, on the other hand, establish a consumer oriented intelligent interaction platform, form a consumer based automotive industry ecology through real-time touch, analysis, prediction and other demand insights, achieve multiple data closed-loop, and improve the accuracy of decision-making.

In the future, the organic combination of intelligent connected vehicles, intelligent transportation and smart cities will serve as the basis for the efficient and collaborative application of "people vehicle road cloud network" integration, and will jointly build a new industrial ecosystem to achieve connectivity.

3. Conclusions

Under the development trend of the new four modernizations of automobiles, the digital economy of the automobile industry continues to deepen with automobiles as the carrier. The new generation of intelligent terminals, mainly including new energy vehicles, intelligent connected vehicles and shared cars, are also rapidly expanding the connotation and extension of automobiles. Therefore, the automobile industry has unique development advantages and broad development space in traditional industries. Starting from the concept, characteristics, connotation and development trend of the digital economy, this paper analyzes the scientific development path of the automobile industry when the breadth and depth of the digital economy continue to extend, and provides reference for the strategic planning and development roadmap of automobile enterprises.

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