

“National core engine”: the theoretical logic and path choice of new quality productivity driving the rise of talents in chip industry

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Abstract. As one of the key sectors for the future, the chip industry is of vital importance to China's rise as a technological powerhouse. This study reveals three major challenges faced by talent in the chip industry: insufficient supply and reserves, room for improvement in per capita output efficiency, and the need to integrate talent cultivation. To more effectively leverage emerging productive forces and promote the rise of talent in the chip industry, we should facilitate educational transformation and the integration of science education, thereby achieving a qualitative leap in the national strategy for talent development in the new era.

Keywords: new quality productivity, chip industry talent rise, theoretical logic

1. Introduction

New quality productivity is spurred by the deep transformation and upgrading of industries, revolutionary breakthroughs in technology, and innovative allocation of production factors, with talent serving as the soil for its emergence. In July 2024, President Xi pointed out at the Third Plenary Session of the 20th Central Committee of the Communist Party of China: “Education, science and technology, and talent are foundational and strategic supports for Chinese-style modernization [1].” Currently, China's chip industry is one of the accelerators of economic development. As a leader in emerging industries, it urgently needs a group of innovative leaders with an international perspective and the ability to lead at the forefront. Stimulating the innovative vitality of various overseas talents, efforts are being made to build a global talent hub, forming a top-tier team of innovative talents, empowering the development of new quality productivity.

2. Results

2.1. The theoretical logic of the rise of talents driven by new quality productive forces

Marxist theory points out that the mode of production of material life is the basis of social development, and new quality productive forces represent the innovation and upgrading of the mode of production. The theory of new quality productive forces is that scientific and technological innovation is the key force to promote the development of productive forces, and the rise of high-quality talents is also an important part of new quality productive forces.

2.1.1. Laborers are an important part of the development of productive forces

Historical materialism generally holds that productive forces are a collection of various production factors, specifically manifested as humanity's ability to adapt to, utilize, and transform nature. Marx pointed out, “The simple elements of the labor process are: purposeful activity or labor itself, objects of labor, and means of labor [2]”, thus workers, means of labor, and objects of labor constitute three important components of productive forces [3].

Traditionally, the main focus of traditional productivity has been on low-skilled workers engaged in simple and repetitive tasks, including both general and technical workers. In contrast, new quality productivity corresponds to highly skilled workers who possess more knowledge and skills, higher proficiency, a willingness to innovate, and strong practical abilities. On one hand, high-quality workers often have broader perspectives and methods in exploring fundamental scientific research and theoretical studies, with a more prominent ability to perceive cutting-edge technological trends. They can more quickly address bottlenecks related to

advanced technologies, such as precision issues in the semiconductor industry [4]. On the other hand, highly skilled workers can leverage the latest information technology to transform labor processes and improve efficiency, thereby driving industrial upgrading and economic growth. The rise of high-skilled talent not only optimizes the labor structure but also forms innovation clusters in key areas like semiconductors, accelerating the transformation of scientific and technological achievements. This injects sustained momentum into new quality productivity and provides strong support for the country to maintain a technological edge globally.

2.1.2. High-quality workers are the core driving force of the development of new quality productive forces

Since the new era began, the digital economy has become a crucial engine for China's economic development. The specific forms of traditional production factors have undergone tremendous changes, and the enhanced integration of technology has imposed stricter requirements on talent in this industry. Thanks to the relentless efforts of high-quality workers, new processes and materials continue to emerge, significantly increasing the complexity and synergy of the production system. Through interdisciplinary integration and innovation, they promote the effective allocation of production factors and accelerate the construction of new productive forces. The deep application of digital technology further enhances workers' creativity and work efficiency, injecting strong momentum into the development of new productive forces. Therefore, the key to building talent hubs lies in cultivating and developing new productive forces.

2.2. Current situation of talent development in chip industry under the wave of new quality productivity

As China's comprehensive reform advances in depth, the new type of productivity is a necessary choice for promoting the renewal and upgrading of productivity and achieving modern development, which requires a smooth virtuous cycle of education, science and technology, and talent. Currently, China's integrated circuit industry exhibits favorable characteristics such as a broad market foundation and strong economic resilience. However, at the same time, there are new situations and issues in the development of industrial talent, mainly manifested in the following three aspects:

2.2.1. The supply and reserve of chip talents to adapt to the new quality productive forces are insufficient

Talent is the primary resource in social, political, and economic development. In the digital age, the world is closely watching emerging fields and advanced technologies. The integrated circuit industry, as a future-oriented sector, will attract significant attention to any changes in its economic benefits or the substantial talent gap. Currently, China's chip industry talent structure is primarily "pyramid-shaped," meaning there is a severe shortage of leading figures in the industry and a notable lack of highly skilled innovative talents.

On the one hand, there is an existing shortage of top talent to adapt to new productive forces. As we enter the information age, labor-intensive enterprises are gradually introducing advanced machinery, shifting workers from "de-skilled" assembly line operations to fully informatized production processes. The demand for talent has steadily increased, with those possessing information technology skills occupying a high position in the labor market. The current supply of top talent in the semiconductor industry is insufficient, hindering industrial upgrading. From a demand perspective, during the development of global semiconductor silicon wafer industries, when emerging regions or markets are in the capacity ramp-up or line-up phase without achieving scale sales, the cultivation of relevant talent is just beginning, with a severe shortage of core engineers. This makes it difficult for companies to quickly respond to market demands, thereby constraining technological innovation and capacity expansion.

On the other hand, there is an insufficient reserve of talent to adapt to the development of new productive forces. Currently, universities, as the most solid foundation for cultivating talent in China's chip industry, have certain shortcomings in their talent cultivation processes, faculty, and goals. There is inadequate support for basic practical training conditions, and the integration of industry and education needs further strengthening. Universities should promote the innovation of their curriculum systems, enhance practical teaching, collaborate with enterprises to build training bases, and improve students' hands-on skills. Enterprises should actively provide internship and training opportunities, establish integrated platforms for industry, academia, and research, promote the deep integration of theory and practice, and create more suitable platforms and opportunities for subsequent talent development.

2.2.2. The per capita output value and benefit of chip talents adapting to new quality productive forces need to be improved

China's modernization is a massive-scale modernization, and under this grand backdrop, the improvement of per capita output value of chip talent is particularly crucial. In China's modernization process, the concentration of population has led to a stratification of labor due to varying levels of technical proficiency. Many people face the threat of unemployment due to changes in skill structures, industry shifts, or the widespread use of machines. As a pillar of emerging industries, the high technical requirements of the chip industry cannot be achieved overnight. The technological gap between the old workforce and the urgent

needs of new industries creates a chain break, making it especially important to enhance the per capita output value of chip talent. By strengthening vocational training and optimizing resource allocation, we can improve the overall quality of talent, effectively bridging the technological gap and promoting high-quality industrial development. This ensures that the chip industry remains invincible in intense international competition. This places higher demands on the technical teams of new enterprises, which need to have substantial technical accumulation and practical experience; otherwise, they will struggle to keep up with the development pace of emerging terminal markets such as new energy, automotive electronics, and high-performance computing. The development of integrated circuit products in these industries is particularly critical.

2.2.3. The cultivation of chip talents to adapt to new quality productivity needs coupling

The activation of human resources efficiency and the realization of human resources value are the basis for activating the innovation vitality of new quality productive forces, among which the link between chip talent training links all aspects become the key. It is mainly carried out in the following two parts:

First, link market employment demands with university curricula. Universities have traditionally been the main force in talent cultivation, and their training programs often exhibit a certain degree of temporal and spatial lag. They tend to adjust their training objectives only after market conditions have changed, which can lead to a mismatch between graduates' job readiness and actual market needs. Universities need to strengthen cooperation with chip companies, closely monitor market demands, and enhance students' adaptability in the job market. At the same time, due to the limited scope of university engagement with society, students may exhibit herd mentality and blindness in career planning, lacking deep industry knowledge, which can result in employment misconceptions. For example, there is more market interest in cultivating R&D talents for the chip industry than in testing and experimental personnel.

Secondly, it involves deeply integrating the requirements for students' abilities with an innovative culture. With the rapid development of generative artificial intelligence, university curriculum reforms have faced significant challenges. Students' demand for acquiring more advanced information technology application skills has increased, especially in terms of how to use relevant technologies to complete their professional tasks. Universities should actively offer related technical courses, strengthen faculty development, and ensure that students' knowledge updates at a pace sufficient to meet the demands of new productive forces on innovation capabilities and the latest skills.

2.3. The path choice of new quality productive forces driving the rise of talents in the chip industry

Talent team is the key resource of new quality productive forces. How to give full play to the advantages of talent resources to promote the high-quality development of various industries is the top priority. To help the chip industry achieve this goal, it is necessary to transform education, integrate science and education, and enhance value from three aspects.

2.3.1. Educational transformation: gradually strengthen industry-oriented education in the era of digital intelligence

In the context of the digital and intelligent era characterized by rapid development in big data, information technology, and artificial intelligence, the development of new quality productive forces has become a crucial measure to drive social and economic development as well as industrial upgrading. As the driving force that accelerates and leads the development of new quality productive forces, education bears the significant responsibility of cultivating talents capable of adapting to societal changes. In the development of the chip industry, there is a need to gradually shift from training labor assembly workers to fostering innovative craftsmen. Strengthening industry-oriented education in the digital and intelligent era, focusing on developing students' big data analysis and AI application skills, and ensuring seamless alignment between curriculum systems and market demands are essential. The construction of various types of practical training bases can enhance students' practical operational abilities and innovative practice capabilities.

2.3.2. Integration of science and education: strive to improve the integrated innovation chain of industry-university-research collaboration

In July 2024, President Xi pointed out at the Third Plenary Session of the 20th Central Committee of the Communist Party of China: "We need to improve the mechanisms and systems for developing new quality productive forces suited to local conditions, promote the deep integration of the real economy and the digital economy, refine the mechanisms and systems for developing the service sector, improve the mechanisms and systems for modern infrastructure construction, and enhance the resilience and security of industrial chains and supply chains [5]." The innovative development of enterprises is closely related to the talent and technology they attract. It is essential to establish an integrated innovation chain that links industry, academia, and research, promote deep cooperation between universities and enterprises, strengthen technological breakthroughs and application of results, and transform theoretical achievements from basic research into practical applications, accelerating the conversion of various research outcomes to achieve value enhancement. At the same time, it is necessary to strengthen the planning system for new

infrastructure, advance the digital transformation of traditional infrastructure, broaden channels for innovation and entrepreneurship risk investment for tech-oriented small and micro enterprises, and build future industry models to facilitate the transformation and upgrading of old quality productive forces. Through educational transformation and integration of education and research, talents in the chip industry will possess stronger innovation capabilities and practical skills, contributing to the improvement and upgrading of new information infrastructure and the deep integration and application of artificial intelligence-related technologies, laying a solid foundation for the development of new quality productive forces.

2.3.3. Value leap: earnestly building a national strategy for talent in the new era

The report of the 20th National Congress of the Communist Party of China proposes to “deeply implement the strategy of making the country strong through talent”, which emphasizes the party’s comprehensive leadership over talent work, strengthens political guidance, ensures that talent work moves forward in the right direction, and at the same time improves the social recognition and professional sense of achievement of talents in the chip industry [6].

Firstly, highlight the role of integrated circuit technology entrepreneurs. “A prime minister must rise from a provincial post, and a valiant general must emerge from the ranks of soldiers.” On a global scale, tech entrepreneurs, with their unique strategic vision and technical insight, often drive the rapid rise of an industry and even lead global technological trends. For example, the business landscapes of figures like Elon Musk and Ren Zhengfei represent new productive forces in the information industry, leading not only to the aggregation and cultivation of various innovative talents but also to the rapid rise of an entire sector.

Secondly, seize and improve the opportunities and systems for the return of overseas chip talent. As domestic and international talent attraction policies continue to improve and optimize, immigration authorities have also begun to actively explore and establish a high-tech talent immigration system. The purpose of this system is to attract chip professionals with high skills and specialized knowledge to return and develop in China, thereby promoting further development of the country’s integrated circuit technology and economy. At the same time, the establishment of this system will also help drive the upgrading and transformation of domestic industries, enhancing the nation’s overall strength and global competitiveness.

Thirdly, upgrade various science and technology parks and industrial parks. Currently, from a global perspective, the development of advanced industries in different countries is closely linked to the layout of national science and technology parks and industrial parks, such as Silicon Valley in the United States. To promote the development of China’s chip industry, it is essential to draw on international experience, optimize the innovation environment of relevant science and technology parks, facilitate the upgrading of old industries, attract top talent and high-return projects to settle in, and leverage the key role of industrial parks in talent introduction, employment, and retention. Providing certain policy incentives can foster a positive cycle of talent aggregation and mobility, building an efficient ecosystem for chip industry talent.

3. Conclusion

In short, we need to give full play to the multiplier effect of education, science and technology, and human resources to provide a steady stream of “internal force” for tackling key core technologies that are “bottlenecks” in the new quality innovation chain. On the new journey of national prosperity and national rejuvenation, we need to continue to accelerate high-quality development.

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