

Research on the Pathways for Cultivating Top Innovative Talents in Changzhou's Synthetic Biology Industry under the Perspective of New Quality Productive Forces

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ABSTRACT

From the perspective of promoting the high-quality development of the synthetic biology industry through new quality productive forces, the demand for top innovative talents in the Changzhou region's synthetic biology industry has been investigated and analyzed. A cultivation path for innovative talents in the synthetic biology industry has been summarized and proposed, offering decision-making references for the cultivation of industry talents by government administrative departments, industry enterprises, and regional colleges and universities.

Keywords: *New quality productive forces, Top innovative talents, Synthetic biology, New industry.*

1. INTRODUCTION

Developing new quality productive forces is an inherent requirement and important focus for promoting high-quality development. Technological innovation is the core of developing new quality productivity, and workers with high quality, high technology, high skills, and innovative spirit are the first element of new quality productivity. By cultivating strategic talents who create new quality productivity, first-class scientific and technological leaders, and other top-notch innovative talents, vocational colleges promote comprehensive innovation in production methods, organizational structures, research and development models, business models, and product technologies, promote breakthroughs in regional economy in new industries, and thus create a new industrial cluster with international competitiveness.[1]

2. NEW QUALITY PRODUCTIVE FORCES AND CHANGZHOU SYNTHETIC BIOLOGY INDUSTRY CLUSTER

New quality productive forces, as a key driver for high-quality economic development, signify for the Changzhou synthetic biology industry cluster the comprehensive enhancement of industrial competitiveness through technological innovation and industrial upgrading.

2.1 Strategic Emerging Industries and Future Industry Layout in Changzhou Area

In recent years, Changzhou has been focusing on its urban positioning as an "internationalized smart manufacturing city and the central axis hub of the Yangtze River Delta," vigorously implementing the "532" development strategy to accelerate the growth of strategic emerging industries. By 2023, Changzhou has five industrial

clusters that have reached the scale of a hundred billion yuan. The high-end equipment cluster has an output value of 543.88 billion yuan, the manufacturing output value in the new energy field is 768.07 billion yuan, the production of new energy vehicles is 678,000 units, and the total output value of the new-type carbon material industry cluster is about 122 billion yuan, accounting for more than 16% of the national share.

In 2023, the Changzhou area achieved a total gross product of 1,011.636 billion yuan, with a year-on-year increase of 6.8%. Where are the new growth points for the future? There is an urgent need to develop new quality productive forces and build strategic emerging industries such as synthetic biology. On November 13, 2023, the Changzhou Municipal Government issued the "Several Opinions on Promoting the High-Quality Development of the Biopharmaceutical Industry in Changzhou," supporting the innovative development of the synthetic biopharmaceutical industry and promoting the construction of a new industrial cluster of complete synthetic biology.[2]

2.2 The Development and Talent Demand of the Synthetic Biology Industry in the Changzhou Area

2.2.1 Current Status of the Development of the Synthetic Biology Industry in Changzhou

In recent years, Changzhou has successively launched the construction of the Jintan Synthetic Biology Industrial Park, the Yangtze River Delta Synthetic Biology Industry Innovation Park, and the West Taihu Lake Synthetic Biology Innovation Industrial Park. Building upon the foundation of the existing five hundred-billion-level industrial clusters, it has cultivated a new synthetic biology industry and formed chemical preparation and biopharmaceutical industry clusters represented by Yangtze River, Hengbang, and Qianhong, entering a new track in the synthetic biology industry.

By the end of 2023, Changzhou had 794 enterprises related to the biopharmaceutical industry, with 2,889 patents in the field of biopharmaceuticals, 2,317 domestically produced medical devices on the market, and 79 generic drugs that have passed the consistency evaluation. From 2016 to 2023, the total number of drug applications for clinical trials in Changzhou was 36,

with 58 approved for clinical trials, 138 clinical trials conducted, 79 applications for market launch, and 36 approved for market launch, ranking around 30th in the nation overall.

2.2.2 Demand for Top Innovative Talents in the Synthetic Biology Industry

Industrial talents who master new quality production tools and utilize new quality production materials are vital resources and drivers for leading the development of new quality productive forces in the synthetic biology industry. The accumulation and advancement of talents at various levels are key to the breakthrough and leapfrog development of the synthetic biology industry[3]. Facing the trend of high-level and high-quality development of the synthetic biology industry in the Changzhou area, it is necessary to explore talent cultivation models with multiple entities and approaches, and to cultivate industry-leading scientific and technological talents, top innovative talents, young scientific and technological reserve talents, and engineering technical talents at different levels and grades[4]. By leveraging digital and intelligent means, a lifelong learning environment and atmosphere for all citizens should be constructed to provide strong "new quality talent" support for the new industry and new productive forces. It is estimated that by 2027, to achieve the goal of a hundred billion yuan in output value for the synthetic biology industry in Changzhou, approximately 5,000 innovative technical talents of various types will be required.

3. SUGGESTIONS FOR CULTIVATING TOP INNOVATIVE TALENTS IN THE SYNTHETIC BIOLOGY INDUSTRY IN THE CHANGZHOU AREA

Innovative talents in the synthetic biology industry need to be equipped not only with the ability to innovate and create new production tools, making them top leaders and young scientific talents, but also with the skills to apply new quality production materials in engineering and technical roles. The development path for cultivating such top innovative talents is shown in "Figure 1".

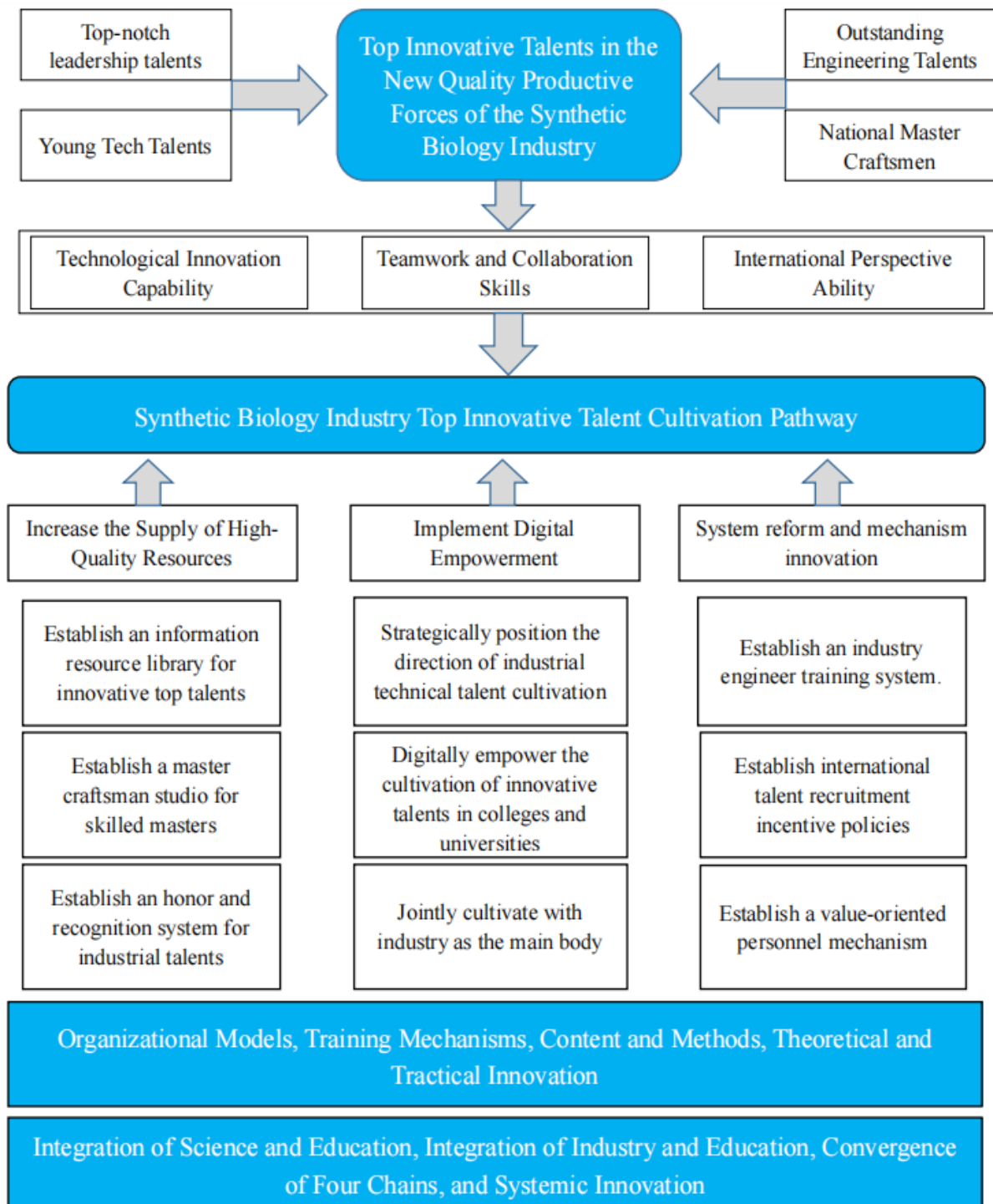


Figure 1 Pathway for cultivating top innovative talents in the synthetic biology industry.

3.1 Increasing the Supply of High-quality Resources to Cultivate Top Innovative Talents

3.1.1 Establishing an Information Resource Database for Innovative Top Talents

Targeting leaders in the synthetic biology industry, establish a talent information resource library that focuses on young talents with outstanding skills, top performers in vocational skill competitions, national and provincial-level skilled workers, master craftsmen, and industrial craftsmen. Categorize and clarify the direction, content, and form of training for various types of innovative talents, and formulate targeted special training plans.[5]

3.1.2 Establishing a Master Craftsman Studio for Skilled Experts

Targeting key talents such as national master craftsmen, provincial-level skilled workers, and provincial labor models, leverage industry enterprises, research institutes, and higher education institutions to establish studios for master craftsmen, skilled master studios, and innovative studios for labor models. Through methods like skill training, joint cultivation by schools and enterprises, practical production experience in enterprises, and participation in scientific research projects, engage in peer exchanges, academic discussions, mentorship by renowned masters, and domestic and international studies to cultivate reserve leading scientific and technological talents for the synthetic biology industry.

3.1.3 Establishing an Honor and Recognition System for Industrial Talents

By organizing various vocational skill competitions and on-the-job training activities, outstanding performers are recognized with corresponding honors as stipulated by regulations. Implement policies for the advancement of vocational skill levels, and recommend individuals with excellent skills and good character for honors such as Changzhou City's, as well as national and provincial-level skilled workers, advanced workers, and labor medals.

3.2 Implementing Digital Empowerment to Enable Universities to Cultivate Innovative Industrial Technical Talents

3.2.1 Strategically and Rationally Positioning the Direction of Industrial Technical Talent Cultivation

By the end of 2023, there were over 6,000 vocational schools nationwide offering majors related to the digital economy, with more than 25,000 specialized programs. In the Changzhou area, there are 5 undergraduate colleges, 8 vocational colleges, and 23 secondary vocational schools. These institutions, aiming at high-end industries and the high-end segments of industries, have prioritized the establishment of new majors in intelligent manufacturing and synthetic biology. They focus on the development trends of high-end, intelligent, and green development in the synthetic biology industry, cultivating innovative talents in industrial technology.

3.2.2 Implementing Digital Empowerment for the Cultivation of Innovative Technical Talents in Colleges and Universities

3.2.2.1 Focusing on Intelligent and Data-driven Training Models

Focusing on intelligent and data-driven training models need to establish a big data platform for the development of teachers and students in colleges and universities, and set up business platforms for online teaching, teaching management, scientific research management, and evaluation assessments to achieve interconnected data throughout the entire process of talent cultivation and all aspects of education and teaching. Accelerate the release of the potential of digital education to empower the professional development of teachers, personalized development of students, improvement of classroom quality, multidimensional student evaluation, and the cultivation of innovative capabilities.[6]

3.2.2.2 Fully Utilizing the Role of Data Elements and Digital Resources

By optimizing resource allocation and building infrastructure for digital resources, establish a teaching resource library for industrial talents, a

virtual simulation training center, an industry training resource library, an industry standard resource library, and a professional knowledge resource library. Also, it need to establish a rapid response mechanism for digital resources to provide precise services for the training of various types of talents, meeting the diverse needs of industrial talents.

3.2.2.3 Implementing Transformations in Digital Teaching Methods

Digital teaching methods can incorporate new industrial technologies, processes, standards, knowledge, and criteria, and implement reforms in the educational and teaching models of industry enterprises, colleges, and educational institutions, both online and offline, and in a modular manner. Use various forms of flexible and efficient high-quality digital resources and networks to build a community of resources between schools and enterprises, and a learning community, achieving inquiry-based learning, self-directed learning, collaborative learning, and intelligent learning for various types of industrial talents. At the same time, the cultivation of industrial talents in colleges and universities should shift from traditional technical skill training to digital and intelligent talent training; shift from traditional professional graduate training to modern enterprise apprenticeship training in industries; and also shift from traditional craftsman operation training to the training of craftsman-like engineering technicians.[7]

3.2.3 Jointly Cultivating Engineering Technical Talents with Industry as the Main Entity

The cultivation of innovative engineering technical talents must integrate industry with education, and achieve collaborative training among "industry, professions, schools, enterprises, and research institutes." It involves practical experience at the industrial site, tempering on the production front line, and innovation in the development of digital and intelligent industries. By promoting the pilot, demonstration, and standard construction of the synthetic biology industry's municipal industry-education consortium and industry-education integration community in Changzhou, and focusing on elements such as industrial technology services, talent cultivation, scientific research, product development, and innovation cultivation, it can strengthen in-depth cooperation between Changzhou's municipal

government, colleges and universities, research institutes, and related industry enterprises.[8] Following the logical main line of technical application and service, technology research and development, and technical skill training, it will gather resources from the government, industry, enterprises, and schools. Through methods such as upgrading, transformation, expansion, and new construction, it will create a comprehensive platform for synthetic biology industry, academia, research, and innovation to jointly cultivate engineering technical talents.

3.3 Promoting the Development of Top Innovative Talents in the Industry Through System Reform and Mechanism Innovation

3.3.1 Establishing an Industry Engineer Training System to Achieve Efficient Integration of the Education Chain, Talent Chain, Industry Chain, and Innovation Chain — Known as the "Four Chains"

By promoting the integrated development of science and technology, industry, education, and talent, and ensuring the smooth flow of these elements, it will cultivate a creative workforce that propels the leap in new quality productive forces and stimulates the creativity and proactivity of new industry talents. By prioritizing the development of education, it will focus on developing a group of top innovative talents, such as strategic industry development talents, scientific and technological leaders, master craftsmen, and engineering technical talents, and cultivate reserve young scientific talents to enhance the domestic and international competitiveness of the synthetic biology industry. This approach explores the formation of a high-level industrial innovative talent training system with regional characteristics of Changzhou, implementing vocational-academic integration, industry-education integration, and science-education convergence, and implementing a linkage mechanism for industry and universities to jointly cultivate high-quality innovative technical talents, continuously cultivating various talents needed by the synthetic biology industry.

3.3.2 *Establishing International Industry Talent Recruitment Incentive Policies to Build High-level Innovative Teams*

Vocational colleges implement an active and open talent introduction policy, it can explore the establishment of global high-end talent recruitment policies that is in line with the Shanghai metropolitan circle and even internationally, and increase the openness of industries, science and technology, education, and talent. Actively introduce foreign-funded enterprises, top foreign experts and scholars to participate in the research and development of synthetic biology products and scientific and technological projects, it can establish industrial public service platforms, and achieves resource sharing and information communication among upstream, midstream, and downstream enterprises in the supply chain. And also colleges set up an innovation team training fund, establish a selection and training mechanism conducive to the rapid growth and emergence of high-level innovative teams, and build a progressive technological innovation team development to create a high-level industrial technological innovation team led by "leading talents, top innovative talents, and master craftsmen."

3.3.3 *Establishing a Value-oriented Personnel Mechanism to Expand the Career Development Channels for Skilled Talents*

Establishing a value-oriented personnel mechanism is useful to guide the government, industry enterprises, and research institutes to establish a compensation distribution system for skilled talents that reflects the value of skills, and effectively improves the treatment level of skilled talents. Colleges also need to adhere to the combination of virtue and talent, highlight the orientation of performance contribution and ability level, and improve the post evaluation mechanism for innovative talents. Innovate management mechanisms such as competition restrictions, retirement policies, and employment methods to achieve a job management mode that matches "position, responsibilities, contributions, and compensation." For vocational colleges, it is useful to introduce a job competition mechanism, hire based on performance, and specially hire for special positions to expand the professional technical position evaluation and employment channels for talents, further breaking through the restrictions of

academic qualifications, experience, age, and ratios in talent evaluation and employment. Explore a combination of annual assessment and team tenure assessment, quantitative assessment and qualitative evaluation to achieve a personnel selection and employment mechanism that allows innovative talents to move up and down, enter and exit.

4. CONCLUSION

The development of the synthetic biology industry in regions with new quality productive forces requires a smooth and virtuous cycle of education, science and technology, and talent. The main approach is the integration of industry and education through the collaboration of government, industry, schools, and enterprises in joint talent cultivation. It is essential to refine the mechanisms for talent cultivation, introduction, utilization, mobility, and motivation in the industry. Increasing the supply of high-quality resources and innovating in systemic mechanisms will nurture the top innovative talents needed by the synthetic biology industry.

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