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Research on Countermeasures to Enhance the Innovation Ability of Haining Manufacturing Enterprises in the Digital Era

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Abstract

Haining, as the top ten industrial counties in Zhejiang, a strong manufacturing city, to keep pace with the pace of the digital era, to deepen the digital application of all aspects of the manufacturing production process, to provide a strong momentum for the transformation and upgrading of the manufacturing industry in Haining. Based on the background of digital economy, this paper analyzes the necessity of improving the innovation ability of China's manufacturing enterprises, as well as the problems faced by Haining's manufacturing enterprises in improving their innovation ability, such as the construction of innovation platforms that need to be perfected, the degree of enterprise innovation investment is not high, and the cultivation of digital innovation talents is facing serious challenges, etc., and from the coordination and optimization of the construction of innovation platforms, accelerating the promotion of the construction of digital infrastructure, deepening the reform of the system and mechanism for the development of talents, building The new pattern of digital transformation of higher education and multiple inputs, focusing on stimulating the vitality of innovation and other five aspects of the digital economy era in the context of Haining's manufacturing enterprises to enhance the innovation capacity of countermeasures, aimed at accelerating the creation of Haining City with Haining's recognizable "142" advanced manufacturing clusters, the construction of "manufacturing strong city digital strong city". The purpose is to provide useful reference for Haining City to accelerate the creation of "142" advanced manufacturing clusters with Haining City's recognizability and to build a "strong manufacturing city and digital city."

Keywords: Digital Era, Manufacturing Enterprises, Innovation Capability, Countermeasure Research

1. Introduction

Manufacturing is the foundation of the real economy, and is the lifeblood of the national economy, the implementation of the manufacturing industry digital technology transformation and upgrading project, cultivate and grow advanced manufacturing clusters is to promote the development of regional economic development of the new impetus of the "leading sheep." Under the background of digital economy, manufacturing industry can make full use of cloud computing, Internet of Things, big data and other new generations of information and communication technology, deepen the digital application of key business links of manufacturing enterprises, use digital technology to reshape business models, empowering organizational innovation. Integrating digital

technology with the integration and penetration of manufacturing enterprises to enhance their innovation capability is an important engine to promote the digital transformation and sustainable development of China's manufacturing industry. The current digitalization of the manufacturing industry is constantly deepening, and digital technology is being widely and deeply integrated with the real economy, providing a source of living water for the high-end and intelligent development of manufacturing enterprises.

In order to guide and incentivize the accelerated development of advanced manufacturing clusters around Zhejiang, to guide the comparative advantages of various places to play, Zhejiang to the provincial party committee, the provincial government set up the highest honor in the field of manufacturing industry, "Zhejiang Manufacturing Tiangong Ding," in which the Haining City, Zhejiang Province, captured the first batch of "Tiangong Ding." Haining, as part of the economically developed areas of Zhejiang Province, has always been ranked among the top ten industrial counties in Zhejiang Province, leading the booming development of the manufacturing industry in Zhejiang Province. Due to the significant regional heterogeneity of the impact of the development of digital economy on the innovation enhancement ability of manufacturing enterprises, the digital economy empowers different regions to enhance the innovation ability of enterprises to drive countermeasures and the direction of the role of slightly different, therefore, the article in the existing literature on the basis of research, focusing on Haining City, exploring the digital economy under the environment of Haining's manufacturing enterprises to enhance the innovation ability of the countermeasures, which not only helps to This is not only conducive to enriching the theoretical research results in this field, but also to accelerating the deep integration of digital technology and the real economy, stimulating the enabling effect of the digital economy on the high-quality development of the manufacturing industry, accelerating the creation of the "142" advanced manufacturing clusters with the recognizability of Haining City, and promoting the construction of the "415X" advanced manufacturing clusters at a high level in Zhejiang Province. 415X" advanced manufacturing cluster has important practical value.

2. Literature review

At present, there are fewer studies on the path and countermeasures to enhance the innovation capacity of manufacturing enterprises in the context of the digital economy, and most scholars have unilaterally studied the innovation capacity of enterprises or explored the internal mechanism of digital transformation to empower the high-quality development of enterprises. The representative viewpoints are: innovation capacity is not only a specific organizational resource, it involves a variety of elements (Ke et al., 2023); at the same time, it is a process of dynamic allocation of resources, which will manifest in different forms at different times (Eisenhardt & Martin, 2000), which is the same as Teece's dynamic capacity theory (Teece, 2007). The government should further improve the mechanism and policy system for the improvement of innovation ability, and enterprises themselves should improve their ability to digest and absorb external knowledge (Han & Zhao, 2018); Some scholars have studied the mechanism for the enhancement of independent innovation ability of SMEs based on the perspective of the consortium, combined with multi-case study and rooting theory, and the results show that the internal mechanism, the external mechanism, and the coordinating mechanism are the three main mechanisms for the enhancement of independent innovation ability of China's small and medium-sized enterprises. Mechanism (Ma & Li, 2016), while others believe that the mechanism of enterprise innovation capacity enhancement mainly includes five mechanisms: leadership mechanism, organizational mechanism, learning mechanism, synergy mechanism, and talent cultivation mechanism (Wu et al., 2019;Liu, 2022). This study believes that innovation capability does not only refer to a single technological innovation capability, but it includes a variety of elements, such as organizational factors, market factors, technological factors, managerial factors, institutional factors, and so on. The mechanism of the digital economy to promote manufacturing enterprises to continuously build new competitive advantages is mainly reflected in the innovation behavior from closed to open, and the transformation of the organizational environment from static to dynamic. Digital transformation has become the strategic core of many manufacturing enterprises, Jane Guanqun and Miao Yuxin selected micro-data of Chinese A-share manufacturing enterprises, empirically analyzed the impact of digital economy development on the innovation of manufacturing enterprises and the internal mechanism through the construction of the model, and the study shows that the digital economy can directly and significantly enhance the innovation ability of enterprises on the one hand, and on the other hand, it can also be used to further promote enterprise innovation through the promotion of

digital transformation. Innovation (Jian & Miao, 2024). Under the background of digital economy, the manufacturing industry chain will be deconstructed and reconstructed (Zhang, 2018; Li et al., 2020), and the digital economy will take the digitalized knowledge and information as the key production factors, which will play the role of innovation and empowerment for the high-quality development of manufacturing enterprises (Shen & Huang, 2020). Third, the necessity of improving the digital innovation capability of manufacturing enterprises

General Secretary Xi Jinping pointed out: "the core of manufacturing is innovation, is to master the key core technology, must rely on self-reliance struggle, rely on independent innovation for." Only the key core technology as well as equipment manufacturing industry firmly in their own hands, in order to crack the neck problem. At present, China's manufacturing core technology is still restricted, it is difficult to solve the problem of independent supply of core parts and core technology through original innovation, such as 2023 high-grade CNC systems and components more than 95% from imports, China's chip self-supply rate of about 23.3%, and a number of developed countries are also continuing to upgrade the AI chip export ban, a number of domestic enterprises and R & D institutions are included in the export control List of entities under export control. According to the data released in January 2024 by the McClean Report division of TechInsights, which is responsible for semiconductor market trend research, in the ranking of the Top 25 global semiconductor manufacturers' sales in 2023, there is only one enterprise in mainland China on the list. At the same time, in the international situation and the impact of the epidemic in recent years, the global industrial chain supply chain began to "security and risk prevention" change, the United States and Europe and other developed economies in order to maintain the security of their own industrial chain supply chain, have to promote the return of manufacturing industry, began to establish an independent, autonomous, safe and controllable industrial system, to a large extent, has reduced the availability of imported technology in China. Reducing the availability of imported technology in China, the global industrial chain supply chain has entered a period of reconstruction and change, and is undergoing deep adjustment in the direction of localization, regionalization, diversification and digitalization. At the same time, due to the advanced manufacturing industry is not strong independent and controllable ability, the Internet of Things, cloud computing, industrial big data, artificial intelligence and other applications of the innovation ability are not strong enough, resulting in uneven product quality in China's manufacturing industry, there is a large gap with the developed economies, which directly affects the international competitiveness of China's manufacturing industry. Huawei encountered "extreme pressure" once again proved that only to enhance the original innovation capacity of China's manufacturing industry, with independent intellectual property rights of the core technology in their own hands, focusing on the key core algorithms, core materials, core technologies, core components, core equipment, and so many "!" Necked" problem to focus on the attack, in order to truly realize the supply chain independent and controllable, grasp the initiative of competition and development, enhance China's manufacturing industry chain supply chain resilience and security level. Fourth, Haining manufacturing enterprises to enhance the innovation capacity of the problems faced by the

2.1. Innovation platform construction needs to be improved

Haining manufacturing industry innovation public service and financing and other support and service platform construction lagging behind, mainly manifested in the following aspects. First, industrial common technology is the cornerstone of enterprise independent innovation, but the current Haining manufacturing industry technology innovation system there is a major chain link, common technology research and development and service platform is missing, common specialized technology and industrialization platform is limited in the number and level of capacity, it is difficult to break through the "neck" technology constraints. Secondly, the construction of innovation carriers is relatively lagging behind, and the small and medium-sized enterprise science and technology incubators in some districts and counties of Haining City have a low degree of marketization and professional management, with insufficient ability to carry out high-level professional assessment and cultivation of incubated enterprises, and a single mode of operation of the incubators, which is lacking in value-added services such as entrepreneurial counseling, technical support, industrial docking, and so on, and the sustained incubation capacity needs to be improved. Thirdly, the public service platform has a single function, the construction of a comprehensive informatization public service platform is lagging behind, and there is a lack of public service activities such as technical services, intellectual property assessment and consultation, entrepreneurial investment and financing, and transformation of achievements.

2.2. Low investment in innovation by enterprises

The research found that Haining manufacturing industry generally exists in the overall scale is not large, the quality of development is not high, the innovation ability is not strong and other issues, most of the enterprises do not have their own R & D institutions, to build the innovation platform is not enough, the manufacturing industry as a whole independent R & D and innovation ability is not strong, although some enterprises already have their own intellectual property rights, but no matter in the number of patents or the value of the quality of the patent is obviously lacking, involving innovation in the field of patenting is less, lacking in core competitiveness. Although some enterprises already have independent intellectual property rights, but both in terms of quantity and patent quality and value are obviously lacking, involving innovative areas of less patents, lack of core competitiveness. The deeper reasons behind this trend are as follows: Firstly, most small and medium-sized manufacturing enterprises have insufficient awareness of the importance of innovative talents and innovation to enterprise development, lack long-term planning, and are unwilling to invest excessive costs in the introduction of talents and technology R&D, and the enthusiasm for recruiting and attracting talents and innovation needs to be improved; secondly, increasing enterprise R&D investment is a necessary basis for enhancing their original innovation ability and improving the conversion rate of scientific and technological achievements. Secondly, increasing the investment in R&D of enterprises is the necessary foundation for enhancing their original innovation ability and improving the conversion rate of scientific and technological achievements, at present, the insufficient support for digital transformation of small and medium-sized manufacturing enterprises in Haining City and the shortage of funds are the main bottlenecks restricting the enterprises from enhancing innovation and constructing their own core competitiveness, and the docking between the capital market and innovation is not ideal, and it is difficult for the enterprises to raise funds, and the lack of corresponding funds to support the large-scale production of scientific and technological achievements has seriously impeded the demonstration, popularization and application of scientific and technological achievements. The diversified social input system for innovation has not yet been formed, and the diversified input system for innovation by the government, enterprises, finance and private capital has not yet been formed, and the multi-channel input mechanism has yet to be perfected.

2.3. Serious challenges to the training of digital innovation talents

Through research visits to manufacturing enterprises in Haining City, it is found that the key challenges faced by the current digital innovation talent team building mainly include the following aspects. First, the shortage of digital professionals. According to the "Industrial Digital Talent Research and Development Report (2023)", the current total shortage of digital talent in China is about 25 million to 30 million, and the rapid development of the industry in the future will continue to aggravate the shortage of digital talent. Managers of automobile, pharmaceutical and other manufacturing enterprises feedback, the Internet, artificial intelligence and other hot industries with flexible market response ability and first-class innovation ability, the attraction of talent far more than the manufacturing industry. By visiting Haining City, new materials, pan-semiconductor, intelligent high-end equipment manufacturing enterprises, managers reflect the digital innovation talent in recent years in short supply, enterprises have to establish a market-competitive salary system to attract and retain employees, greatly increasing the cost of manufacturing enterprises to introduce innovative talent. Secondly, the supply of digital innovation talents in universities is out of line with the actual demand of manufacturing enterprises. With the rapid development of digital technology and the increasing integration of the manufacturing industry, the intelligent manufacturing industry has put forward new requirements for the digital literacy ability and innovation ability of laborers. After the Haining City manufacturing industry enterprise managers interviews show that Haining "digital craftsmen" school and enterprise incubation environment there are short boards, did not form the linkage of industry, academia and research digital innovation talent training mechanism, there is a general lack of depth of university-industry-academia-research cooperation, lack of supply of higher education digital skills composite talents and other issues, the contradiction between the supply and demand of skills is mainly reflected in the university graduates in the intelligent manufacturing industry, the supply of digital innovation talent and the actual needs of the manufacturing industry. The contradiction between supply and demand of skills is mainly reflected in the lower ability of college graduates to apply digital technology in the intelligent manufacturing industry, and their ability to innovate and innovate is not strong. Thirdly, the enthusiasm for digital innovation of employees in

manufacturing enterprises is not high. Most of the manufacturing enterprises in Haining City do not have a strong innovation atmosphere, the enthusiasm of employees for digital innovation is not high, and there is a lack of institutional mechanisms within the enterprise to promote the transformation of employees' digital thinking and activate employees' vitality for digital innovation.

3. Digital economy empowers Haining's manufacturing enterprises to enhance the innovation ability of countermeasures

3.1. Coordinate and optimize the construction of innovation platforms

First, Plan and layout the construction of high-skill innovation platforms. Focusing on the national strategic objectives, the major needs of Zhejiang Province and the development needs of Haining City's innovative industries, we actively declare the construction of various types of innovation platforms at the national and provincial levels, integrate into the national and provincial strategic scientific and technological forces, improve the system of Haining's innovation platform bases, and accelerate the construction of provincial key laboratories, industrial research institutes, and enterprise research and development centers in the fields of new materials, pan-semiconductors, energy storage, and intelligent and high-end equipment manufacturing to create a High-level innovation platform. Second, build new R&D organizations. Docking the introduction of the world's top 500 enterprises, Zhejiang Province and other outstanding universities, high-end scientific research institutions, provincial local state-owned enterprises to Haining City alone to set up new R & D institutions, or joint Haining enterprises, research institutes, colleges and universities and other high-level new R & D institutions, to promote the industrial chain, the chain of talent, the depth of the integration of the innovation chain. Efforts to build enterprise-led industry-university-research-use deep integration of innovation consortium, the establishment of applied basic research, key core technology research, industrial common technology R & D and services as the core business, set the scientific and technological achievements of R & D, results of the pilot maturation, transformation of innovative achievements and small and medium-sized enterprise incubation as a whole of the independent legal person of the new innovation body to accelerate the innovation of high-quality development of the manufacturing industry. Third, build a ladder cultivation mechanism to systematically promote the construction of high-level innovation platforms. On the one hand, for manufacturing enterprises that have not constructed innovation platforms, we encourage them to organize a wide range of industry-university-research docking and exchange activities to improve their innovation capabilities, and in cooperation with the government, enterprises, scientific research institutes, etc., we will guide them to establish innovation platforms in accordance with the four criteria of "R&D sites, R&D investment, R&D teams and R&D projects." According to the standard of "four", enterprises above the scale with R&D activities will be guided to set up various forms of R&D institutions within their units in accordance with their own development needs, so as to improve the coverage rate of R&D institutions above the scale of industrial enterprises and organize and guide them to upgrade their R&D institutions gradually in accordance with the standard of municipal-level innovation platforms. On the other hand, for manufacturing enterprises that already have municipal-level innovation platforms, the government should also strengthen support and guidance, implement innovation platforms to cultivate action, and promote their upward benchmarking of provincial and national-level innovation platforms and gradual upgrading.

3.2. Accelerating the development of digital infrastructure

First, the deployment of digital infrastructure construction should be moderately ahead of schedule. Haining Municipal Government should base on Haining's local industrial demand and actual development situation, uphold the principle of "moderately ahead of schedule", and comprehensively promote the construction of new infrastructure such as 5G base stations, integrated data centers, cloud computing centers, industrial Internet, etc., so as to improve the ability of supplying services for digital transformation, and provide the underlying support for building the digital future. At the same time, in order to maximize the benefits of the new infrastructure in the whole life cycle, it should focus on the optimization of its location and layout, adhere to the system concept, coordination, and strengthen the technological convergence, network synergy, and intelligent interaction between different regions of Haining City, so as to promote the overall effectiveness of the new infrastructure to play a sustained role. Second, synergize the deployment of data and arithmetic infrastructure. Construct a diversified

arithmetic supply system with the collaborative development of cloud computing, edge computing, intelligent computing and supercomputing, build a factor system with "arithmetic+algorithm+data" as the core to enhance the degree of integration, guide Haining City to form a new type of data center development pattern with a reasonable layout, advanced technology, green and low-carbon, and interconnection, and push forward the digitization of business and process flow, and fully build a centralized and integrated data center. process digitization, and comprehensively build an intensive, green, intelligent, ubiquitous and resilient Haining City integrated arithmetic infrastructure. Third, strengthen the support guarantee. Strengthen local and departmental coordination, make good use of the task force mechanism, build a "government, industry, academia, research and gold taking" school-enterprise collaborative education community, focus on strengthening the policy support and financial guarantee for Haining City's manufacturing industry transformation and upgrading to speed up again, build a safe, compliant and trustworthy data circulation and application system, and provide support for the promotion of cross-industry and cross-region data elements circulation, creating a good environment for the development of the digital economy. Support for the development of digital economy to create a good ecology.

3.3. Deepening the reform of institutional mechanisms for talent development

Constructing a self-reliant and self-reliant digital technology innovation system depends on high-level digital innovation talents in the final analysis, and the key to fully releasing the innovation vitality of digital innovation talents lies in the institutional mechanism. First, build a scientific talent evaluation system to stimulate the innovation vitality of digital talents. Encourage Haining universities, scientific research institutions and local manufacturing enterprises to actively promote the reform of the evaluation mechanism of digital innovation talents, enrich the form of contribution recognition in the innovation contribution incentive system, such as strengthening the incentives for personnel and teams who have won important scientific and technological awards, high-value patents, undertake national innovation projects, etc., and improve the assessment mechanism of the innovation team, highlighting the distinctive orientation of quality and contribution, which is of great significance for mobilizing digital talents. It is of great significance to mobilize digital talents' enthusiasm for innovation and entrepreneurship. Secondly, explore and carry out joint innovation system and mechanism, and build and cultivate innovation consortium. Support cross-industry and cross-field talents to collaborate and fight as a team, work together to overcome problems in the same direction and goal, guide talents to form innovation synergy, build an innovation consortium led by leading enterprises, supported by colleges and universities, and synergized by various innovation subjects, and jointly build an innovation ecosystem covering talents, funds, projects, and application scenarios, so as to build a modern manufacturing industry system with the characteristics of Haining to provide strong Talent support.

3.4. Building a new landscape for digital transformation in higher education

The digital transformation of higher education is not only an upgrade at the technical level, but also a profound change, which is mainly reflected in the following aspects. First, accelerate the digital transformation of colleges and universities, and carry out the cultivation of disciplinary composite. Colleges and universities need to be guided by the needs of the manufacturing industry, integrate the cutting-edge technologies of the digital economy, promote the cross-fertilization of higher education disciplines, strengthen interdisciplinary and cross-field cooperation and communication, integrate digital literacy into the curriculum, form a digital curriculum system with the characteristics of the times, update and improve the relevant teaching materials, teaching cases and other teaching resources, explore and practice new teaching modes, and focus on strengthening the cultivation of cross-border integration of the thinking ability, digital literacy ability and innovation ability, and broaden the students' ability to develop and develop the digital literacy skills. The first step is to promote the development of digital literacy, digital literacy ability and innovation ability, broaden students' knowledge horizons and breadth of thinking, and promote the cultivation of digital talents with a digital literacy framework to promote the digital transformation of education. Second, continue to promote the digital transformation of teacher team building. Teachers as the practice of digital education development of the main body and supportive force, is a profound change in the education model and the key to the innovation of education concepts, teachers can take the lead in the realization of the digital transformation, a direct impact on the results of the education digital strategy action. In order to promote the digital transformation of Haining's teaching force, the top-level design and grassroots

exploration can be used to systematically promote the digital transformation of the teaching force, such as the timely introduction of the guide to the digital development of teachers and other guiding documents to clarify the course of action and key tasks, and to promote the standardization of teachers to carry out various digital education and teaching practices; focus on the actual needs of teachers to carry out digital training, and continue to enhance the ability of college teachers to carry out digital teaching; build the capacity of teachers to carry out digital teaching; and build the capacity to carry out digital teaching. Focus on the actual needs of teachers, carry out digital training, and continuously improve the ability of college teachers to carry out digital teaching on a regular basis; build a regional digital teacher training platform in Haining City, set up an integrated and intelligent digital teaching and research space, and create a collaborative teaching and research network linking schools and districts. Third, deepen the integration of government, school, enterprise, industry, academia and research to create a digital economy talent highland. To give full play to the advantages of Haining City, rich in university resources, strong scientific research institutes, and bursting with enterprise innovation and vitality, we should explore the talent training mechanism of industry-university-research linkage, jointly carry out the key core technology research, promote the integration of innovation and industrial innovation, actively serve the upgrading of the national manufacturing industry as well as the development of Haining's regional economy, and revise the digital talent training program based on the vocational needs of digital talents in the manufacturing industry. We will revise the digital talent training program based on the vocational needs of digital talents in manufacturing industry, set up a "transformation bridge" between scientific research results and industrialization, promote the organic convergence of digital innovation talent training and the needs of manufacturing industry, deepen the cooperation between schools and enterprises, schools and localities, strengthen the synergistic innovation, and build a "talent development community" with win-win cooperation, complementary advantages and resource sharing. "for the high-quality development of manufacturing industry in Haining to inject new momentum.

3.5. Multiple inputs to stimulate the vitality of innovation

First, increase the financial investment in science and technology. Haining City, the relevant financial departments should conscientiously implement the Party Central Committee, Zhejiang Province, Haining City, on the deployment of support for innovation, play the role of government traction, advanced manufacturing investment "lead" program, the establishment of special funds for innovation, increase the expenditure of science and technology special funds for the manufacturing industry to carry out original leading scientific and technological research, recruitment It will also increase the expenditure of special funds for science and technology to provide solid financial support for the manufacturing industry to carry out original and leading scientific and technological research, attract talents and venture capital. Secondly, build a diversified investment and financing system for innovation. Haining City, the financial sector should strengthen the synergy of financial and fiscal policies, the implementation of the new mechanism of cooperation between the government and banking and financial institutions, social capital, give full play to the role of financial funds "four or two pounds" prying role, the normalization of the promotion of major projects to financial institutions and private capital, with the help of funds, financing, and other financial tools, effectively guide its Increase support for innovation, tilt more financial resources and private investment flows to innovation, advanced manufacturing and other key areas, and effectively enhance the efficiency of resource allocation. Thirdly, enhance the enthusiasm of enterprises' own funds for R&D investment. The report of the 20th CPC National Congress emphasized that it is necessary to "strengthen the status of the main body of enterprise innovation," and innovation is the inevitable choice and top priority for the company's high-quality development, which also means that the enterprise has an important social responsibility and historical mission to promote the autonomy of the key core technologies, build a modernized industrial system, and realize the scientific and technological self-reliance and self-improvement. Enterprises should proactively adapt to and lead the new round of scientific and technological revolution and industrial change, strengthen the awareness of innovation, enhance the enthusiasm of R&D investment, optimize the innovation ecosystem, establish an enterprise-led technological innovation system for the in-depth integration of industry, academia and research, and strive to play a dominant role in the enterprise in the areas of innovation decision-making, R&D investment, scientific research organization and scientific and technological transformation, and make more efforts to enhance the effectiveness of innovation in the manufacturing industry.

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