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Analysis of the Impact of Science and Technology Service Industry on the Innovation Performance of Intelligent Manufacturing Enterprises and Research on Strategies

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Abstract: In the context of the intelligent transformation of the global manufacturing industry, the impact of the science and technology service industry on the innovation performance of intelligent manufacturing enterprises is becoming increasingly significant. Through a comprehensive analysis of relevant research, this paper analyzes the impact of the science and technology service industry on the innovation performance of intelligent manufacturing enterprises from two aspects: knowledge supply and intermediary platform. And it puts forward strategies to promote the science and technology service industry to improve the innovation performance of intelligent manufacturing enterprises. It analyzes how to promote the innovation performance of intelligent manufacturing enterprises from aspects such as optimizing the innovation environment, strengthening collaborative innovation, improving talent cultivation, and building an innovation ecosystem, providing theoretical support and practical guidance for the improvement of innovation performance.

Keywords: Science and technology service industry; Intelligent manufacturing enterprises; Innovation performance; Knowledge supply; Intermediary platform

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1. Introduction

With the deep integration of information technology and the manufacturing industry, intelligent manufacturing has become an important trend in the development of the global manufacturing industry. As a bridge connecting science and technology with industries, the science and technology service industry plays a key role in promoting the improvement of the innovation performance of intelligent manufacturing enterprises. In the current increasingly competitive economic environment, in-depth research on the impact mechanism of the science and technology service industry on the innovation performance of intelligent manufacturing enterprises and the proposal of effective improvement strategies are of great significance for promoting the high-quality development of the manufacturing industry and enhancing the national industrial competitiveness.

In recent years, the application of emerging technologies such as artificial intelligence, big data, and the Internet of Things in the manufacturing industry has been continuously deepened. Intelligent manufacturing enterprises are facing challenges and opportunities in many aspects such as technological innovation, product upgrading, and production

process optimization. The science and technology service industry can provide intelligent manufacturing enterprises with diversified services such as technical research and development support, integration of innovation resources, and professional consultation, helping enterprises break through innovation bottlenecks and improve innovation performance.

2. Literature review

2.1. Research on the science and technology service industry

The science and technology service industry is characterized by knowledge-intensity, technology-intensity, and high added-value, and can provide important technical support and innovation services for other industries [1]. In terms of agglomeration characteristics, the agglomeration of the science and technology service industry is affected by many factors such as economic development level, scientific and technological strength, knowledge spillover, and government behavior, and there are differences in the agglomeration levels of different regions [2]. The Yangtze River Delta region, as an economically developed area in China, has a rapid development of the science and technology service industry. However, within the Yangtze River Delta, regions such as Jiangsu Province and Shanghai have a relatively high degree of agglomeration, while Anhui Province has a relatively low degree. Indicators such as the spatial Gini coefficient reflect the different agglomeration trends [3].

2.2. Research on the innovation performance of intelligent manufacturing enterprises

The measurement indicators of the innovation performance of intelligent manufacturing enterprises are diverse, including the number of patent applications, new product sales revenue, and technological innovation efficiency. The innovation performance of enterprises is affected by many factors, such as internal factors like the enterprise's own research and development investment, human capital, and technology absorption capacity, as well as external factors such as market competition, policy environment, and industrial agglomeration [4].

2.3. Research on the relationship between the science and technology service industry and the innovation performance of intelligent manufacturing enterprises

Some studies have explored the relationship between the science and technology service industry and the innovation performance of enterprises, but there are relatively few studies specifically on intelligent manufacturing enterprises. Existing studies show that the science and technology service industry can have a positive impact on the innovation performance of enterprises by promoting technological innovation and optimizing resource allocation. The agglomeration of the science and technology service industry can bring about technology spillover effects, reduce enterprise innovation costs, and improve innovation efficiency. However, in intelligent manufacturing enterprises in different regions, of different sizes, and in different industries, the impact of the science and technology service industry is heterogeneous, and its impact paths and mechanisms still need to be further refined and deeply studied [5].

At present, the internal relationship between the science and technology service industry and the innovation performance of intelligent manufacturing enterprises still needs to be further studied in depth, especially in terms of the systematic analysis of the impact mechanism and targeted improvement strategies, there is still certain research space.

3. Analysis of the impact of the science and technology service industry on the innovation performance of intelligent manufacturing enterprises

The two dimensions of the science and technology service industry, namely knowledge supply and the intermediary platform, affect the dynamic capabilities of intelligent manufacturing enterprises through the innovation synergy effect, and further influence the innovation performance of enterprises.

3.1. The science and technology service industry provides knowledge supply through the resource integration and sharing mechanism

The science and technology service industry can integrate various scientific and technological resources, such as the research and development achievements of universities and scientific research institutions, as well as resources like technical talents and equipment, and match them with the needs of intelligent manufacturing enterprises. The science and technology service industry provides intelligent manufacturing enterprises with rich knowledge resources, including technical knowledge, market information, and industry insights. These knowledge resources are transmitted to the sharing platform through means such as technology transfer and consulting services. It helps enterprises break through technical bottlenecks and enhance their innovation capabilities.

3.2. The science and technology service industry, as an intermediary platform, promotes the flow and integration of innovation elements

The science and technology service industry connects innovation entities such as enterprises, universities, and scientific research institutes by building technology trading platforms, innovation and entrepreneurship platforms, etc., and promotes the optimal allocation of knowledge, technology, talents, and capital. This intermediary role not only reduces the innovation costs of intelligent manufacturing enterprises but also improves innovation efficiency. By establishing a science and technology resource sharing platform, enterprises can obtain external advanced technologies and innovative concepts, making up for the shortage of their own innovation resources.

3.3. Helping enterprises improve their innovation performance by enhancing their dynamic capabilities

Based on the dynamic capabilities theory, the science and technology service industry can enhance the dynamic capabilities of intelligent manufacturing enterprises, including innovation capabilities, absorption capabilities, and adaptability. Science and technology service enterprises help enterprises improve the technical level and innovation awareness of their employees and enhance the innovation capabilities of enterprises by providing professional training, consulting services, etc. At the same time, the science and technology service industry can assist enterprises in better identifying, absorbing, and utilizing external knowledge and technologies, improving the absorption capabilities of enterprises. When facing market changes and technological transformations, the science and technology service industry can also guide enterprises to adjust their strategies and production methods in a timely manner, enhancing the adaptability of enterprises. For example, when an enterprise introduces artificial intelligence technology, the science and technology service industry can provide technical training and application guidance to help enterprise employees master new technologies, and improve the intelligent level and innovation performance of the enterprise.

The impact of the science and technology service industry on the innovation performance of intelligent manufacturing enterprises is shown in **Figure 1**.

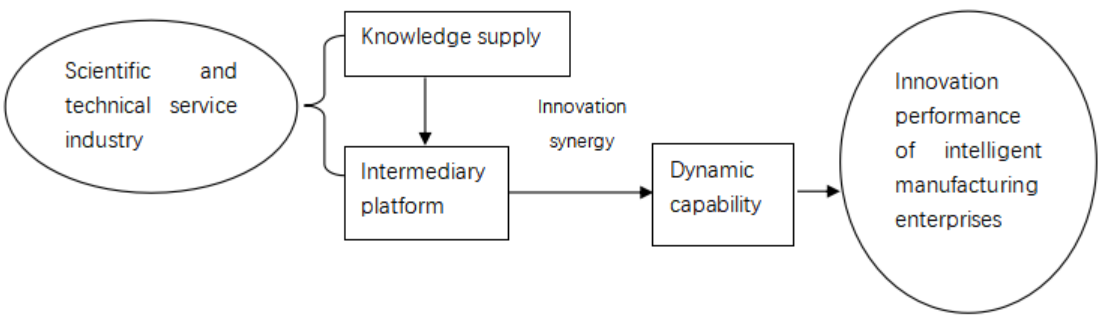

Figure 1. Influence of science and technology service industry on innovation performance of intelligent manufacturing enterprises

4. Strategies for the science and technology service industry to promote the improvement of the innovation performance of intelligent manufacturing enterprises

4.1. Optimize the innovation environment and improve policy support

First of all, the government should introduce more policies to encourage the development of the science and technology service industry. It can support the establishment and operation of science and technology service institutions through means such as tax incentives and financial subsidies. Especially for institutions engaged in cutting-edge technology research and services, the government should provide more research and development funding support to reduce their operating costs and improve their service capabilities.

Secondly, improve the intellectual property protection system. Intellectual property is an important guarantee for innovation. Only in a sound intellectual property protection system can enterprises carry out technological innovation and achievement transformation with confidence. The government should strengthen the protection of intellectual property rights and optimize the institutional and legal environment for innovation activities.

Thirdly, the government should also promote the establishment of industry standards and norms for the science and technology service industry. By formulating unified service standards and evaluation systems, the service quality and efficiency of science and technology service institutions can be improved, and the trust and satisfaction of enterprises can be enhanced. At the same time, the government can also support the technological research and development and service innovation of science and technology service institutions by setting up a development fund for the science and technology service industry, and promote the upgrading and development of the entire industry.

4.2. Strengthen collaborative innovation and build an innovation network

First of all, encourage science and technology service institutions to establish long-term cooperative relationships with intelligent manufacturing enterprises. Through signing strategic cooperation agreements, the two sides can conduct in-depth cooperation in technological research and development, product design, market promotion, and other aspects, and form a stable innovation alliance. Science and technology service institutions can provide customized technical solutions for enterprises and help them solve technical problems in the production process.

Secondly, promote in-depth cooperation among industry, university, and research institutions. Universities and scientific research institutes are important forces in scientific and technological innovation. Through cooperation with science and technology service institutions and intelligent manufacturing enterprises, scientific research achievements can be quickly transformed into actual productive forces. The government should encourage the establishment of industry-university-research cooperation platforms to promote the flow of knowledge, technology, and talents among different innovation entities.

Thirdly, establishing an open and shared innovation platform is also an important means to strengthen collaborative innovation. By building online and offline innovation platforms, information exchange and resource sharing among science and technology service institutions, intelligent manufacturing enterprises, universities, and scientific research institutes can be promoted. For example, a technology trading platform can be established to facilitate enterprises to find the required technologies and services; an innovation resource sharing platform can also be established to promote the sharing and utilization of innovation resources such as equipment and talents.

4.3. Improve talent cultivation and establish an introduction mechanism

First of all, strengthen the cultivation of science and technology service talents. Universities and vocational colleges should offer majors and courses related to the science and technology service industry to cultivate composite talents with interdisciplinary knowledge and practical abilities. Majors such as science and technology service management, technology transfer, and intellectual property can be set up to cultivate composite talents who understand both technology and management.

Secondly, establish a flexible talent introduction mechanism. Intelligent manufacturing enterprises and science and

technology service institutions should actively introduce excellent talents at home and abroad, especially high-end talents with rich experience in fields such as intelligent manufacturing, artificial intelligence, and big data. A talent introduction fund can be set up, and competitive salaries and benefits can be provided to attract excellent talents to join. At the same time, channels for introducing overseas talents can also be established to attract high-level overseas talents to start businesses or work in China.

Thirdly, the talent incentive mechanism should also be strengthened. By setting up innovation reward funds, equity incentives, and other means, the innovation enthusiasm and initiative of science and technology service personnel and employees of intelligent manufacturing enterprises can be stimulated. An "Innovation Award in Science and Technology" can be set up to reward individuals and teams that have made outstanding contributions to technological innovation and achievement transformation; equity incentives can also be used to enable science and technology service personnel and the core technical personnel of enterprises to share the achievements of enterprise development.

4.4. Build an innovation ecosystem and promote industrial integration

First of all, encourage science and technology service institutions to develop in the direction of specialization and refinement. Different science and technology service institutions form distinctive service models. Some institutions can focus on technological research and development, some can focus on technology transfer, and some can focus on intellectual property services. Through specialized division of labor, service efficiency and quality can be improved to meet the diverse needs of intelligent manufacturing enterprises.

Secondly, promote the in-depth integration of the science and technology service industry and the manufacturing industry. Science and technology service institutions should take the initiative to integrate into the industrial chain and innovation chain of the manufacturing industry and establish close cooperative relationships with intelligent manufacturing enterprises. In-depth cooperation with enterprises in technological research and development, product design, etc. can be carried out by establishing joint laboratories, technology research and development centers, etc. At the same time, science and technology service institutions can also help enterprises optimize production processes, improve production efficiency, and reduce production costs by providing comprehensive innovation services.

Thirdly, establish carriers such as innovation incubators and science and technology parks to provide comprehensive innovation support for intelligent manufacturing enterprises. Innovation incubators and science and technology parks are important components of the innovation ecosystem and can provide office space, financial support, technical consulting, and other services for start-ups and small and medium-sized enterprises to help them grow rapidly. An intelligent manufacturing innovation center can be set up in the science and technology park, gathering a number of science and technology service institutions and intelligent manufacturing enterprises to form a good ecosystem for collaborative innovation.

Fourthly, the government should strengthen the guidance and support for the innovation ecosystem. Through the formulation and implementation of a series of policy measures, the collaborative development of the science and technology service industry and the manufacturing industry can be promoted. An intelligent manufacturing innovation fund can be set up to support the cooperation projects between science and technology service institutions and intelligent manufacturing enterprises; intelligent manufacturing innovation competitions can also be held to stimulate the innovation vitality of enterprises and institutions.

5. Conclusion

The science and technology service industry plays an irreplaceable role in promoting the improvement of the innovation performance of intelligent manufacturing enterprises. Through strategies such as optimizing the innovation environment, strengthening collaborative innovation, improving talent cultivation, and building an innovation ecosystem, the promoting role of the science and technology service industry can be fully exerted, and the innovative development of intelligent

manufacturing enterprises can be promoted. At the same time, intelligent manufacturing enterprises should also take the initiative to strengthen cooperation with science and technology service institutions and make full use of external resources to enhance their own innovation capabilities and achieve sustainable development. In the future, with the continuous progress of science and technology and the in-depth integration of industries, the collaborative innovation between the science and technology service industry and intelligent manufacturing enterprises will usher in a broader development space.

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The author declares no conflict of interest.

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