Exploration and Practice of Weifang Innovation Community under the Background of Innovation Driven Development

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ABSTRACT

Chinese government has timely put forward a series of methods and judgments on technological innovation, faced with various challenges and problems in both externally and internally fields. It is emphasized that both the formation and development of new driving forces and the transformation and improvement of old driving forces stem from industry-university-research cooperation, which is an interconnected, interdependent, and internally integrated organic system, utilizing the power of financial capital and technological services to transform and apply science and technology, forming a new economy and new development. Guided by the national innovation driven development strategy, this paper conducted deep research on the innovative development community and demonstration model experiences. Through literature review, enterprise research, on-site interviews, and other methods, this paper gained a deep understanding of the participating entities of the innovation community, the roles and tasks undertaken by each entity, and the collaborative relationships among them. This paper focuses on studying the advantages and disadvantages of technological development and innovation in Weifang, summarizes the influencing factors of Weifang innovation community, introduces the triple helix theory, Schumpeter's innovation theory, and innovation community theory to construct the integrated innovation ecological development path in Weifang, summarizes evaluation indicators for innovation communities to build an innovation driven development model, and provides theoretical basis and policy recommendations for the government to scientifically formulate development plans and policies for the innovation community.

1. Introduction

Technological innovation has played an indispensable and crucial role in several transformations of human society. With the rapid development of technology and industrial transformation, new technologies and industries are reshaping the global economic landscape, and the competition for global technological innovation is becoming increasingly fierce [1, 2, 3]. Chinese government has timely put forward a series of methods and judgments on scientific and technological innovation, providing inexhaustible strength for China to solve social contradictions, resolve development problems, form a new pattern of dual circulation high-speed development, and support the high-level growth of China's sustainable economic development [4, 5]. With the deepening of globalization, China's economy and society have taken solid steps towards achieving high-quality development, which has provided unprecedented favorable conditions for China's asymmetric growth [6]. But it should be seen that both the formation and development of new driving forces, as well as the transformation and improvement of old driving forces, stem from industry-university-research cooperation. The cooperation utilizes the power of financial capital and technological services to transform and apply science and technology, which is an interconnected, interdependent, and internally integrated organic system, forming a new economy and society development [7, 8].

The strategy of innovation driven development was first clearly proposed at the 18th national congress of the communist party of China, and subsequent measures, such as the national innovation driven development strategy outline, have deepened the strategic and core position of the innovation driven development strategy in the overall development, laying the foundation for promoting the sustainable development of the Chinese economy. In 2019, Shandong provincial government has issued the implementation opinions on building an innovative and entrepreneurial community, which requires the construction of a group of innovative and entrepreneurial communities with concentrated elements and unique characteristics. Through the coordinated linkage of elements and integrated

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development, innovative industrial clusters with different characteristics and models will be formed to support and lead high-quality economic development of Shandong [9].

Under the guidance of the innovation driven development strategy and the implementation opinions on building an innovative and entrepreneurial community of Shandong provincial government, this paper will regard how to gather various innovative elements to create an innovation and entrepreneurship community as the overall focus, with enterprises as the innovation subject, to explore a way to release the innovation vitality of scientific researchers and promote the deep integration of industry, university, and research. Based on the government policy innovation stimulating market vitality to deepen the integration of science and technology finance, this paper will draw on and absorb relevant research results such as Schumpeter's innovation theory, triple helix theory, regional innovation system theory, collaborative innovation theory, and innovation community theory, reveal the operating mechanism of the innovation and entrepreneurship community, and design a path for building a science and technology integration innovation ecosystem and an evaluation index system for innovation and entrepreneurship communities, aiming to provide scientific theoretical guidance and management strategies for the development of regional science and technology innovation, and at the same time, fully leverage the comprehensive advantages of local small and medium-sized enterprises in technological innovation, enhance the overall strength of local industries, and promote the progress and development of scientific and technological innovation.

This paper reviews policies and systems for scientific and technological innovation, as well as research related to Schumpeter's innovation theory, triple helix theory, and regional innovation system theory. From the perspectives of macro national policy interpretation, meso regional coordination and linkage, and micro enterprise innovation subjects, the theory of innovation community is reasonably applied to solve practical problems in regional innovation driven development. A development path for the innovation and entrepreneurship community is designed under the context of innovation driven development strategy in Weifang. The internal influencing factors of the innovation community are clarified, and corresponding scientific evaluation indicators are proposed, enriching the theoretical ideas of scientific and technological innovation system construction and providing reference for further research by other scholars.

In the context of Weifang innovation driven strategy, by analyzing the local innovation environment and industrial advantages, this paper will apply the concept of innovation community to reveal the development laws of local scientific and technological innovation, improve the coordination and linkage mechanism between the government, enterprises, scientific research institutions, scientific and technological talents, financial institutions, intermediary institutions, and the market, and explore the path of integrating "government, industry, university, research, finance, service, and utilization" into the development of an innovative ecosystem. The research results will provide theoretical basis and ideological guidance for the government to scientifically formulate development plans and policies for the innovation community, accelerating the process of technology transfer and diffusion for enterprises, reducing innovation costs, and improving innovation efficiency.

The contributions of this paper can be summarized as follows:

- The innovation community under innovation driven development strategy is explored and researched in this paper. The roles and tasks undertaken by each entity of Weifang "government, industry, university, research, finance, service, and utilization" innovation community are deeply analysed, and 5 collaborative mechanisms among entities are established.

- An innovation driven evaluation index system is designed, where four main dimensions and their most important indicators are proposed based on the analysis of data from survey questionnaires.

- On the basis of theoretical achievements, policy recommendations for the government are proposed to scientifically formulate development plans of the innovation community, involving open strategy, innovation ecosystem, entity roles, technological talents, and virtual alliance.

The rest of this paper is organized as follows: Section 2 reviews relevant research about innovation communities and collaborative innovation to provide theory support for scientific and technological innovation. Section 3 proposes the roles and tasks of the seven major entities participating in the innovation activities in Weifang, and establishes 5 collaborative mechanisms to promote the development of the innovation community. Section 4 designs the innovation driven evaluation index system and analyses data to identify most important indicators of evaluation dimensions, proposing policy recommendations about innovation community for the government. Finally, Section 5 concludes this paper.

2. Related Works

2.1. Innovation Communities

Scholars have different perspectives and understandings on innovation communities, including scientific and technological innovation communities, collaborative innovation communities, and regional innovation communities. From the research results, scholars mainly focus on the connotation, operation mode, influencing factors, and construction path of innovation communities.

Wang et al. pointed out that the innovation community was an innovative organizational model that promoted the enhancement of innovation capabilities of technological innovation entities and the overall improvement of regional innovation capabilities [10]. They delved into the formation mechanism of innovation communities and examined it from six aspects: common goals, innovative resources, participating members, network structure, operational mechanism, and formation foundation. They pointed out that the organizational model of innovation communities may be led by governments, universities, commercial organizations, or non-profit organizations. They believed that establishing connections between regions could promote communication among innovation entities and achieve common development. Wu et al. proposed the construction of the cooperation model of the scientific and technological innovation community in the Belt and Road from the aspects of knowledge innovation, industrial institution interaction, technology park cooperation, government leadership, and so on [11]. Tian et al. believed that mechanism barriers were important factors that constrained regional collaborative innovation. In response to the difficulties encountered in the process of collaborative innovation in the Beijing-Tianjin-Hebei region, such as insufficient connection between innovation entities, insufficient connection between technology innovation chains and industrial chains, and large gaps in technological innovation, It was pointed out that the construction of a regional collaborative innovation community could be achieved by leveraging the respective knowledge innovation advantages, technology innovation advantages, and achievement transformation advantages of the three regions [12]. From the perspective of collaborative governance, Hu et al. proposed that the formation of innovation communities was influenced by administrative divisions and vicious competition between cities, and institutional reforms at the organizational, institutional, and policy levels would promote the construction of cross regional innovation communities [13]. Xie et al. used the entropy TOPSIS method to analyze the influencing factors of innovation communities, and proposed that researchers, research and development platforms, and patent application volume were the main factors affecting the construction of innovation communities [14]. Liu et al. proposed to take the government as the leader, strengthen the concept of collaborative innovation through top-level design, and build a big data platform and a networked technology service platform to promote the exchange and sharing of information and technological innovation resources, in response to the problems existing in the current situation of scientific and technological collaborative innovation [15]. Bo et al. proposed to build a regional collaborative innovation community by designing at the central level, establishing institutionalized cooperation mechanisms, and constructing an industrial collaborative innovation service system [16]. Zhao et al. proposed that implicit market barriers, lack of institutional arrangements, weak policy tools, and dispersed technological innovation forces were factors that affected the construction of innovation communities. They constructed innovation communities from four aspects: value, synergy, institutions, and digital governance [17].

2.2. Collaborative Innovation

With the advancement of the collaborative system theory, the global concept of collaborative innovation has also been incorporated into economic research. It not only involves the scope of collaborative innovation, but also involves collaborative governance, which refers to the joint efforts of multiple entities across administrative boundaries, using advanced governance techniques and management models to promote the process of collaborative innovation. After deep exploration, this paper defines regional collaborative innovation as a comprehensive innovation model that involves various participants participating together, allocating resources to each other, sharing risks, experiences, values, benefits, social responsibilities, benefits, prosperity, and win-win outcomes.

Wang et al proposed that collaborative innovation could be narrowly defined from a regional perspective. The narrow definition referred to technology innovation as the guide, where various technology innovation market entities achieved joint development within the region, relying on collaboration to maximize scientific and technological innovation benefits and enhance regional scientific and technological innovation capabilities [18]. Bai et al. thought that collaborative innovation could be mainly divided into two levels. One was the collaboration between innovation subjects, i.e., the internal innovation systems of each region, such as government, industry, university, research, and finance, allocated innovation resources in a complementary manner through collaborative cooperation to obtain the

transformation of scientific and technological innovation achievements. The other was the collaboration at the level of spatial correlation, i.e., the flow of innovation resources among innovation entities in different regions presented the effect of innovation correlation in regional space [19]. Wang et al. proposed that various collaborative innovation models could be constructed based on geographical location, subject, and industry characteristics, such as cluster network models, multi-agent models, and industrial chain models [20]. Wang et al. classified the mode of industry-university-research cooperation into five structural modes based on the hierarchical structure and closeness of industry-university-research cooperation: project-based, collaborative, physical, alliance based, and virtual[21]. Zhang et al. constructed a game model between enterprises, research and development institutions, and regulatory departments to study the cooperation and resource sharing mechanisms among regional innovation entities [22]. Xu et al. proposed the path of building a regional innovation system from the aspects of industrial cluster cooperation, innovation policy synergy, and improving innovation carriers [23].

3. Method

The triple helix driving mechanism of industry-university-research cooperation has been recognized as a key driving force for promoting the development of innovation communities, and the implementation of industry-university-research cooperation helps to promote collaborative cooperation between enterprises and universities, as well as the important role played by the government in promoting technological development. Their operating modes are all implemented through policy guidance. Finance, service, and utilization are committed to promoting the progress of scientific research and become important tools to drive social progress. They can not only provide strong financial subsidies to financial institutions, but also help enterprises achieve high-quality research results. At the same time, they can adjust research content in a timely manner according to the actual situation of consumers to meet their needs. The specific composition relationship of the innovation community is shown in Figure 1.
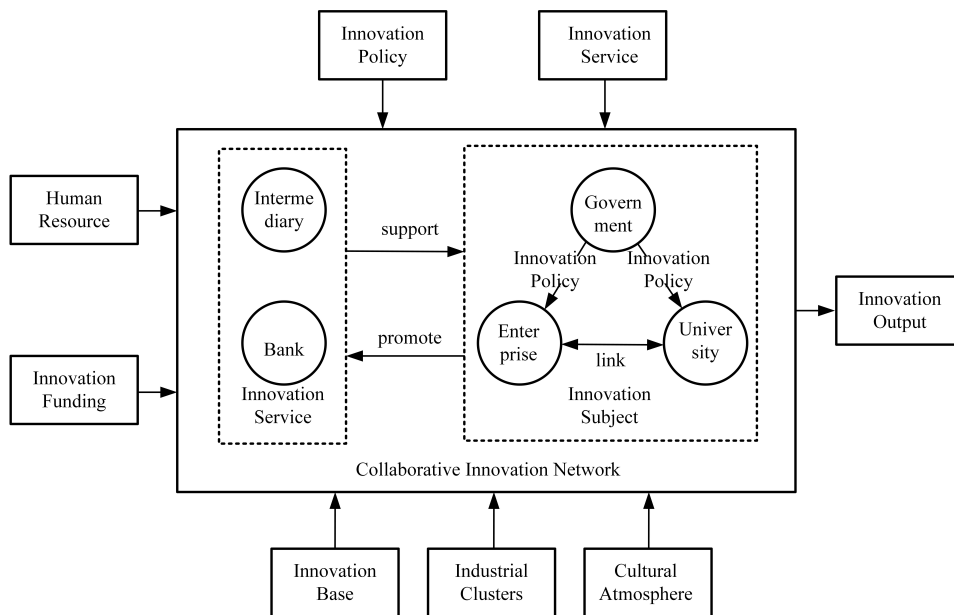

Figure 1: Schematic diagram of the research on the innovation driven development strategy of "government, industry, university, research, finance, service, and utilization" in Weifang.

This paper takes the national innovation driven development strategy as a guide and conducts deep research on the innovative development community and demonstration model experience of "government, industry, university, research, finance, service, and utilization". Through reading literature, enterprise research, field interviews, and other methods, this paper deeply understands the participating subjects of the innovation community, the roles and tasks undertaken by each subject, and the mutual synergy between each subject. Focusing on studying the advantages and disadvantages of Weifang technological development and innovation, this paper summarizes the influencing factors of Weifang innovation community, introduces the triple helix theory, Schumpeter's innovation theory, and

innovation community theory to construct the integrated "government, industry, university, research, finance, service, and utilization" innovation ecological development path of Weifang, summarizes evaluation indicators for innovation communities to build the innovation driven model, and provide theoretical basis and policy recommendations for the government to scientifically formulate development plans and policies for the innovation community.

3.1. Analysis of the Seven Major Innovation Nodes

In Weifang innovation community, the seven major entities participating in the innovation activities, i.e., "government, industry, university, research, finance, service, and utilization", are required to have a unique role and responsibility, as well as collaborative cooperation, to form a close network to achieve common innovation goals. Each participant can obtain information from the "government, industry, university, research, finance, service, and utilization" to better participate in innovation activities.

Government With the development of society, the popularization of public management movements, and the pursuit of better public interests, the government is constantly reforming its role, evolving from a "rower" to a "helmsman", and ultimately achieving a "servant". In this shared space, the government will formulate more comprehensive policies, implement more capital investment, and strengthen communication with society in order to better promote social development and build a more open and just market environment. The government plays a crucial role in promoting the progress of scientific research. It can not only provide guidance, encouragement, and promotion, but also provide funding and services for enterprises, greatly improving market efficiency and enhancing their competitiveness.

Core Innovative Industries The innovative industry is undoubtedly the engine of global economic development today. It not only represents the growth direction of the market, but also serves as a catalyst for scientific and technological progress. Its vigorous development will bring more opportunities and challenges to the entire social economy. Therefore, enterprises should seize opportunities, strengthen their research and development capabilities, enhance their scientific literacy, in order to achieve higher economic benefits. To promote innovation, organizations from different industries should become important forces driving their progress. At the same time, a group of outstanding entrepreneurs and elite operators and managers should also be strived to cultivate.

University Higher education institutions are the main training bases for technology. Higher education institutions have gathered a large number of researchers, and various research and training bases have established the main media and network platforms for higher education technology. Developed countries have implemented large-scale research fund subsidies for higher education institutions year by year, and various economic and industrial institutions have also provided large-scale horizontal funds to higher education institutions. This unique situation has made higher education institutions the main carriers of technology. The technological creativity of higher education institutions generally manifests as basic technical abilities, innovative investment management, innovative production management, research achievement transformation, and social environmental support capabilities. China's higher education contains enormous technological creativity in comprehensive national strength, which has a huge impact on the vigorous development of the economy and society. Therefore, accelerating the cultivation of scientific research talents in universities, promoting industry-university-research cooperation, and strengthening multidimensional evaluation of the scientific and technological innovation quality of universities are inevitable requirements for stimulating the scientific and technological innovation ability and management level of universities.

Scientific Research Institution As an important force driving social development, scientific research institutions are committed to promoting the discovery of advanced technologies and theories, not just limited to traditional educational work and learning. They are not only committed to promoting social development, but also to establishing and improving the core values of society, and becoming the intellectual support system of social development. In today's society, the relationship between research institutions and enterprises is becoming increasingly inseparable. This relationship is essential for enhancing the creative thinking of small and medium-sized enterprises. Therefore, the support for these institutions should be strengthened to assist them in areas such as local government, finance, technology, law, education, medicine, consulting, financial services, insurance, logistics management, accounting, and taxation.

Financial Institution The investment of financial institutions can be ubiquitous. They can not only help enterprises obtain sufficient financial investment, but also effectively promote the research and practice of scientists, craftsmen,

businessmen, and so on, thereby promoting the economic development of society. In addition, they can also drive the achievements of scientists in the crystallization of their wisdom, thereby promoting social progress. Due to the lack of diversified banking products, comprehensive credit guarantee systems, financial institutions focused on providing high-quality research services, as well as the multi-level capital markets, the contribution of financial institutions in promoting research and innovation is limited. Therefore, increasing investment, establishing a more flexible financial environment, and establishing stricter investment management are necessary to truly realize the contribution of financial institutions in promoting scientific research and innovation.

Science and Technology Intermediary Service Agencies Science and technology intermediary service agencies generally include various talent exchange management centers, labor promotion centers, various incubators, professional associations, technology consulting management centers, and so on. They provide science and technology consulting services for relevant small and medium-sized enterprises in the innovation community, and play the role of information communication and collaboration. However, the development of the science and technology intermediary service industry is still far from mature. Public services themselves lack policy and legal guarantees, and important social issues such as the standardization of public service fund collection and the tax incentives that science and technology intermediary service agencies can enjoy are not clearly defined in corresponding policies and regulations. Without specific implementation rules, it is impossible to effectively implement them. The objective existence of various important social issues mentioned above has hindered the development and service capacity improvement of technology intermediary service agencies.

Customer The "target customers" of the innovation community can be defined as companies, users, and retailers who are willing to purchase products of the innovation community. Enterprises in the innovation community should take customers' market demands as the core of their development, while universities should strive to provide effective professional knowledge and actively explore effective methods to meet customers' expectations. At the same time, scientists should also apply their research results to practical life to establish good connections with customers. Based on their actual usage experience, customers continuously stimulate innovative needs with competitive advantages, thereby promoting cooperation and development between enterprises in the innovation community.

3.2. Research on the Construction of Collaborative Mechanism for Innovation Community

It is necessary to establish a series of collaborative mechanisms to promote the development of the innovation community. This paper proposes to establish 5 collaborative mechanisms as shown in Figure 2. Triple helix pulling mechanism is a unique, open, dynamic, and self-organizing innovation development model that interweaves and spirals forward among enterprises, universities, and scientific research institutions to form a complete network, enabling each innovation subject to obtain valuable information and stimulate more vitality and innovation capabilities. Policy guidance mechanism makes governments at all levels play different roles, by formulating and implementing effective science and technology policies, to promote social innovation development. Lubrication support mechanism invests a significant amount of financial resources to promote and facilitate the growth of competitive and innovative companies. Demand feedback mechanism more actively promote the development of enterprises, by integrating user preferences into an innovative environment. Platform guarantee mechanism builds a comprehensive and efficient innovation network, and provides a secure and high-quality service for all participants, in order to achieve technology sharing and integration, and achieve win-win outcomes for enterprises.

4. Result

4.1. Innovation Driven Evaluation Index System

This paper establishes an evaluation index system for the Weifang "government, industry, university, research, finance, service, and utilization" innovation community, which aims to assess the impact of innovative activities from four dimensions: depth, breadth, persistence, and effectiveness.

Specifically, the depth dimension consists of five indicators: the type of resources invested by the participating parties, the quantity of resources invested, the investment method, the proportion of contractual cooperation, and the degree of enterprise dominance. The breadth dimension consists of five indicators: the total number of collaborative market entities, the number of specific collaborative content items, the number of students participating in project management, the proportion of teachers participating in project management, and the number of users participating
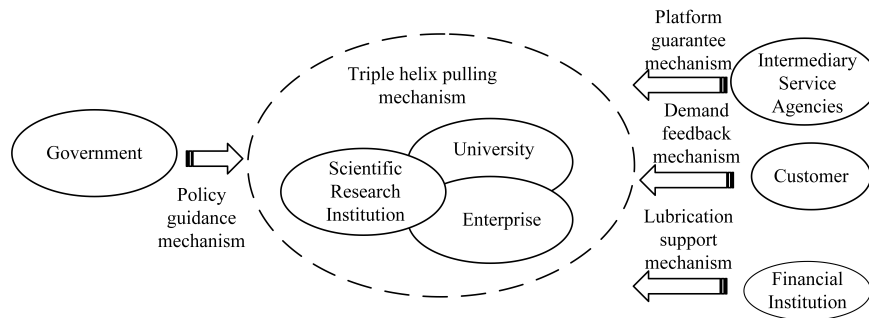
Figure 2: Schematic diagram of the construction of 5 collaborative mechanisms for the Weifang "government, industry, university, research, finance, service, and utilization" innovation community.

in project management. The sustainability dimension consists of nine indicators: community duration, general sustainability of collaborative innovation capability, longest sustainability of collaborative innovation capability, project management cooperation efficiency, retention rate of project cooperation technology innovation participants, joint technology innovation management personnel, joint innovation service team, joint technology innovation norms and management mechanism, and joint technology innovation execution efficiency. The effectiveness dimension can be measured through 12 different indicators, including government support, company performance, reputation of colleges and universities, social recognition, consumer preference, completion of cooperative projects, employment status of graduates, proportion of having multiple experts, comprehensive benefits of the community, consumer benefits, bank benefits, and expert benefits.

Survey questionnaires were designed for participants of the "government, industry, university, research, finance, service, and utilization" innovation community in Shandong. 500 questionnaires were distributed through online and offline methods, and 420 valid questionnaires were collected. The importance of evaluation indicators was measured using the Likert five point method, and frequency data analysis, reliability data analysis, and factor data analysis were performed on the valid data using the SPSS 24.0 software system.

The analysis results show that the weights of the four primary indicators of collaborative innovation, i.e., depth, breadth, sustainability, and effectiveness, are 0.077, 0.088, 0.192, and 0.643, respectively. The weight of the effectiveness of collaborative innovation is the highest, and the comprehensive income of technology intermediary service agencies, the number of collaborative innovation achievements, and enterprise satisfaction are the most important indicators for evaluating effectiveness. The weight of the sustainability of collaborative innovation is second, and the community duration and the effectiveness of collaborative innovation operation are the most important indicators for evaluating sustainability. The weight of the breadth of collaborative innovation is third, mainly evaluated by the proportion of participating project users and the number of collaborative entities. The depth of collaborative innovation has the lowest weight, and the degree of enterprise leadership and investment methods are the most important indicators for evaluating depth.

4.2. Policy Recommendations

Based on the theoretical achievement above, policy recommendations for the government to scientifically formulate development plans and policies for the innovation community are listed as follows:

- **Adopting an open innovation strategy to promote innovation driven development.** By embracing an open innovation strategy, the innovation community can actively engage with external partners, leverage diverse resources, and accelerate the pace of innovation. This approach not only fosters a collaborative environment but also drives forward the development of new technologies and business models, ultimately propelling the entire innovation community towards a more dynamic and sustainable future.

- **Strengthening the top-level design and task implementation of innovation.** By enhancing the top-level design and meticulously implementing tasks related to innovation, the government can create an environment that supports high-quality services and encourages collaboration, creativity, and continuous improvement. This holistic approach ensures that all elements of the innovation process are aligned, leading to a more dynamic and sustainable ecosystem that drives progress and excellence.

- **Re-examining the role positioning of various innovative entities.** It is crucial to re-examine the role positioning of various innovative entities within the ecosystem. It can ensure that each entity clearly understands and effectively performs their own duties. Moreover, it allows each entity to fully benefit from their own interests, thereby fostering a more collaborative and efficient environment. This not only enhances the overall innovation capacity but also promotes sustainable development and mutual success for all involved parties.

- **Actively attracting and motivating technological talents.** By creating an attractive working environment, offering competitive compensation packages, and providing ample opportunities for professional growth, the innovation community can draw in the best minds in the field. Additionally, fostering a culture of recognition and support will further encourage these talents to contribute their expertise and creativity, ultimately leading to breakthroughs and sustainable development.

- **Following the "Internet Plus" innovation virtual alliance.** The "Internet Plus" innovation virtual alliance can effectively promote the development of sharing and cooperation in various sectors, leveraging the power of the Internet and digital technologies, to facilitate the integration of resources, enhance communication among different stakeholders, and drive collaborative innovation. It can create a more interconnected and dynamic ecosystem, where knowledge, resources, and opportunities are shared to foster mutual growth and progress.

5. Conclusion

Guided by the national innovation driven development strategy, this paper researches Weifang "government, industry, university, research, finance, service, and utilization" innovation community under innovation driven development strategy. The roles and tasks of each entity are deeply analysed and 5 collaborative mechanisms are then established among those 7 entities. To construct an accurate innovation driven evaluation index system, survey questionnaire based data analysis are conducted, which finds most important indicators of four main dimensions in the designed innovation driven evaluation index system. Finally, policy recommendations for the government are proposed according to the theoretical findings, to help the development of Weifang innovation community in aspects such as open strategy, innovation ecosystem, entity roles, technological talents, and virtual alliance.

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