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Research on the relationship between "two-chain integration", knowledge management and innovation ability of electronic information enterprises

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Abstract: *The integration of industrial chain and innovation chain is an important way to improve the stability and creative development of industrial chain. The integration of industrial chain and innovation chain is an important strategic direction of China's future economic development, and it is of far-reaching significance to explore the impact of "two-chain integration" on the innovation ability of electronic information enterprises. This paper explores the influence of two-chain fusion on the innovation ability of electronic information enterprises from three dimensions: fusion path, fusion effect and fusion mechanism. Based on the structural equation model analysis of 252 questionnaire data, the results show that the integration of two chains and knowledge management have positive effects on the innovation ability of electronic information enterprises. The integration of the two chains also has a positive impact on knowledge management. The research conclusion has important practical guiding significance for improving the innovation ability of electronic information enterprises in the Beijing-Tianjin-Hebei region and promoting the transformation and upgrading of electronic information industry in the Beijing-Tianjin-Hebei region.*

Keywords: *two-chain fusion, knowledge management, enterprise innovation capability structural equation model*

1. Introduction

The world today is in the historical confluence of a new round of scientific and technological revolution and industrial revolution. New technologies are developing with each passing day, and the demand for the transformation of science and technology into real productive forces has accelerated significantly. The 20th report of the Party proposed that it is necessary to "maximize the release of the innovation and creation potential of the whole society" and "promote the deep integration of the innovation chain, industrial chain, capital chain and talent chain", which clarified the direction for further accelerating the implementation of the innovation-driven development strategy. Among them, to promote the integrated development of the industrial chain and the innovation chain is actually to create an innovation ecology in which the main body of the industrial chain and the main body of the innovation chain interact, such as core enterprises, collaborating manufacturers, governments, universities, and research institutes. The acquisition, application and sharing of knowledge by electronic information enterprises through the integration of the two chains can not only eliminate the inefficient behavior of some links in the industrial chain, but also help to enhance the overall value of the industry. Therefore, based on the knowledge management theory, this paper discusses the influence of the integration of two chains and knowledge management on the innovation ability of electronic information enterprises, and puts forward practical suggestions according to the results of structural equation model verification.

2. Literature Review

At present, most domestic scholars focus their research on the integration of the two chains mainly from a macroscopic theoretical perspective. In terms of the theoretical basis and connotation of two-chain integration, Liu Cheng explored the path of two-chain integration with the help of the experience of the lighting cluster of Ancient Town in Zhongshan, Guangdong Province, and conducted a further analysis of the mode of two-chain integration of the lighting cluster in ancient town [1]. Han Jiangbo analyzed the basic mode of two-chain integration and believed that the mode of two-chain integration

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has different forms of expression at different levels, but the most important mode can be divided into the mode of innovation chain promoting industry chain integration and the mode of industry chain pulling innovation chain integration [2]. Wu Zhongchao explored and analyzed the operation mechanism of industry-university-research collaborative innovation in applied universities from the perspective of two-chain integration [3]. Gao Hongwei further analyzed the theoretical connotation of promoting the integration of the two chains and expounded the practical progress [4]. Sun Qin studied the development path of two-chain integration of Chinese IC, and deeply analyzed the mechanism of two-chain integration [5]. As for the research of enterprise innovation ability, many scholars also discuss it from different angles. Lin Shaojiang conducted an empirical study on the impact of the embeddedness of innovation network structure on the innovation capability of enterprises [6]. Wang Xingyu explored the innovation ability of enterprises from the perspective of senior management team [7]. Gu Jianping analyzed the impact of strategic corporate social responsibility, organizational resilience and network embeddedness on the innovation capability of enterprises [8]. Knowledge resource is very important to the development of enterprise innovation ability, and it is also a hot topic of academic research in recent years. Wang Wen, based on the perspective of knowledge spillover, studies the innovation potential of high-tech enterprises in a high-tech zone in Beijing [9]. Cong Zhen believes that an enterprise's innovation ability is closely related to its knowledge storage, market knowledge acquisition and technical knowledge acquisition [10]. Zhang Jun analyzed the dynamic evolutionary relationship between knowledge accumulation and innovation ability [11]. Therefore, from the micro-perspective of the integration of the two chains and the overall perspective of knowledge management as the starting point, this paper explores the impact of both on the innovation ability of electronic information enterprises.

3. Theoretical basis and research hypothesis

3.1 Two-chain integration and innovation ability of electronic information enterprises

The core point of integrated development of industrial chain and innovation chain is to deploy innovation chain around the industrial chain and lay out the industrial chain around the innovation chain. Since then, he has made important statements on the integration and development of the industrial chain and innovation chain in important conferences. The paths of the integration of the two chains have different forms of expression. At the same time, referring to the in-depth interpretation of the two chains by scholars, this paper summarizes the two modes of the integration path as the mode of promoting the integration of the innovation chain to the industrial chain, and the mode of pulling the industrial chain to the innovation chain. The integration path can absorb powerful resources of participants according to the integration activities, improve the allocation rate of resources, and maintain the stability of the integration platform. The more paths of integration, the easier it is to obtain more valuable information, knowledge and technology in the market, thus improving the innovation ability of enterprises. The integration effect refers to the "complementary and mutually reinforcing" effect of innovation chain and industrial chain. This kind of "complementary and mutual promoting" effect is actually the embodiment of "complementary and mutual promoting effect" between technological innovation and industrial development. The more ideal the fusion effect is, the better the fusion effect is between the fusion subjects, the more adequate the knowledge exchange and technology exchange, and the more helpful it is to improve the innovation ability of enterprises. The integration mechanism can effectively guarantee and safeguard the interests of all the integration subjects, complete the common vision of the integration subjects, achieve the expected goals of the integration subjects, reduce, share and prevent innovation risks, improve the innovation ability of enterprises, and ensure the smooth realization of the integration innovation results. To sum up, this paper puts forward the following hypothesis:

H1: The integration of the two chains has a positive impact on the innovation ability of electronic information enterprises

H1a: The integration path has a positive impact on the innovation ability of electronic information enterprises

H1b: The fusion effect has a positive impact on the innovation ability of electronic information enterprises

H1c: The integration mechanism has a positive impact on the innovation ability of electronic information enterprises

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3.2 Two-chain integration and knowledge management

In the process of the integration of the two chains, knowledge, as an important resource in the integration, is the source of innovation for electronic information enterprises to carry out innovative activities. The integration path of the two chains sets up a platform for the acquisition, absorption, creation and utilization of the core knowledge of electronic information enterprises, which can effectively promote the interaction of knowledge among innovation subjects, and also arouse the attention of electronic information enterprises on the effectiveness of knowledge management. The pattern of knowledge management between fusion agents and the pattern of two-chain fusion path have the same evolution law, that is, the two-chain fusion path is conducive to the improvement of knowledge management level. As knowledge is a scarce resource that determines the core competitiveness of enterprises, the interaction and cooperation of various innovation subjects means that important knowledge must be exchanged, and the fusion effect of the two chains can be seen in this process. The improvement of integration effect will naturally further utilize R&D knowledge resources, efficiently integrate innovation resources with market demand, further tap the integration potential of "industry, university and research", and thus improve the level of knowledge management. The better the effect of fusion, the more full the knowledge exchange between fusion subjects, the more abundant the innovation results will naturally be. From the perspective of the fusion mechanism of the two chains, the more perfect the fusion mechanism, the stronger the knowledge interaction between the fusion subjects, which will also promote the improvement of knowledge management level. To sum up, this paper puts forward the following hypothesis:

H2: The integration of the two chains has a positive impact on knowledge management

H2a: Fusion path has a positive impact on knowledge management

H2b: Fusion effect has a positive influence on knowledge management

H2c: Fusion mechanism has a positive influence on knowledge management

3.3 Knowledge management and innovation ability of electronic information enterprises

Knowledge management is the process by which an organization learns and utilizes knowledge. In this process, knowledge is communicated and interacted among the organization's subjects. In the current era, the competition between enterprises is not only the competition of capital, technology and talents, but also the knowledge element is a very important competitive resource. The level of knowledge management directly affects the development of enterprises. The relationship between knowledge management and electronic information enterprises should be viewed from two aspects: on the one hand, it is to meet the external demand of other members for heterogeneous knowledge; on the other hand, it is to ensure that they obtain the knowledge needed for their own development from other members. Previous studies have found that knowledge management has both direct and indirect effects on core competitiveness, specifically, it can improve enterprises' ability to respond to environmental changes and form sustainable market competitive advantages. Knowledge reserve has become one of the important indicators to measure the innovation behavior of enterprises, and knowledge contribution and knowledge acquisition play a significant role in promoting the innovation ability of enterprises. At the same time, knowledge absorption capacity and knowledge communication quality are positively correlated with the innovation performance of enterprises, which can also indirectly indicate that there is a positive correlation with the innovation ability of enterprises . To sum up, this paper puts forward the following hypothesis:

H3: Knowledge management has a positive impact on the innovation ability of electronic information enterprises

4. Research Design

4.1 Variable Measurement

This study includes three elements: two-chain integration, knowledge management and electronic information innovation ability. The main part of the questionnaire is composed of relevant scales of these three elements. The original scales are all from mature questionnaires at home and abroad. Combined with the actual situation of electronic information enterprises from the perspective of double chain fusion, the independent variable double chain fusion is measured from three dimensions: fusion path, fusion

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effect and fusion mechanism. As for the measurement of knowledge management, referring to Wu Yan and Li Siqi et al., it is proved that knowledge management capabilities such as knowledge transfer, integration, sharing and creation have a positive promoting and mediating effect on the innovation ability of new ventures. Four items such as knowledge acquisition ability and knowledge utilization ability are put forward. The innovation capability of electronic information enterprises is mainly measured from the input of innovation activities and the output of innovation activities. With reference to the measurement items proposed by Cloodt M and Hagedoorm J, and combined with the actual situation of the development of innovation capability of electronic information enterprises, The amount of R&D funds jointly developed by electronic information enterprises and other fusion subjects, and the number of patents jointly applied by electronic information enterprises and other fusion subjects were put forward. In order to facilitate statistics, the following table is represented by the first letter of each variable.

4.2 Questionnaire design and data collection

This paper follows the principles of scientificity, objectivity, logic and simplicity, and refers to relevant literature and some mature subscales to determine the content of the questionnaire, form the first draft, and form the final questionnaire after experts embellished and modified the items. The data collection process is divided into pre-investigation stage and formal investigation stage. The pre-survey was concentrated in the electronic information enterprises with obvious characteristics of the integration of the two chains in Hebei. More than 100 pre-survey questionnaires were distributed, and preliminary data collection and sorting were carried out to further improve the survey questionnaires. In the formal research stage, electronic information enterprises with obvious integration of the two chains in the Beijing-Tianjin-Hebei region are selected as the research object.

5. Empirical Analysis

5.1 Descriptive statistical analysis

Table 1: Distribution of sample characteristics

Item	Mean value	Variance	Standard deviation	Skewness	Kurtosis
RHLJ1	2.71	1.505	1.227	0.269	-0.915
RHLJ2	2.5	0.96	0.98	0.254	-0.355
RHLJ3	2.6	1.094	1.046	0.345	-0.439
RHLJ4	2.61	1.091	1.045	0.135	-0.537
RHXY1	3.19	1.786	1.336	-0.194	-1.156
RHXY2	3.06	1.191	1.091	-0.127	-0.508
RHXY3	3	1.191	1.091	0.048	-0.486
RHXY4	3.07	1.23	1.109	0.035	-0.551
RHJZ1	2.97	1.461	1.209	0.149	-0.926
RHJZ2	2.83	0.968	0.984	0.239	-0.184
RHJZ3	2.8	1.092	1.045	0.025	-0.625
RHJZ4	2.71	1.075	1.037	0.258	-0.338
ZSGL1	3.34	0.951	0.975	-0.261	-0.706
ZSGL2	3.22	0.923	0.96	-0.159	-0.495
ZSLG3	3.25	0.977	0.988	-0.07	-0.297
ZSGL4	3.15	1.056	1.027	-0.092	-0.282
CXNL1	3.66	0.831	0.912	-0.224	-0.586
CXNL2	3.64	0.908	0.953	-0.262	-0.476
CXNL3	3.67	0.797	0.893	-0.275	-0.628
CXNL4	3.76	0.772	0.879	-0.475	-0.208

As can be seen from Table 1, the sample mean value ranges from 2.5-3.76, the variance ranges from 0.772 to 1.786, the standard deviation is small, the absolute value of skewness is less than 3 and the absolute value of kurtosis is less than 8, the data meet the approximate normal distribution, and the data concentration is good.

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5.2 Reliability and validity analysis

SPSS22.0 was used to test the reliability of the sample data, and AMOS24.0 was used to test the validity of the sample data. The test results are shown in Table 2 and Table 3.

Table 2: Reliability test results

Dimensionality	Item	Correlation between corrected items and total score	Klonbach coefficient after deleting the item	α
Fusion path	RHLJ1	0.763	0.837	0.878
	RHLJ2	0.764	0.836	
	RHLJ3	0.735	0.845	
	RHLJ4	0.704	0.856	
Fusion effect	RHXY1	0.777	0.814	0.870
	RHXY2	0.722	0.834	
	RHXY3	0.702	0.841	
	RHXY4	0.704	0.841	
Fusion mechanism	RHJZ1	0.743	0.783	0.848
	RHJZ2	0.623	0.833	
	RHJZ3	0.708	0.798	
	RHJZ4	0.682	0.809	
Knowledge management	ZSGL1	0.709	0.788	0.843
	ZSGL2	0.604	0.832	
	ZSLG3	0.738	0.775	
	ZSGL4	0.665	0.808	
Enterprise innovation ability	CXNL1	0.715	0.847	0.875
	CXNL2	0.736	0.84	
	CXNL3	0.767	0.827	
	CXNL4	0.714	0.848	

According to the data in Table 2, the total correlation of the revised items is greater than 0.6, and the coefficient of alpha reliability after deleting the items is smaller than the coefficient of alpha reliability of the whole, so there is no need to delete the item, and the coefficient of alpha reliability of the whole is greater than 0.8, indicating a high correlation among the items.

Table 3: Validity test results

Dimensionality	Path relation	Standardized factor load	AVE	CR
Fusion path	RHLJ1<---RHLJ	0.835	0.65	0.881
	RHLJ2<---RHLJ	0.825		
	RHLJ3<---RHLJ	0.799		
	RHLJ4<---RHLJ	0.763		
Fusion effect	RHXY1<---RHXY	0.851	0.631	0.872
	RHXY2<---RHXY	0.785		
	RHXY3<---RHXY	0.765		
	RHXY4<---RHXY	0.774		
Fusion mechanism	RHJZ1<---RHJZ	0.817	0.587	0.85
	RHJZ2<---RHJZ	0.688		
	RHJZ3<---RHJZ	0.805		
	RHJZ4<---RHJZ	0.749		
Knowledge management	ZSGL1<---ZSGL	0.724	0.577	0.843
	ZSGL2<---ZSGL	0.634		
	ZSLG3<---ZSGL	0.867		
	ZSGL4<---ZSGL	0.794		
Enterprise innovation ability	CXNL1<---CXNL	0.778	0.64	0.876
	CXNL2<---CXNL	0.801		
	CXNL3<---CXNL	0.842		
	CXNL4<---CXNL	0.776		

The data in Table 3 show that the minimum value of standardized factor load is 0.634, all of which

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are greater than 0.6; the minimum value of AVE is 0.577, all of which are greater than 0.5; and the minimum value of CR is 0.843, all of which are greater than 0.8, indicating that the questionnaire has good validity.

5.3 Testing of structural equation model

The sorted sample data was imported into the initial SEM model constructed in this paper, and AMOS software was used to fit it. The fitting results are shown in Figure 1. The fitting evaluation criteria and fitting results of structural equation are shown in Table 4 Fitting results of structural equation model.

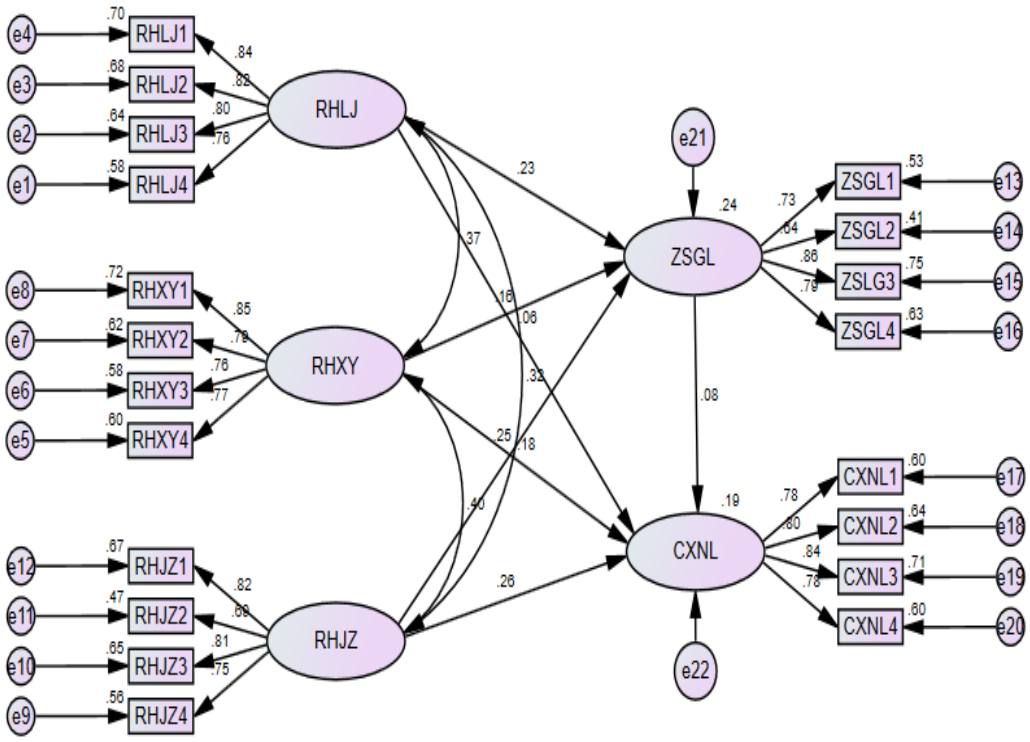

Figure 1: Structural equation model fitting diagram

As can be seen from Figure 1 Structural equation model fitting diagram, the coefficients between latent variables and observed variables are greater than 0.6, and the coefficients between observed variables and error variables are greater than 0.36, indicating a good degree of fitting of structural equation model.

Table 4: Fitting results of structural equation model

Index name	Measured result	Evaluation criteria
CMIN/DF	2.132	1<CMIN/DF<3 The model fits well
RMSEA	0.067	RMSEA<0.08 The model fits well
PCFI	0.785	PCFI>0.5 The model fits well
IFI	0.933	IFL>0.9 The model fits well
TLI	0.919	TLT>0.9 The model fits well
CFI	0.932	CFI>0.9 The model fits well

As can be seen from Table 4 Fitting results of structural equation model, the above six indicators all meet the evaluation criteria, the model has a high fit, and the measurement model has a high fit with the questionnaire data.

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Table 5: Verification results of path coefficients

Path relation	Estimate	S.E.	C.R.	P
RHLJ1<---RHLJ	0.835	0.099	12.943	***
RHLJ2<---RHLJ	0.825	0.076	13.366	***
RHLJ3<---RHLJ	0.799	0.084	12.485	***
RHLJ4<---RHLJ	0.763			
RHXY1<---RHXY	0.851	0.102	13.003	***
RHXY2<---RHXY	0.785	0.082	12.107	***
RHXY3<---RHXY	0.765	0.078	12.414	***
RHXY4<---RHXY	0.774			
RHJZ1<---RHJZ	0.817	0.105	12.175	***
RHJZ2<---RHJZ	0.688	0.084	10.389	***
RHJZ3<---RHJZ	0.805	0.09	11.992	***
RHJZ4<---RHJZ	0.749			
ZSGL1<---ZSGL	0.724			
ZSGL2<---ZSGL	0.634	0.089	9.723	***
ZSLG3<---ZSGL	0.867	0.109	11.134	***
ZSGL4<---ZSGL	0.794	0.108	10.713	***
CXNL1<---CXNL	0.778			
CXNL2<---CXNL	0.801	0.083	12.974	***
CXNL3<---CXNL	0.842	0.079	13.471	***
CXNL4<---CXNL	0.776	0.077	12.418	***

As can be seen from Table 5 Verification results of path coefficients. In the test relation of the path coefficient, all items of convergence path (RHLJ), convergence effect (RHXY), convergence mechanism (RHJZ), knowledge management (ZSGL) and innovation capability of electronic information enterprise (CXNL) can be reasonably measured ($P < 0.01, CR > 1.96$).

Table 6: Results of hypothesis testing

Hypothesis	Path relation	Estimate	S.E.	C.R.	P	Conclusion
H1a	CXNL <---RHLJ	0.233	0.067	3.097	0.002	Set up
H1b	CXNL <---RHXY	0.162	0.065	2.054	0.04	Set up
H1c	CXNL <---RHJZ	0.247	0.072	3.11	0.002	Set up
H2a	ZSGL <---RHLJ	0.065	0.069	2.834	0.003	Set up
H2b	ZSGL <---RHXY	0.178	0.066	2.229	0.026	Set up
H2c	ZSGL <---RHJZ	0.26	0.075	3.155	0.002	Set up
H3	CXNL<---ZSGL	0.078	0.079	3.983	0.005	Set up

As can be seen from Table 6 Results of hypothesis testing, assume H1(H1a, H1b, H1c), H2(H2a, H2b, H2c) and H3 all meet $p<0.05$ $CR>1.96$, and the standardization coefficients of each path are greater than 0. This shows that the two-chain fusion has a positive impact on knowledge management, the two-chain fusion has a positive impact on the innovation ability of electronic information enterprises, and the knowledge management has a positive impact on the innovation ability of electronic information enterprises.

6. Research conclusions and suggestions

Taking electronic information enterprises in Beijing-Tianjin-Hebei as investigation samples, this paper constructs a model of the influence mechanism of the integration of industrial chain and innovation chain on the innovation ability of electronic information enterprises, and clears the influence relationship among the integration of the two chains, knowledge management and the innovation ability of electronic information enterprises. Through empirical analysis, the following conclusions are drawn: Both the integration of the two chains and knowledge management have positive effects on the innovation ability of electronic information enterprises. The integration of the two chains has a positive effect on knowledge management. The research conclusions enrich the research results and empirical data in related fields, and the research conclusions have important practical significance. The innovation activities of electronic information enterprises depend on the process of the integration of the two chains, and the innovation behavior no longer highlights the independent innovation, but gradually manifests as the collaborative innovation based on the integration of subjects. Therefore, to improve the innovation ability of electronic information enterprises, we can start from the following:

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We will strengthen cooperation among innovation entities. To further enhance the innovation ability of electronic information enterprises, it is necessary to build joint cooperation between enterprises, universities and research institutes, adhere to the dominant position of enterprise innovation subjects, optimize the form of new science and technology projects, build an ecological model of innovation integration, follow the development law of electronic information industry, and lead innovation-driven development. In view of the complexity of electronic information production technology, we should vigorously cultivate leading enterprises, accelerate the initial formation of the integration chain, develop industrial clusters, form industrial scale advantages, and realize the independent and controllable key technologies of the innovation chain. Promote the mutual communication between enterprises and the government, universities and scientific research institutions, promote the construction of innovation carriers such as State key laboratories and college students' innovation and entrepreneurship parks, and contribute to the improvement of the innovation ability of electronic information enterprises. Attach importance to the exchange and cooperation between enterprises and intermediary service agencies, ensure that intermediary service agencies provide relevant resources for the development of electronic information enterprises, and escort the improvement of innovation ability of electronic information enterprises.

The improvement of the innovation ability of electronic information enterprises is inseparable from a good innovation environment in the social atmosphere. The government should provide forward-looking policy guidance for industrial development through the "visible hand", so that resources tend to enterprises with high growth, and encourage leading enterprises to drive the coordinated development of small and medium-sized enterprises, and promote regional economic development to a certain extent. Optimize the protection of intellectual property rights, improve the joint development mechanism of the two chains, based on the weak links of the industry, combined with industrial technological advantages and policy advantages, to ensure the legitimate rights and interests of senior technical personnel. Talent is the first resource, strengthen the talent cultivation system of colleges and universities, improve the introduction mechanism of high-tech talents, improve the welfare benefits of high-tech talents, encourage the joint establishment of talent training centers by universities and enterprises, and maintain an important position in the integration of universities and scientific research institutes.

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