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Talent Incentive Policy of Chinese High-tech Enterprises from the Perspective of Industrial Informatization Intervention

Zhangzhong HUANG[1], Yaoping LIU[2], Bijie LI[3]

Abstract

Priority development of education is the fundamental guarantee for the construction of high-level talent highlands. Technological self-reliance and self-improvement are strategic support for the construction of high-level talent highlands, and talent innovation guidance is the intrinsic driving force for the construction of high-level talent highlands. The construction of a high-level talent highland in the Guangdong Hong Kong Macao Greater Bay Area requires the integration of innovative elements that connect the "education chain, technology chain, and talent chain". It is necessary to build a three-dimensional integrated spatial architecture of "education technology talent". We need to build a community that integrates "education highland, technology highland, and talent highland". Accelerating the construction of high-level talent highlands in the Guangdong Hong Kong Macao Greater Bay Area requires the construction of a highland for scientific and technological innovation talents, a highland for technical and skilled talents, and a highland for scientific and technological finance talents. Based on this, this article selected 399 listed high-tech enterprises in the Greater Bay Area as the research objects, and conducted multiple regression on the relevant data of sample enterprises from the perspective of property rights heterogeneity from 2018 to 2021 to reveal which open innovation model can effectively solve specific situational problems faced by enterprises. The multi role matching mechanism can effectively improve the performance of new product development and its market competitive advantage of enterprises, as well as how the nature of property rights affects the relationship between open innovation strategies and new product development performance of enterprises. The research results show that, firstly,

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open innovation between enterprises is beneficial for the precise improvement of product development performance by high-level talents in enterprises. Secondly, open innovation in industry, academia, and research is beneficial for improving talent performance in enterprises, but its effect is weaker than that of open innovation between enterprises. Enterprises focus more on the open innovation model between enterprises.

Keywords: industrial informatization social intervention; talent incentives; policy perception; innovation performance.

Introduction

With the deepening development of globalization, the application of information technology in the industrial field is becoming increasingly widespread, and industrial informatization has become a key factor in promoting enterprise innovation and enhancing competitiveness. In this context, how to promote the innovation performance of enterprises through effective social intervention talent incentive policies is an urgent research issue (D'Attoma & Ieva, 2020; Lestari *et al.,* 2020). This article will take high-tech enterprises (hereinafter referred to as "high-tech enterprises") in the Greater Bay Area as the research object, and explore the impact of talent incentive policies under the intervention of industrial informatization development on enterprise innovation performance (Tseng *et al.,* 2020; Si *et al.,* 2020). The first driving force of development is innovation, and the root of innovation is talent. Therefore, the essence of innovation driven is talent driven. In other words, human capital, as the main body of technological innovation, is the most dynamic core element in technological innovation investment, playing a key role in improving innovation capabilities and levels. As innovation is a high knowledge and high-tech investment that requires active and sensitive talent participation, education will increase people's information and technology stock, as well as their awareness and pursuit of opportunities (Law *et al.,* 2021; El Ghak *et al.,* 2021). Therefore, the level of human capital education plays a very important role in the innovation of talent incentive policies, and this role is increasingly being valued. Since the implementation of the "QR Plan" in 2008, various regions and departments have formulated and implemented talent introduction policies, and in recent years, the "talent competition" between cities has become increasingly fierce (Freund *et al.,* 2020). It can be found from the "talent recruitment and intelligence introduction" policies of various cities that highly educated talents are the key targets of competition among cities, and the main focus is to provide different levels of reward policies for highly educated talents at different levels (Singh & Kumar, 2022; Rodríguez-Sánchez *et al.,* 2020). In recent years, enterprises have increasingly attached importance to the important role of highly educated talents in their competitive advantages, so highly educated talents have also become

the target of competition in recruitment. In previous studies on highly educated talents, most of them were generalized and positioned as college or above or undergraduate or above. This article considers that the educational backgrounds and training methods of highly educated talents at different levels may have differentiated effects on the innovation performance of enterprise talent incentive policies (Zhao *et al.,* 2013; Kandemir & Acur, 2022). Therefore, highly educated talents are divided into three levels based on their educational level: undergraduate, master's, and doctoral, in order to explore the differential impact of talents at each level on the innovation of talent incentive policies in enterprises.

Compared with the international first-class Greater Bay Area, the Guangdong Hong Kong Macao Greater Bay Area has the development potential of a "technology bay area", "industrial bay area", and "financial bay area". In the future, it can build an internationally first-class comprehensive Greater Bay Area with outstanding advantages of "technology+industry+finance" (Berraies, 2020; Cao *et al.,* 2020). The construction of the world-class comprehensive Greater Bay Area requires accelerating the construction of a world-class talent center and a high-level talent highland. The cluster development of high-level universities with distinctive characteristics in the Bay Area is an important platform for cultivating and gathering a large number of international strategic scientific and technological talents, first-class scientific and technological leaders, and high-level applied talents. The construction of a high-level talent highland in the Guangdong Hong Kong Macao Greater Bay Area requires the gathering of internationally competitive talent resources, and a world-class high-quality higher education system with an international level is needed as a fundamental guarantee. On the basis of fully understanding and following the development law of "education technology talent", further implement the strategy of prioritizing the development of education, especially higher education (Liu *et al.,* 2020). This can provide a new development path for accelerating the construction of a high-level talent highland and building an innovation cluster network in the Guangdong Hong Kong Macao Greater Bay Area. In this sense, prioritizing the development of education, especially higher education, is the fundamental guarantee for the construction of a high-level talent highland in Guangdong, Hong Kong, and Macao.

Talent incentive policies are one of the important factors affecting the innovation performance of enterprises. According to the research of domestic and foreign scholars, effective incentive policies can stimulate employees' enthusiasm for innovation and improve the innovation ability of enterprises (Hsu *et al.,* 20210; Jiang *et al.,* 2020). In the context of the development of industrial informatization, the role of talent incentive policies is more prominent. This is because the development of information technology has brought about profound changes in the operational mode, organizational structure, and management methods of enterprises, all of which require the active participation and contribution of talents. This article will use quantitative research methods to analyze the impact of talent incentive policies on innovation performance of enterprises based on

data from high-tech enterprises in the Greater Bay Area. Specifically, we will collect data on talent incentive policies and innovation performance of high-tech enterprises in the Greater Bay Area. Through statistical analysis methods, we will explore the relationship between talent incentive policies and enterprise innovation performance, and further study the intervention effect of industrial informatization development on this relationship.

Literature review

In recent years, scholars have defined the innovation connotation of open industrial information society intervention from multiple perspectives. Open innovation in industrial informatization, as a new innovation paradigm, has achieved a leapfrog development of enterprises from closed to open, from one-dimensional to multi-dimensional, and from slow to fast (Alassaf *et al.,* 2020). It is the leading model for enterprises to connect stakeholders to promote the flow of innovative elements, enhance organizational innovation and competitiveness (Nuryyev *et al.,* 2020). One is the resource-based perspective. Open innovation refers to the innovative model in which enterprises leverage external innovation forces to promote interaction, integration, and collaboration of innovation resource elements, enrich the internal resource pool of enterprises, reduce research and development costs and risks, and promote a virtuous cycle of product research and development. The second perspective is organizational learning (Nuryyev *et al.,* 2020). Open innovation refers to enterprises taking learning as the starting point, crossing organizational boundaries to search for external innovative entities' technical knowledge, using their own learning abilities to digest and absorb it, and applying it to new product development, thereby enhancing sustainable competitive advantages. Thirdly, from the perspective of external networks, open innovation refers to the construction of an external innovation organizational network with enterprises as the elements, promoting resource sharing, enriching social capital, and forming interest connections to enhance the innovation model of enterprise strength (Udeagha *et al.,* 2023). Some scholars, unable to directly observe whether enterprises implement open innovation and the degree of openness, have found through comprehensive analysis that whether it is for the purpose of financing or the premise of introducing technology, joint patents are a manifestation of stakeholders relying on their respective technological knowledge and resources to jointly develop innovative products. Therefore, open innovation is defined as collaborative innovation in the form of joint patents, which reflects the level of cooperation between the company and the outside world through the results (Arias-Pérez *et al.,* 2021; Litvinenko, 2020).

Many scholars at home and abroad have roughly divided their understanding of the innovation performance of talent incentive policies into two categories: one is the evaluation of the input-output efficiency of enterprise talent incentive

policy innovation activities, and the other is the evaluation of the output results of enterprise talent incentive policy innovation activities (Badir *et al.,* 2020; Nascimento *et al.,* 2021). Due to the difficulty in clearly defining the concept, there is currently no consensus in the academic community on the concept of innovative performance in talent incentive policies. Scholars often define this concept from their own research perspectives. The innovation performance of talent incentive policies refers to the innovative achievements of talent incentive policies obtained by enterprises in the innovation activities of talent incentive policies, mainly including the new technologies and knowledge produced in the process. Some scholars define the innovation performance of talent incentive policies as the comprehensive results achieved by enterprises in carrying out talent incentive policy innovation activities. Some people believe that the innovation performance of talent incentive policies includes the output and process performance of talent incentive policy innovation, which is the efficiency, output results, and contribution to business success of the innovation process of enterprise talent incentive policies. It measures the innovation performance of talent incentive policies by measuring the degree of improvement in enterprise performance and production efficiency after the new combination of production factors, that is, the innovation performance of talent incentive policies is the contribution to economic, social, and growth performance (Dana *et al.,* 2021). It believes that the innovation performance of talent incentive policies is the performance of technology creation output in the innovation process of enterprise talent incentive policies, which is mainly reflected in newly developed products.

Research on the impact of policy environment on technology-based enterprises: Enterprises will innovate and invest in research and development until the marginal benefits of research and development equal the marginal cost of research and development capital, revealing the mechanism of the impact of research and development subsidies on enterprise innovation (Tajpour *et al.,* 2022). Some scholars have found that R&D subsidy policy elements have the most positive impact on corporate innovation activities. The additional resources brought by fiscal subsidies enable enterprises to better respond to market and technological changes, and can expand their "resource pool" for innovation. It is beneficial for reducing innovation risks for enterprises and can also have complementary effects with internal innovation resources. Most studies suggest that the crowding out effect of fiscal subsidies is more pronounced in mature markets represented by the United States. Through the analysis of the above research, it can be seen that the innovation performance of talent incentive policies is mainly reflected in the innovation output of new product output, patents, etc., which is the efficiency and comprehensive income achieved by enterprises in talent incentive policy innovation activities.

Methodology

Factors Influencing the Technological Innovation Performance of High-Tech Enterprises in the Greater Bay Area

Government financial incentives. At present, the most commonly used incentive tools for high-tech enterprises in the Greater Bay Area in China are government subsidies and tax incentives. Government subsidies are direct subsidies for enterprise research and development activities, while tax incentives play a role in intervening in the market and controlling costs in innovation activities, that is, by increasing the enthusiasm of enterprises to participate in research and development activities to improve their innovation output. The relationship between government subsidies and technological innovation performance is significantly positively correlated; therefore they believe that government subsidies have a significant promoting effect on the technological innovation activities of enterprises. In private listed companies, tax incentives can have a significant positive effect on the technological innovation performance of enterprises through the intermediary effect of innovation investment. Tax incentives can only have a significant promoting effect on technological innovation performance at high percentiles. Some scholars have compared and analyzed the relationship between two incentive policies and technological innovation performance within the same framework, and found that both government subsidies and tax incentives can positively promote the technological innovation performance of enterprises. Government subsidies have a positive incentive effect on the number of patents and innovation sales output of enterprises, while there is a weak negative correlation between tax incentives and innovation sales of enterprises. Figure 1 shows the enterprise performance evaluation process.

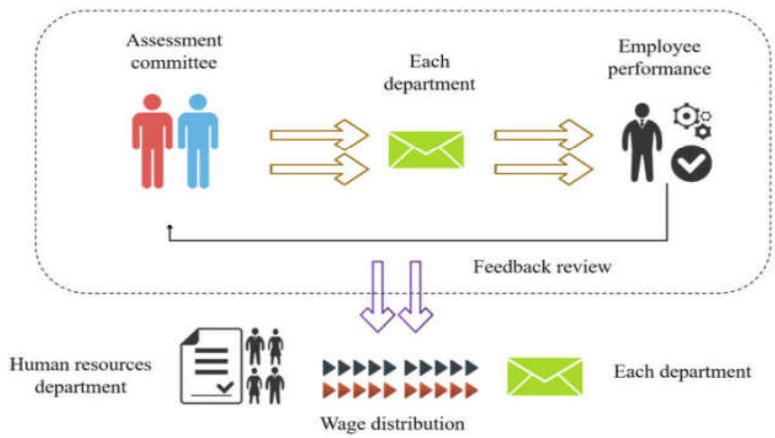

Figure 1. Enterprise Performance Evaluation Process

Industrial informatization development social relationship network. Any enterprise is located in various relationship networks, and these networks will to some extent affect and restrict the enterprise's access to resources. Therefore, networks will provide convenience for enterprises to access heterogeneous resources, and the heterogeneity of enterprise resources will affect the enterprise's technological innovation performance. At present, research on the impact of enterprise relationship networks on technological innovation performance mainly focuses on network embeddedness and the relationship between network location and technological innovation performance. Through empirical research, it has been found that both relational and structural embeddings are positively correlated with technological innovation in enterprises, and network embeddedness has an inverted U-shaped impact on innovation performance. Further research was conducted on the impact of network reciprocity on technological innovation performance in relationship embedding, and it was found that the degree of network reciprocity can significantly promote technological innovation performance. Research has shown that the impact of network strength in relational embedding on technological innovation performance is not significant. The centrality of network location, the degree of interaction and embedding of network relationships can significantly promote innovation performance, and information governance capabilities play an incomplete mediating role in the promotion process.

Research on the Impact of Innovative Strategies for Talent Incentive Policies in the Greater Bay Area on Enterprise Performance

The similarity of technology, resources, and goals among enterprises in the Greater Bay Area can accurately meet the needs of enterprise development and resource optimization from multiple aspects such as information acquisition, technology sharing, market entry, cost and risk optimization. Thus effectively improving the performance of new product development in enterprises often becomes an important starting point for the selection of open innovation models. On the one hand, peers, customers, and suppliers are important sources of knowledge for enterprises to develop new products and gain market advantages. Enterprises can obtain diversified knowledge and market resources needed to develop new products, as well as business strategies and operational models from the cooperative relationship between both parties. The implementation of open innovation between enterprises enables the target enterprise to break through the original organizational boundaries and reshape resources, integrating the acquired knowledge and technological resources with its own resources. Forming a diversified and enriched knowledge system, helping enterprises break through innovation bottlenecks and regain innovative ideas from a more comprehensive and new perspective. Shorten the product lifecycle and improve the performance of new product development.

Compared to open innovation among enterprises in the Greater Bay Area, industry university research open innovation often brings forward-looking technology, disruptive innovation achievements, and high-end talents to enterprises. But it also faces practical problems such as long innovation cycles, low investment returns, and market uncertainty. The direct appointment and promotion of senior management personnel in state-owned enterprises by government departments have led them to pay more attention to the short-term benefits of the enterprise and tend to carry out short-term, flat, and fast innovation projects. Therefore, strategies such as industry university research open innovation, which have a long return cycle and high risk pressure, are not the best choice for state-owned enterprises. It is also believed that the appointment period of enterprise managers has a reverse impact on the investment of exploratory innovation in enterprises. In addition, under the supervision and intervention of relevant governments, state-owned enterprises are more likely to follow the industry's conventional strategy, that is, to choose open innovation strategies between enterprises, while considering their own political future and corporate social responsibility. In contrast, non-state-owned enterprises without government support can only choose to deviate from industry norms and develop new markets and products to establish lasting competitiveness. However, non-state-owned enterprises have weak financial strength, and hastily adopting disruptive strategies can cause drastic fluctuations in performance, posing great risks. Therefore, non-state-owned enterprises often seek forward-looking technological resources and financial support through industry university research open innovation, jointly developing new products to seize market opportunities. Based on this, this article proposes the following assumptions:

H6: In state-owned enterprises, compared to open innovation in industry, academia, and research, open innovation between enterprises has a more significant promoting effect on the performance of new product development.

H7: In non-state-owned enterprises, compared to open innovation between enterprises, industry university research open innovation has a more significant promoting effect on the performance of new product development in enterprises.

In summary, exploring the impact of open innovation strategies on the performance of new product development in enterprises and the mediating role of organizational learning from the perspective of property rights heterogeneity is the focus of this study. The theoretical model is shown in Figure 2.

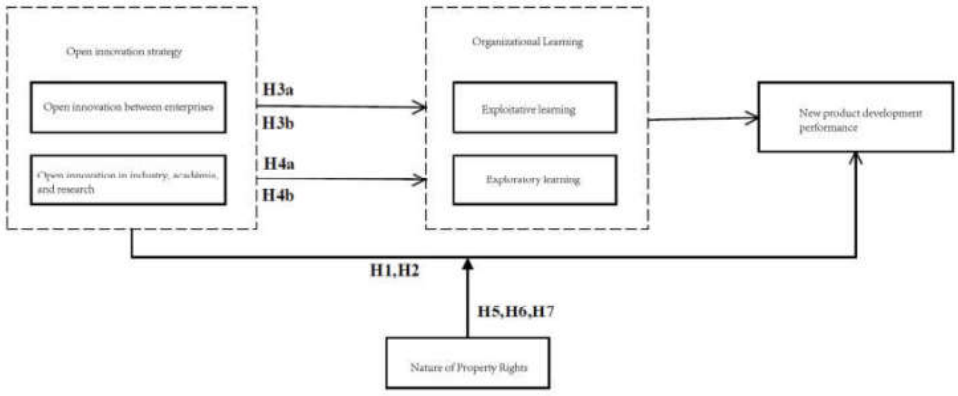

Figure 2. Theoretical Model

Results

This article selects 399 listed high-tech enterprises in the Greater Bay Area as the research objects, and conducts multiple regression on the relevant data of sample enterprises from the perspective of property rights heterogeneity from 2018 to 2021 to reveal which open innovation models can effectively solve specific situational problems faced by enterprises. The multi role matching mechanism can effectively improve the performance of new product development and its market competitive advantage of enterprises, as well as how the nature of property rights affects the relationship between open innovation strategies and new product development performance of enterprises. The principle of systematicness is that the selected assessment indexes should be comprehensive, holistic, relevant and hierarchical, which is the first principle to establish the assessment index system. The assessment index system should include many factors that affect enterprise performance. The AHP assessment index of enterprise performance in this paper is shown in Table 1.

Table 1. AHP assessment index of enterprise performance

Performance assessment index	Primary index	Secondary index
	Solvency	Liquidity ratio
		Net value ratio
		Reserve ratio
		Fixed capital ratio
	Profitability	Business profit margin
		Business yield
		Return on net assets
		Return on total assets
	Operating efficiency	Loss ratio
		Cost rate
		Total asset turnover
	Growth ability	Asset growth rate
		Price growth rate

Table 2 presents the descriptive statistical results of the full sample variables in this article. From the table, it can be seen that the average performance of new product development is 1.67, the median value is 12.81, the standard deviation is 0.267, and the deviation coefficient is greater than 0, indicating a right skewed distribution. This indicates that in the current Chinese scenario, the number of enterprises engaged in new product development activities is relatively small. The deviation coefficient is greater than 0, both of which are right skewed distributions, indicating that the willingness of most enterprises to participate in open innovation is not strong, and it is found that open innovation between enterprises is much greater than industry university research open innovation, indicating that enterprises generally engage in open innovation between enterprises. The mean value of exploratory learning is 1.76, median value is 74, standard deviation is 14.58, and the deviation coefficient is greater than 0. The mean value of utilization learning is 1.72, median value is 6.11, standard deviation is 5.624, and the deviation coefficient is greater than 0. Binary learning is a right skewed distribution, indicating that most enterprises generally have “non local invention syndrome” and are unwilling to obtain external relevant information and knowledge through organizational learning.

Table 2. Descriptive statistical analysis of samples

Variable	N	Mean value	Standard deviation	Minimum value	Maximum value	Median
HOI	453	1.67	0.267	0	25.62	12.81
HEI	453	1.85	0.357	11.45	32.45	21.95
State	453	1.35	167.2	1	5.62	3.31
Inage	453	1.57	48.12	0	4	2
EL	453	1.76	14.58	1	147	74
UL	453	1.72	5.624	4.215	8	6.11

Through data analysis, we found that talent incentive policies have a significant positive impact on corporate innovation performance. In the context of the development of industrial informatization, this impact is more pronounced. This indicates that in the era of rapid development of information technology, enterprises need to adopt more proactive talent incentive policies to stimulate employees' enthusiasm for innovation and enhance their innovation capabilities. In addition, we also found that the development of industrial informatization has an intervention effect on the relationship between talent incentive policies and corporate innovation performance. Specifically, with the improvement of industrial informatization, the promotion effect of talent incentive policies on enterprise innovation performance becomes more significant. Table 3 analyzes the autocorrelation test of exploratory learning in open innovation among enterprises.

Table 3. Autocorrelation testing of exploratory learning in open innovation between enterprises

Lags(P)	Chi2	df	Prob>chi2
1	0.212	1	0.645

Secondly, to verify the mediating effect of exploratory learning in the relationship between open innovation and new product development performance among enterprises, we also tested the autocorrelation first, as shown in Table 5.7, with a P-0.05, indicating that there is no autocorrelation. From Table 5.8, it can be seen that in Model (14), the impact of open innovation among enterprises on the performance of new product development is significantly positive (α 1=0.011, P-0.1). The regression coefficient of open innovation between enterprises on exploratory learning in model (16) is significantly positive (β 21=0.233, P<0.01), and the adjusted R2 is close to 1, indicating a good fitting effect of the model. The coefficient of open innovation among enterprises in model (18) is significantly positive (p1=0.015, P<0.1), but the coefficient of exploratory learning is not significant (P>0.1). From this analysis, it can be concluded that ai, Bel, and pi are significant, while y2 is not significant. Further validation will be conducted using a

soft test. As shown in Table 5.9, the coefficient is still not significant, indicating that exploratory learning does not have a mediating effect between open innovation and new product development performance among enterprises, that is, H3b has not been validated. Compared with the utilization learning mentioned above, it is found that enterprises usually match the effective resources obtained through open innovation between enterprises with utilization learning methods. This may be because in the process of cooperating with upstream, midstream, and downstream partners in the industry, enterprises are afraid of excessive cooperation to let the other party know their core technology and innovation direction, losing development opportunities and competitive advantages. Therefore, the implementation of open innovation strategies among enterprises is more about utilizing learning to transfer resources to the product research and development process to improve the performance of new product development.

Conclusion

This study indicates that under the intervention of industrial informatization development, talent incentive policies have a significant impact on the innovation performance of high enterprises. In order to enhance the innovation capability and competitiveness of enterprises, high-tech enterprises should formulate and implement effective talent incentive policies to attract and retain high-quality talents. At the same time, high-tech enterprises should actively promote industrial informatization construction, improve the level of informatization, and provide better support and platform for talent innovation activities. In addition, the government and society should also increase their support for incentive policies for high-level talents, creating a favorable environment and conditions for the innovative development of enterprises.

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