Analysis of the Multi-Stakeholder Integration Mechanism for Cultivating Innovative and Entrepreneurial Talents in Vocational Colleges
—— Perspective on the Integration of School Education, Enterprise Practice, and Innovation Networks

Yueheng Li*

School of Management, Guangdong Industry Polytechnic, Guangzhou, China

Abstract: The accelerated implementation of the innovation-driven development strategy has established new standards for the cultivation of entrepreneurial talents in vocational education in the new era. Based on industrial logic, the integration and coordination among educational institutions, corporate practices, and innovation networks have become important approaches for fostering entrepreneurial talents. Findings from questionnaire surveys, structural equation modeling, and hierarchical regression analysis indicate that participation mechanisms and cooperation mechanisms are the two main dimensions influencing the integration mechanism. To cultivate high-quality innovative and entrepreneurial talents and facilitate the integration among educational institutions, corporate practices, and innovation networks, it is necessary to construct a core mechanism for sharing interests among the government, educational institutions, businesses, and other stakeholders from the perspectives of "mutual benefit" and "commonality". This mechanism should leverage the resources and research strengths of each participating entity and establish a new relationship for resource flow at the institutional level.

1. INTRODUCTION

As China's economic development enters a new normal, the accelerated implementation of the innovation-driven development strategy and the rapid pace of technological advancement pose significant challenges to traditional education and traditional models of innovation transformation. Extensive promotion of innovation and entrepreneurship education in higher education is an educational strategy developed to address these challenges. Vocational education plays a crucial role in the innovation and entrepreneurship education system by cultivating high-quality technical and skilled talents and meeting the demands of the market and industries. However, in an era characterized by emerging industries, new business models, and new professions in the fields of cloud computing, Internet of Things, big data, and artificial intelligence, vocational education also faces a series of challenges, such as the quality of professional education, students' innovation abilities, and employment and employment quality issues. The integration of industry and education is one of the key solutions to these problems. National policies such as the "Opinions of the General Office of the State Council on Deepening the Integration of Industry and Education" (State Council Document No. 65, 2017) and the "National Vocational Education Reform Implementation Plan" (State Council Document No. 4, 2019) have been promulgated, elevating the integration of industry and education to a comprehensive institutional arrangement for national education reform and talent development [1]. These policies aim to promote the integration of industry and education from a development concept to an institutional supply, facilitating its practical implementation.

Both domestically and internationally, active exploration and practice have been carried out in the cultivation of innovation and entrepreneurial talents, leading to the development of different models. In foreign countries, there are various models such as the "Quality Assurance" model in the UK, the "Dual System" model in Germany, the "Market-Driven" model in the United States, and the "Cultural Integration" model in Japan. In China, models such as "Industry-University-Research Cooperation Education," "Industry-Education Integration and School-Enterprise Cooperation," and "Integration of Theory with Practice" have gradually emerged. Although there has been substantial practical experience in the cultivation of entrepreneurial talents based on the integration of industry and education, the collaborative process and influencing factors involving the government, educational institutions, businesses, and other

* Corresponding author: 562626805@qq.com

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stakeholders are highly complex. Therefore, based on industrial logic, it is necessary to clarify the interests and conflicts among the participating entities in the cultivation of entrepreneurial talents, explore the "value creation" and multi-stakeholder integration mechanisms in the collaborative cultivation process that contribute to the enhancement of innovation and entrepreneurial abilities and the potential economic benefits arising from the emergence of new knowledge. This will promote the integration of school education, corporate practices, and innovation networks, and leverage the resources and advantages of various stakeholders in the cultivation of innovation and entrepreneurial talents. It not only accelerates the national innovation-driven development strategy but also meets the requirements for cultivating high-quality technical and skilled talents in the new era.

2. THEORETICAL ANALYSIS AND SURVEY DESIGN

2.1 Theoretical analysis and conceptual modeling

Due to differences in cooperative goals, interests, and expected performance, there may be discrepancies among the parties involved in the cultivation of entrepreneurial talent, which can lead to malfunctioning participation mechanisms and impact cooperative performance. Each entity's investment in resources for entrepreneurial talent cultivation and the expected returns are often unpredictable, mainly manifested in the ambiguity of cooperative goals, difficulty in quantifying cooperative resources, unverifiability of cooperative benefits, and the sustainability of the cooperative period[2]. Firstly, extensive research indicates that cooperative parties need to reach strategic consensus on cooperative goals, avoiding being driven solely by short-term interests, in order to achieve sustainable development. This is particularly crucial considering the distinct regional differences in the entities responsible for talent cultivation, entrepreneurial practices, and innovative capabilities; it becomes even more important for the participating parties to reach a consensus on goals. Secondly, resource complementarity is a critical factor in selecting cooperative partners. The advantage complementarity formed by educational resources, information resources, human resources, technological resources, and financial resources plays a significant role in achieving integration and is the driving force behind it. Furthermore, for cooperative enterprises, the organizational image and social reputation of cooperative institutions are important indicators that influence the selection and depth of cooperation [3]. A closely-knit cooperation model is more conducive to joint innovation within the community of interests and clarifying the rights, responsibilities, and benefits structure of all parties [4]. Therefore, this study considers goal factors, resource factors, and organizational image factors as the three main factors influencing the degree of participation in school education, enterprise practices, and innovation networks. The sustainable collaborative cultivation of entrepreneurial talent in vocational colleges depends on the cooperative performance of school education, enterprise practices, and innovation networks. Previous research and practice have shown that the main reasons for poor cooperative performance are environmental uncertainties, high cooperation costs, and low cooperation efficiency [5]. This study categorizes them as "environmental factors" and "cooperativeness factors." Relevant research also indicates that "participation mechanisms" and "cooperative mechanisms" interact and influence each other. The integration of multiple entities in school education, enterprise practices, and innovation networks is a dynamic process of "common development," where various influencing factors often interact and transform each other.

Based on the above analysis, the theoretical model of the participation mechanism and cooperative mechanism in the integration of school education, enterprise practices, and innovation networks can be constructed as shown in Figure 1.

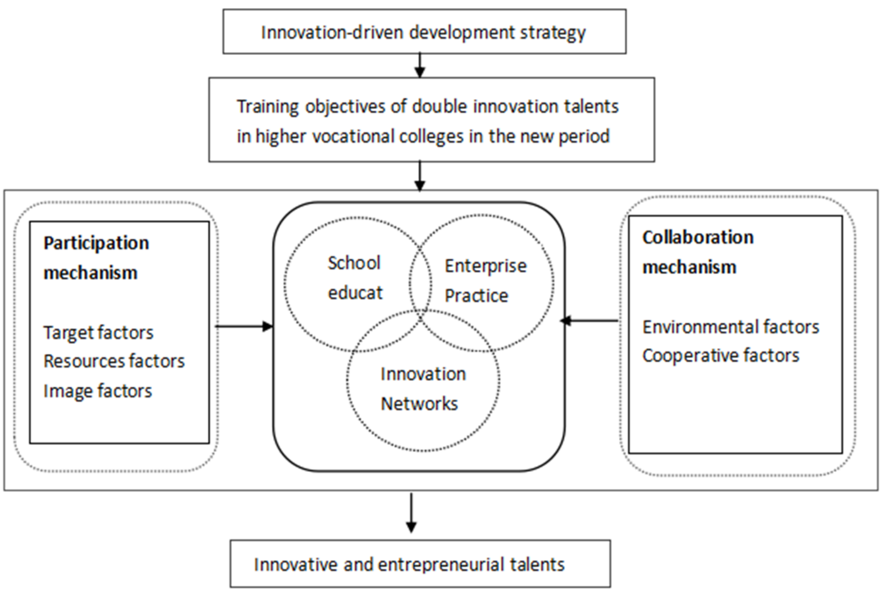

Figure 1: The theoretical model of the integration mechanism in school education, enterprise practices, and innovation networks

2.2 Survey Subjects and Questionnaire Design

2.2.1 Survey Subjects.

A questionnaire survey was conducted through online platforms and on-site surveys. A total of 280 questionnaires were distributed to vocational colleges, enterprises, and innovation networks. Out of these, 255 valid questionnaires were collected and considered in the analysis. The composition of the survey sample is presented in Table 1.

Table 1: The composition of the survey sample

Collaborating entities	Category	Sample size (proportion)
School education	In-service teachers	32（12.59%）
	Enrolled students	69（27.05%）
Enterprise practice	Enterprise managers	60（23.52%）
	Enterprise technicians	50（19.60%）
Innovation network	Innovation institution managers	8（3.13%）
	Innovation institution technical personnel	36（14.11%）
In total		255

2.2.2 Questionnaire Design.

The survey questionnaire consists of two parts: "Characteristics of Entrepreneurial and Innovative Talents" and "Factors Influencing the Integration Mechanism Survey".

Characteristics of Entrepreneurial and Innovative Talents questionnaire: This part of the research aims to capture the characteristics of entrepreneurial and innovative talents, which are summarized into three dimensions: "personal innovation ability," "entrepreneurial ability," and "entrepreneurial and innovative spirit." A total of 30 specific ability characteristics have been selected for assessment.

Factors Influencing the Integration Mechanism survey: This questionnaire investigates the factors that influence the multi-party integration mechanism. It includes target factors, resource factors, organizational image factors, environmental factors, and cooperative factors. The structure of the questionnaire and the related measurement items are presented in Table 2.

Table 2 : Questionnaire Structure and Related Measurement Items

<table>
<tr><th>Questionnaire number</th><th colspan="2">Measurement dimensions</th><th>Measurement items (Five-point Likert scale)
1 (Least applicable) ------------- 5 (Most applicable)</th></tr>
<tr><td rowspan="3">Questionnaire I: Characteristics of Entrepreneurial and Innovative Talents</td><td colspan="2">Innovation ability</td><td>Familiarity with the current status and development trends of the profession A1; Scientific research A2; Independent solving of complex problems A3; Knowledge of economic management A4; System design A5; Information acquisition and knowledge updating A6; Professional knowledge A7; Technological innovation and development A8; Data analysis A9; Scientific knowledge A10.</td></tr>
<tr><td colspan="2">Entrepreneurial ability</td><td>Integration capability of projects B1; Strategic thinking B2; Communication and interpersonal skills B3; International perspective and cross-cultural communication B4; Coordination ability B5; Crisis management ability B6; Teamwork ability B7; Organizational and management skills B8; Project development and design B9; Ability to obtain policy support and financing B10.</td></tr>
<tr><td colspan="2">Entrepreneurial spirit</td><td>Pursuit of excellence attitude C1; Familiarity with industry technical standards and regulations C2; Sense of social responsibility C3; Professional ethics C4; Quality and safety awareness C5; Lifelong learning C6; Humanities literacy C7; Ecological and environmental awareness C8; Dedication and passion for work C9; Systematic thinking C10.</td></tr>
<tr><td rowspan="5">Questionnaire II: Investigation of Factors Influencing Integration Mechanisms</td><td rowspan="3">Participation mechanism</td><td>Target factor</td><td>Innovation ability X1, Entrepreneurial ability X2, Entrepreneurial spirit X3.</td></tr>
<tr><td>Resource factors</td><td>Human resources X4; Value creation X5; Benefit compensation X6; Material resources X7; Information resources X8.</td></tr>
<tr><td>Image factors</td><td>Development opportunities X9; Social image X10.</td></tr>
<tr><td rowspan="2">Collaboration mechanism</td><td>Environmental factors</td><td>Geographical factors X11; Policy factors X12; Industry characteristics X13.</td></tr>
<tr><td>Cooperative factors</td><td>Organizational openness X14; Power and responsibility structure of collaborating organizations X15; Collaborative goals X16; Collaboration cycle X17; Collaboration effectiveness X18.</td></tr>
</table>

The questionnaire utilized a five-point Likert scale and was developed into a formal version after modifications based on a small-scale pilot test. The reliability of the questionnaire was estimated using Cronbach's alpha coefficient, with an overall α value of approximately 0.732 for both the questionnaire as a whole and the individual evaluation dimensions, indicating good internal consistency. Factor analysis was conducted on the indicators of each dimension, with a KMO value exceeding 0.8. The positive and significant correlations among the factors indicate the questionnaire's statistical significance.

3. DATA PROCESSING AND ANALYSIS

3.1 Fit Test and Results of the Theoretical Model

Analysis and modification were conducted on factors such as target, resource, organizational image, environmental factors, and cooperation. The standardized factor loadings of all dimensions were above 0.68 with significant p-values. The reliability of the structure was above 0.8, and the average variance extracted (AVE) was above 0.5, meeting the relevant standards. Each dimension demonstrated convergent validity. Structural equation modeling was applied to test the fit between the observed data and the hypothesized model, using LISREL 8.7 statistical software for analysis. The fit between the theoretical model and the observed data is presented in Table 3.

Table 3: Common Indices and Criteria for Assessing the Fit of the Theoretical Model Pathways

Fitting index	Test results			The ideal value for goodness of fit	Model adequacy assessment		
	Participation mechanism	Collaboration mechanism	Overall results		Participation mechanism	Collaboration mechanism	Overall results
$\chi2$/df	3.52	3.20	3.57	2-5	Ideal	Ideal	Ideal
RMSEA	0.097	0.092	0.097	<0.10	Ideal	Ideal	Ideal
CFI	0.97	0.97	0.97	0-1	Ideal	Ideal	Ideal
RMR	0.035	0.033	0.046	<0.10	Comparatively ideal	Comparatively ideal	Comparatively ideal
GFI	0.86	0.87	0.65	0-1	Ideal	Ideal	Ideal
AGFI	0.82	0.81	0.60	0-1	Ideal	Ideal	Comparatively ideal

The data indicate that the influencing factors for integration and coordination primarily include two aspects: "participation mechanisms" and "cooperation mechanisms." The influencing factors of the "participation mechanisms" include target factors, resource factors, and organizational image. The influencing factors of the "cooperation mechanisms" for integration and coordination include environmental factors and cooperative factors. The data models for the above factors show a high degree of fit with the observed data.

3.2 Path Analysis of Factors Influencing Integration and Coordination

The path coefficients and relationships between various influencing factors of integration and coordination among school education, corporate practice, and innovation networks are shown in Figure 2.

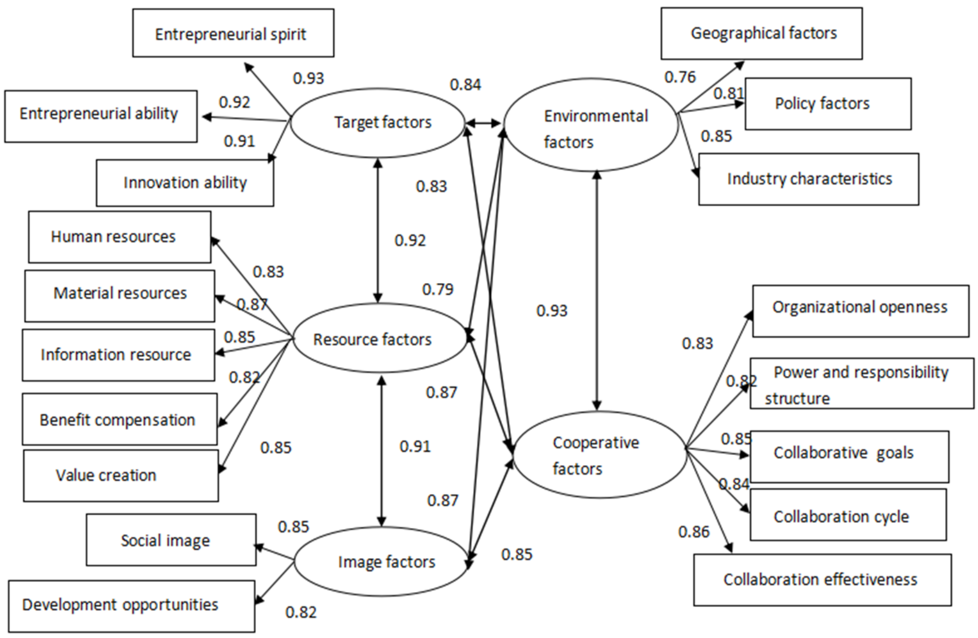

Figure 2: Structural Equation Model Path Diagram of Influencing Factors in Multi-Actor Synergistic Mechanisms

In the "participation mechanisms" of integration and coordination, the "target factors" have the most significant influence, followed by the "resource factors" and "image factors." In the "cooperation mechanisms" of integration and coordination, the "cooperative factors" have the most significant impact, and the "environmental factors" play a positive role in promoting cooperative performance. There is an interactive relationship between the "participation mechanisms" and "cooperation mechanisms" that affects the multi-party integration of collaborative training for entrepreneurial talents. The "organizational image factors" have a significant impact on the "environmental factors," while the "resource factors" have a significant influence on the "cooperative factors." The "target factors," "organizational image factors," and "cooperative factors" mutually influence each other.

3.3 Hierarchical Relationship Analysis of Factors Influencing Integration and Coordination

To explore the mechanisms of multi-party integration in the cultivation of entrepreneurial talents in vocational colleges, it is essential not only to identify key influencing factors but also to clarify the logical relationships among these factors. Therefore, hierarchical regression analysis was further employed to analyze the logical relationships among various influencing factors. Based on the results of the path analysis, the participation mechanism acts as a "third variable" affecting the cooperative mechanism and the effectiveness of cultivating entrepreneurial talents in vocational colleges. Considering that the "target factors" serve as both the driving force for collaborative education among different stakeholders and an important criterion for evaluating cooperative performance, they incentivize stakeholders to continue participating in the next stage of cooperation. Therefore, this study focuses on examining the mediating role of "image factors" and "resource factors," and the regression results are presented in Table 4.

Model 2 and Model 3 respectively indicate that "environmental factors" and "cooperative factors" have a significant positive impact on the collaborative educational outcomes of multiple stakeholders. Model 4 and Model 5 represent partial mediation models with "image factors" and "resource factors" as mediating variables, indicating that "environmental factors" and "cooperative factors" can directly influence the collaborative educational outcomes of multiple stakeholders and can also indirectly affect the outcomes through "image factors" or "resource factors".

Table 4 : Hierarchical Relationship Regression Results of Factors Influencing Integration and Coordination

Dependent variable		Cultivation of innovative and entrepreneurial talents in vocational colleges				
		Model 1（M1）	Model 2（M2）	Model 3（M3）	Model 4（M 4）	Model 5（M 5）
Control variables	Professional category	0.033	0.047	0.038	0.042	0.061
	Educational background	0.007	0.030	0.043	0.052	0.073
	Vocational type	0.090	0.091	0.097	0.073	0.075
	Age	0.080	0.090	0.081	0.074	0.075
Independent variable	Environmental factors		0.156**	0.203**	0.319**	0.212**
	Cooperative factors			0.324***	0.302***	0.396***
Intermediate variable	Image factors				0.363***	0.375***
	Resource factors					0.322**
R2 value		0.071	0.192	0.231	0.166	0.226
R2 value		0.024	0.186	0.152	0.023	0.135

Note: *** indicates significance at the 0.001 level, ** indicates significance at the 0.01 level.

Through regression analysis, it can be observed that "environmental factors" and "cooperative factors" have a significant positive impact on the effectiveness of school-enterprise cooperation in fostering talents. This indicates that within a certain region, the more vocational colleges, enterprises, research institutes, and innovation organizations there are, or the greater the policy support for collaborative cultivation of innovative and entrepreneurial talents, the more evident the promotion of industry-education integration becomes. This is because the provision of institutional support and reforms can effectively mobilize the enthusiasm of various stakeholders, serving as a sustained driving force for diversified innovative and entrepreneurial activities. However, the long cooperation cycles and difficulties in evaluating cooperative performance can be addressed by increasing the openness of all parties involved and further clarifying the responsibilities and rights of cooperative organizations. "Openness" also serves as an important starting point for alleviating the challenges of resource demands and high requirements in the process of cultivating entrepreneurial talents in vocational colleges. Furthermore, "resource factors" exhibit strong mediating effects, while "image factors" play a partial mediating role. This implies that the cultivation of innovative and entrepreneurial talents requires higher resource demands, necessitating the integration and utilization of advantageous resources from various parties to compensate for their respective deficiencies. However, in reality, there are certain barriers among government, educational institutions, industry, and enterprises, hindering the efficient flow of resources between them. Moreover, resources within each stakeholder are relatively dispersed and require further optimization for enhanced efficiency. The partial mediating effect of "image factors" suggests that entities with a positive social image and reputation are more likely to be recognized and chosen by other willing collaborators, thereby increasing the likelihood of communication and cooperation among them. Additionally, a positive image can attract more outstanding students to participate in entrepreneurial activities, further promoting the integration of professional education and innovative entrepreneurial education intentions.

4. CONCLUSION

In the new era, the cultivation of innovative and entrepreneurial talents in vocational colleges requires the integration and utilization of advantageous resources from various parties. It should be based on industrial logic, relying on the "big ship strategy," and integrating into the innovation chain and industry chain to achieve the integration of talent, education, science and technology, and other resource elements. This involves breaking the constraints of the existing institutional mechanisms and mindset on diversified and shared development. It is important to leverage the resources and research advantages of participating entities, further clarify the roles and responsibilities of different stakeholders in the process of cultivating innovative and entrepreneurial talents and establish division of labor and cooperative relationships based on integration among the stakeholders. From the perspectives of mutual benefit and commonality, it is necessary to establish a core mechanism for sharing interests among the government, schools, industries, and enterprises. This mechanism should be built on the foundation of integration and form a new relationship between school education, enterprise practice, and innovation networks. It should also innovate talent cultivation models and cooperative organizational forms, ensuring the consistency between the interests of all parties and the contribution rate, and fostering a virtuous cycle of integration and coordination in the chain. Overall, the aim is to integrate and leverage the strengths and resources of various stakeholders, establish a cooperative framework based on integration, and create a harmonious and mutually beneficial ecosystem for the cultivation of innovative and entrepreneurial talents in vocational colleges.

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