

Empirical Research on the Synergistic Innovation Pattern of Vocational Colleges from the Perspective of Stakeholders

Xin Lei

Dept. of Economy & Trade, Hunan Vocational College of Commerce, Changsha 410205, China
 Xinlei_hncs@126.com

As a novel organization pattern, synergistic innovation is applied to the systematic and mechanic innovation in talent training of vocational colleges. Despite conflicts in the connection between involving parties, such pattern can help form win-win positive interactions between stakeholders, and finally facilitate a better integration between school resources and outside innovation power.

1. Introduction

'Synergistic Innovation' refers to the effective convergence of innovative resources and elements, through the breakthrough of the barriers between the main body of innovation, and fully release the vitality of innovation factors such as talent, capital, information, technology and other innovative elements to achieve in-depth cooperation..

To implement synergistic innovation, vocational colleges are required to take educational system and organization innovation as pathways, make full use of specialized characteristic and advantageous resources, and help all stakeholders play a full role in talent training, knowledge formation and achievements transformation. As a result, the win-win positive interaction among many sides will possibly take shape.

As a rising organization pattern, there is instability fixed in itself and unavoidable conflicts in the connection process. By selecting appropriate partners to cooperate with, colleges can not only cut off unnecessary input and loss to save expenditure greatly, but also facilitate an organic integration between inner resources and outside innovation power, and promote systematic and mechanic innovation of talent training in vocational colleges.

Collaborative innovation' is the logic origin of the cooperation between enterprise and vocational colleges as well as an important mode of the college's innovation ability. The cooperation could realize the synergy of innovation subject and the synergy of goal and method, thus powerfully improve the innovation of the vocational colleges' personnel training mode. The developing quality of vocational education is effected by the result of the cooperation between enterprise and colleges directly. Nowadays, the cooperation remain problems such as the monolithic form and the shallow degree of the levels. As the representation of industry and the enterprise, and one of the stakeholder of vocational education, the industry association have the function of coordination and service, which can make up the shorts occurred in the direct-joint of college and enterprise, and should moreover participate in the process of the cooperation. As we all know, the developing of the industry enterprise is result from the support of the excellent industrial talents. The vocational colleges should embrace the demand for talents in the new era in social and industrial development and provide environment that be beneficial to the training of talents. On this account, to attract and concentrate more elite talents and leaders. As for the partner with relevant experience, they can come up with useful experience for personnel training, provide actual platform for theoretical talents and build the mutual-beneficial system, thus realize the visualized win-win.

2. Synergistic innovation pattern in vocational colleges

Currently, as the representative of industries and enterprises, and as one of the stakeholders in vocational education, the Industry Association which performs coordination and service functions in school-enterprise

cooperation can compensate disadvantages in direct connection between colleges and enterprises. Thus, it is of higher necessity for the Industry Association to participate in school-enterprise cooperation.

“Synergistic Innovation” is not only a logical starting point in school-enterprise cooperation for vocational colleges, but also a significant innovative power pattern of vocational colleges. The synergistic innovation pattern in vocational colleges in this paper refers to a synergistic innovation that involves colleges, enterprises and industries in vocational colleges. It is well-known that industries and enterprises develop from underpinned prominent industrial talents. Years of our practice has proved that the school-enterprise cooperation synergistic innovation pattern with the participation of the Industry Association begins to take shape, and its certain effects have been obtained.

3. Data models

By analyzing the impact on interaction between relative indexes in the synergistic innovation system in school-enterprise cooperation, and with the use of dynamic grey relational degree analysis (Γ_i), the paper obtains the association coefficient among various indexes, and sets up a synergistic innovation development model of school-enterprise cooperation. This model aims at validate the feasibility and popularization potential of synergistic innovation pattern in school-enterprise cooperation.

Assuming that $C_i(K)$ is the synergistic degree among various indexes, namely the impact of other indexes in the system on index i , then:

$$C_i(K) = \frac{b_i(K)}{\sum_{i=1}^n b_i(K)} \quad (1)$$

Where:

$$b_i(K) = \beta_i S_i(k) \quad (2)$$

$$S_i(K) = \frac{U_i(K)}{\sum_{i=1}^n U_i(K)} \quad (3)$$

$b_i(k)$ refers to the overall impact among various indexes in the index system, and $s_i(k)$ is the result from standardizing $u_i(k)$. The paper uses the associated degree among various indexes to indicate the relation-

value coefficients among various indexes, meaning that $\beta_i = \Gamma_i$.

calculate the maturity of comprehensive synergistic development

Define $D(k)$ as the maturity of synergistic development among various indexes, then:

$$D(K) = \sum_{i=1}^n C_i(K) U_i(K) \quad (4)$$

There are interconnection and interaction among the aforementioned association degree, synergistic degree of development, and maturity of comprehensive synergistic development respectively among various indexes of synergistic innovation development in school-enterprise cooperation. All of them can well reflect the state and level of the development degree of synergistic innovation in school-enterprise cooperation.

4. Empirical analysis

4.1 Construction of evaluation index system of synergistic innovation development in school-enterprise cooperation

Colleges and enterprises collaborate to integrate resources that each of them possesses and make use of its advantage for the purpose of achieving synergistic development in school-enterprise cooperation. However, some problems have aroused out of years of development. The up rise of synergistic innovation pattern in school-enterprise cooperation has indeed brought vitality to colleges and enterprises. By utilising specific data, the paper aims at analyzing and validating many advantages of synergistic innovation pattern rather than of traditional school-enterprise cooperation pattern. Also, the paper predicts and analyzes some detailed issues worthy of attention to maintaining positive development of synergistic innovation pattern. According to years of rich experience in implementing synergistic innovation in my school, and my own researches on school-

enterprise cooperation theory, it can be concluded that the main indexes impacting the development and evaluation of synergistic innovation pattern in school-enterprise cooperation include that of the college level, the enterprise level and the industry level.

On the basis of principles such as systematisms, feasibility and accessibility to data, and combining with practical situations in the process of school-enterprise cooperation, the paper uses the time dimension of nearly five years as a benchmark in gaining the secondary index system of developing the synergistic innovation pattern in school-enterprise cooperation, which is as follows:

the school level: growth rate of college enrollment, talent training input for school-enterprise cooperation, cover rate of talent training in school-enterprise cooperation, matching rate between majors and posts for students in school-enterprise cooperation, and vocational loyalty degree for students in school-enterprise cooperation.

The enterprise level: main business (revenue), talent training input, net profit growth rate, employee turnover rate, and promotion rate of entrepreneurial reputation.

The industry level: economic development level, development rate, growth rate of government input (expenditure), financed amount, and growth rate of talent training.

Table 1: Development and evaluation index system of synergistic innovation in school-enterprise cooperation

First grade index	Second grade index	Characters of index
College level	talent training input in school-enterprise cooperation in recent five years (X1)	Positive
	growth rate of college enrollment in recent five years (X2)	Positive
	cover rate of talent training in school-enterprise cooperation in recent five years (X3)	Positive
	matching rate between major and post for students in school-enterprise cooperation in recent five years (X4)	Positive
	vocational loyalty degree for students in school-enterprise cooperation in recent five years (X5)	Positive
Enterprise level	main business (revenue) in recent five years (X6)	Positive
	talents training input in recent five years (X7)	Positive
	net profit growth rate in recent five years (X8)	Positive
	intern and employee turnover rate in recent five years (X9)	Negative
Industry level	economic development level (industry GDP) in recent five years (X11)	Positive

4.2 Data process and results analysis

The sample data testified empirically in the paper is drawn from HNSW Vocational College, ten sample enterprises that collaborate with it (which continue to carry out school-enterprise cooperation activities during the research period), and the Industry Association. Among the data, the school-level research-targeted students are those that are classified largely in finance and economics from the class of 2008 to 2012. They cover six majors with the total number of 11,580. The trace period of each student is five years, the first three years among which is for studying at school, and the last two years serves for vocational purpose. The

vocational-period data is obtained from students who regularly fill in charts of graduates' job information. The obtainment rate is 83%. Enterprise-level data is the average value of ten sample enterprises, all of which are middle-scale or above. They range from wholesale corporations with 20 million RMB or above of annual sales to retail corporations with 5 million RMB or above of annual sales. The sample enterprises mainly undertake commercial and trade operations (e-commerce internet corporations are included). They are all under development with higher needs of talents. 85% of such enterprises own eight-year-or-above experience in school-enterprise innovation. There are four samples in the industry level from e-commerce association, chain operation association, marketing sales association to logistics and purchases league. The period of data collection is from 2010 to 2014.

First, with the use of DPS8.5 data processing system, the paper carries on grey relational degree analysis after the standardized processing on development indexes of synergistic innovation in school-enterprise cooperation. The result is shown in Table 2 as follows:

Table 2: The value of association degree of synergistic development in school-enterprise cooperation

index	association degree	index	association degree
X1	0.848	X9	0.853
X2	0.736	X10	0.582
X3	1.106	X11	0.780
X4	0.422	X12	0.814
X5	0.314	X13	0.963
X6	0.524	X14	0.674
X7	0.826	X15	0.871
X8	0.514		

Where the average association degrees of the first grade indexes are respectively: the college level: 0.685; the enterprise level: 0.657; and the industry level: 0.820. Based on equation (1), (2), (3) and (4), the synergistic degree and development degree of various indexes are calculated, whose results is seen in Table 3 as follows:

Table 3: The association degree of synergistic development in school-enterprise cooperation

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	D(K)
2010	0.70	0.49	0.20	0.01	0.18	0.08	0.20	0.08	0.02	0.31	0.41	0.36	0.05	0.12	0.04	6.45
2011	0.84	0.48	0.39	0.09	0.02	0.01	0.19	0.15	0.08	0.37	0.48	0.48	0.19	0.09	0.10	9.49
2012	0.86	0.53	0.79	0.43	0.19	0.28	0.30	0.28	0.06	0.46	0.62	0.55	0.32	0.43	0.28	10.18
2013	0.91	0.58	0.82	0.64	0.18	0.31	0.41	0.36	0.01	0.69	0.87	0.68	0.58	0.54	0.31	11.39
2014	0.95	0.62	0.91	0.76	0.21	0.35	0.45	0.39	0.12	0.78	0.90	0.79	0.65	0.69	0.45	12.63
The average value of synergistic degree	0.85	0.54	0.62	0.40	0.20	0.21	0.31	0.24	0.08	0.44	0.66	0.53	0.36	0.37	0.24	---

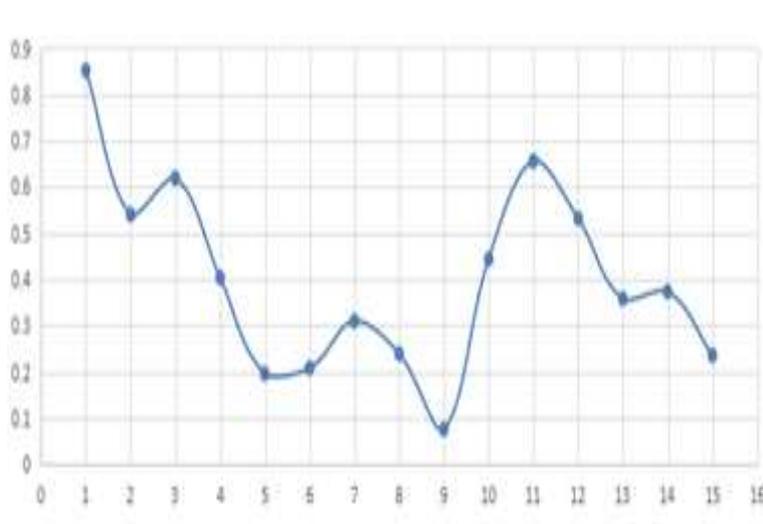


Figure 1: The development synergy degree of each index

According to calculation results in Table 2, Table 3 and Figure 1, and conclusion is drawn as follows:

(1) The industrial factor in synergistic innovation development pattern in school-enterprise cooperation is the main impact on the development of synergistic degree.

From values among the grey association degrees of various indexes, it can be obtained that among the subsystem index size of association degree of synergistic innovation development in school-enterprise cooperation, the industry-level subsystem index ranks first, with an average association degree of 0.820, which is far bigger than the school-level subsystem index of 0.685 and the enterprise-level subsystem index of 0.657. Such results show that the involvement of the Industry Association plays an important role in synergistic development in school-enterprise cooperation. Therefore, the measure to enhance the industrial involvement in school-enterprise cooperation, which can also be called as synergistic innovation development pattern in school-enterprise cooperation, is the main work in promoting school-enterprise synergistic development.

(2) Although the school-enterprise cooperation is all the way maintaining continuous positive development, its degree of synergistic development is low, and is also much lower than the maturity degree of development.

As is seen in Chart 3, in recent years, especially since 2010, the maturity degree of synergistic development in school-enterprise cooperation has been kept in a higher level, and has a tendency to increase constantly. The maturity degrees of synergy (from since 2010) are 9.49, 10.18, 11.39, and 12.63, respectively. This shows that the synergistic development in school-enterprise cooperation gradually matures in a persistently positive way. However, it is not exactly so from the perspective of the synergistic development degree of various subsystem indexes. It is shown in Diagram 1 that the maturity degree of school-level subsystem development is higher. However, this phenomenon is closely related to years of school-enterprise cooperation in vocational schools. Another reason lies in the development of industrial economic level that provides new opportunities for developing school-enterprise cooperation. Under such better situation, it is worthy of reflection on the reason why it lacks good follow-ups of government input funds (which is used in school-enterprise cooperation construction).

(3) Students' loyalty degree to enterprises during the process of school-enterprise cooperation has become the primary bottleneck in synergistic development in school-enterprise cooperation

School-enterprise cooperation cannot develop without students. As seen in Chart 3, the two indexes of students' loyalty and corporate employee turnover rate have the lowest synergistic degree of 0.196 and 0.076, respectively. Also, its growth rate is low. As colleges, enterprises, and even industries work together to initiate school-enterprise cooperation, it is the hope of colleges to help more students find suitable jobs by such pattern, and the hope of enterprises to recruit suitable employees. However, as seen from this data, students don't adopt a cooperative attitude in most cases. Such low synergistic degree of two indexes of students' loyalty to posts and employee turnover rate in corporations also warn us of the unavoidable cultivation and training in students' vocational planning and professional attainment during the process of vocational education.

5. Conclusions

School enterprise cooperation is an important way to innovate and create the characteristics of higher vocational colleges. The current, There are some problems existing in the school-enterprise cooperation such as the cooperation form is single and the cooperation is still in a low level. The participation of the industry association is required to solve this problem. Industry association as one of of the industry enterprise representatives and vocational education stakeholders can fill in the gaps between school and enterprise.

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