

Research on the Construction of School-Enterprise Cooperation Model Based on Synergy Theory

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Abstract: In the systematic project of school-enterprise cooperation(SEC) with the synergistic cooperation of multi-subjects, the SEC model, as the overall guiding strategy, is particularly important for its scientific construction and should be included in the framework of synergy theory. Based on this, this paper investigates the construction of SEC model in vocational education under the framework of synergistic theory in order to provide a scientific construction idea for the construction of SEC model. In order to achieve this purpose, this paper introduces the concepts of supply chain and knowledge management into the SEC, analyzed the subject categories and cooperation contents of SEC from the perspective of the extension of the supply chain of SEC, and explores the subject roles and cooperative relationships of SEC from the perspective of the connotation of knowledge management of SEC, and then puts forward the idea of constructing the SEC model in vocational education. After the study, it is found that the SEC model should be constructed from the two dimensions of the lead-subject category and the subject cooperative relationship of SEC; and the construction of the model dimensions of both the dominant subject category and the subject cooperative relationship should be based on the degree of knowledge transfer-ability of SEC. The results show that SEC should be constructed independently and independently of the modes of each SEC sub-platform under the overall dominant mode of the institution, and the construction of SEC modes should effectively promote the knowledge transfer between schools and enterprises.

Keywords: School-Enterprise Cooperation; Vocational Education; Supply Chain; Knowledge Management; transfer-ability of Knowledge.

1. Introduction

The development from enterprise-led vocational training to school-led vocational education has met the skilled personnel needs of enterprises, promoted the capacity development of skilled personnel and conformed to the direction of social development. However, vocational education has also been characterized by structural contradictions between the institutional supply of skilled personnel and market demand due to the separation of schools and enterprises. Influenced by the transformation of China's economic growth mode, the transformation and upgrading of the regional economy and the transformation from old drivers to new drivers of growth, this structural contradiction tends to expand based on the relatively slow process and the difficult adjustment in personnel cultivation of colleges. This also requires that school-led vocational education needs to continuously strengthen school-enterprise cooperation(SEC), take the initiative to integrate into regional development, understand the development trends of enterprises, industries, regions, etc., and realize the industry-education integration to provide more high-quality skilled personnel for the development of enterprises and to contribute to the development of regional economies in the role of vocational education.

Although SEC is a collaborative way of educating people for the purpose of cultivating personnel needed by enterprises, there have been some problems in SEC, such as school-hot and enterprise-cold, fireplace phenomenon and idle phenomenon, due to the influence of the different organizational characteristics between the public welfare of institutional organizations and the for-profit nature of enterprise organizations. The focus of these problems centers

on the imbalance of the willingness of both schools and enterprises to participate in SEC. In order to solve the problems of SEC, government departments, scientific research institutions and students of colleges and universities have been involved to varying degrees, forming a situation of multi-principal collaborative cooperation. In the SEC, the rationalization of the SEC mode has become the first problem to be solved.

2. Theoretical Traceability

SEC is a necessary path for the development of vocational education, and it is a key link connecting institutions and enterprises, higher vocational education and regional economy[1]. Based on the important role of SEC in vocational education, scholars have conducted in-depth research on SEC from different perspectives.

From the perspective of the subject category of SEC, some scholars believed that SEC is a "double-subjects" mode of education shared by vocational colleges and enterprises, and studied the "double-subjects" school system and operation mechanism[2], the game and cooperation between the "double-subjects"[3], the transaction costs and compensation mechanism for enterprises to participate in SEC[4]. However, some scholars believed that the SEC of "double-subjects" can not fully meet the development demands of SEC, and that SEC should be a multi-subjects parenting model[5] and collaborative parenting systematic project[6], and should be based on synergistic theory of SEC to carry out research[7].

From the perspective of the content of SEC, Fu Junwei believed that SEC is a kind of transaction based on game theory, in which one party to the transaction gives benefits to other parties while receiving corresponding returns from them,

and the other parties to whom the benefits have been given are thus under pressure to reciprocate[8]; Wang Dong also believed that SEC is a kind of social exchange relationship in which each party takes what it needs and believes that the current SEC in vocational education in China is a kind of unequal[9]; Li Xiao believes that SEC is essentially a kind of enterprise system rather than an education system regarding the transfer of vocational skills and vocational knowledge[10]; Nie Wei believed that SEC is a kind of transitional form, one of the temporary forms in which vocational education returns to the true nature of the enterprise, and that it is a kind of fusion or integration of the school and the enterprise at the knowledge level based on the game of interests, and the "pendulum movement" between the two ends of the enterprise and the school. The process of "pendulum movement"[11]; Li Ni believed that SEC is essentially a kind of strategic synergy, which is the process of strategic partnership construction between SEC subjects[12]; Chu Jinhua believes that SEC is a kind of flexible enterprise organization or dynamic strategic alliance between the market and independent organizations[13].

From the perspective of the mode of SEC, Nie Jinsong and others believe that SEC not only needs to build a community of interests, but also should build a new pattern of governance of SEC [14]; Tang Jinhua believes that the SEC in vocational education should be changed from "school-driven" to "market-driven", from "point-to-point" to "face-to-face", from "rigid single" to "flexible multiple", and from "hard single" to "flexible multiple"., from "point to point" to "face to face", from "hard single" to "flexible multiple The change from "point-to-point" to "face-to-face", from "rigid single" to "flexible multiple", and the implementation of flexible cooperation mode [1]. Shi Weiping and others believe that there is a difference between SEC and industry-teaching integration, and that SEC should be transformed from SEC mode to industry-teaching integration thinking[15].

From the perspective of personnel cultivation mode, Li Jianqi believes that university- enterprise cooperation should build the personnel cultivation mode of industry-teaching fusion and on-demand cultivation[16]; Liu Chang'an and others also believe that universities with special characteristics should build the personnel cultivation mode of "demand-oriented, university-enterprise cooperation"[17]; Zhou Lijuan and others have explored the personnel cultivation mode of university-enterprise cooperation with the example of the "Nuopushin class" of the South China Agricultural University[18]; and Liu Jun has made empirical investigations and analyzed the feasibility of the change of the personnel cultivation mode of university-enterprise cooperation of vocational education under the background of the "Internet Plus" [19].

To summarize, various scholars have conducted a lot of research on SEC mode and personnel cultivation mode, which provides valuable reference for this study, but the methodology of how to scientifically construct the SEC mode has not yet been studied in depth. The collaborative innovation model is the overall guiding strategy for all scientific research activities in collaborative innovation[20]. In the SEC of multi-body collaborative cooperation, the model of SEC needs to be solved first. From the perspective of vocational education supply chain and based on the theory of synergy, this study investigates the categories of subjects involved in SEC, the content and characteristics of cooperation, and the construction of the cooperation model.

3. Supply Chain of Sec

The purpose of SEC model construction is to promote the development of SEC content by the subjects of SEC, so the construction of the model type should depend on the type of the subjects of SEC and the content of cooperation. Since SEC is the link between institutions and enterprises, vocational education and regional economy, the analysis of the subject category and content of SEC should be carried out from the perspective of the whole process of the supply chain of SEC in vocational education. SEC in vocational education not only directly affects the development of enterprises in the region, but also indirectly affects the industrial development and economic development of the region. In the supply chain of SEC in vocational education, SEC is formed when the behaviors of institutions and enterprises, industries, and governments are intertwined to different degrees, as shown in Fig. 1.

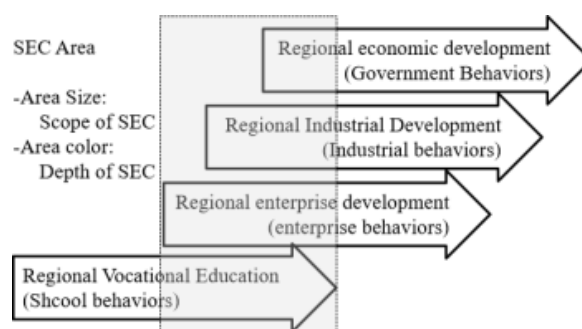


Figure 1. Supply Chain Diagram of SEC

In Fig. 1, the gray part represents the area of SEC, the area size represents the scope of SEC, and the area color represents the depth of SEC, both of which together constitute the horizontal dimension of SEC. SEC, as a way of nurturing vocational education to serve regional enterprises, industries and economy, affects the vocational education of the institutions and the regional enterprises, industries and economic development. Therefore, the subject categories of SEC should include the subject categories of institutions, enterprises, industries and governments, among which institutions and enterprises constitute the main subjects of SEC.

The supply chain necessarily involves three major processes, and so does the supply chain of vocational education and SEC. In the vocational education supply chain, the product flow mainly refers to the flow of students, which is a single top-down process from institutions to regional development; the information flow mainly refers to the flow of knowledge and information, which is a top-down process of vocational education knowledge flowing from institutions to regional development and a bottom-up process of knowledge and information on regional development flowing from the region to institutions. It is a two-way flow that combines the knowledge of vocational education flowing from institutions to regional development and the knowledge information of regional development flowing from regions to institutions in a bottom-up process; the financial flow mainly refers to the single bottom-up process of education funds flowing from governments to institutions in the form of taxes feeding back to education. The three processes of the vocational education supply chain play different roles in the nurturing process of vocational education and affect SEC to

different degrees.

Firstly, as a special product in the product flow of SEC supply chain, "student", unlike general commodities, is a "person" with subjective thinking, judgment and feelings. Therefore, all the work of SEC should be centered on the special product of "students", and the degree of students' participation in SEC affects the level of SEC, as well as the functioning of all the policies and measures related to SEC. Therefore, SEC cannot ignore the important subject of "students". The subject category of SEC should include institutions, teachers, enterprises, industries, government, students and other subjects, forming an all-round synergistic cooperation process among government, industry, academia, research and utilization. "Government" represents the government, including the central government and local governments; "production" includes both enterprises and industries; "learning" represents both institutions and teachers; "Research" represents the scientific research subjects related to university-enterprise cooperation; "Use" represents the users, and it should be especially pointed out here that the users are not the employing enterprises as we usually understand, but should be identified as the students, that is to say, all the policies and measures of university-enterprise cooperation need to be effectively applied to the students. That is to say, all policies and measures of SEC need to be effectively applied to students. Only by comprehensively improving the quality and ability of students can students become high-quality skilled personnel who can really meet the needs of the market, and then fundamentally solve many problems in SEC.

Secondly, as the information flow of the SEC supply chain, the main role of the knowledge and information flow is to realize the SEC supply chain to produce students who can meet the market demand. SEC, as an important cooperation platform between vocational education and regional economic development, improves the level of vocational education by integrating the knowledge information of the institutions and the knowledge information of regional development, and cultivates high-quality skilled personnel who can really meet the needs of enterprises. Therefore, this study believes that SEC is a process of knowledge information management for the purpose of educating people, and its central work should be centered on the "effective integration of institutional knowledge with enterprise knowledge and industrial knowledge".

Thirdly, as a financial flow in the supply chain of vocational education, the financial flow of education is a way for government departments to feed back into vocational education in the form of taxes. By investing in vocational education, government departments can, on the one hand, improve the educational and practical training facilities of institutions, and promote the level of teachers' education, ability and scientific research, so as to enhance the level of SEC from the institutions' end; on the other hand, they can also improve the imbalance of inputs and outputs in the SEC of enterprises by means of tax relief, government subsidies and other methods, so as to enhance the level of SEC from the market's end.

To summarize, SEC is a knowledge management process for the purpose of educating people in which multiple subjects such as government, industry, academia, research and utilization work together, and each subject plays a different role in the process of SEC. As most of the prior research on SEC ignores the important subject of "students", the central

work of SEC is not well understood, and it mainly starts from the external measures such as governmental behavior, enterprise behavior, institutional behavior, teachers' behavior, scientific research activities, etc., which is not conducive to solving the problem of uneven willingness of SEC at the root of the problem.

4. Construction of Sec Model Type

As mentioned earlier, the real purpose of the construction of the SEC model is to effectively promote the SEC content of the main body of SEC, so the construction of model types depends on the subject categories and content of SEC.

4.1. Test of grinding fineness

In the process of SEC with the participation of multiple subjects, no matter how the form of cooperative cooperation is, the establishment of the leading subject is particularly important, which is the guarantee for the formulation of policies, the acquisition of resources, the construction of the software and hardware environment, and the effective operation of the whole.

In the process of SEC, due to the different degrees of transfer-ability of knowledge information, the two parties of the university-enterprise as the main subject, especially the enterprise side, have different degrees of knowledge of different categories of knowledge information management, resulting in different roles played by the university-enterprise in the process of different categories of knowledge information management [13], as shown in Fig. 2.

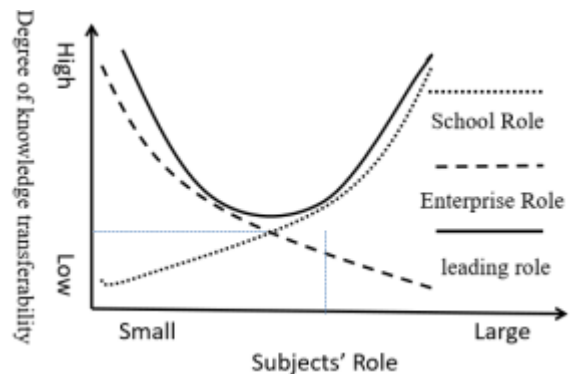


Figure 2. Subjects' Role Trends of SEC Based on Knowledge transfer-ability Degree

In Fig. 2, based on the degree of transfer-ability of knowledge, the roles played by the university and the enterprise in different categories of knowledge management process are different, and the trend of the roles of the university and the enterprise is shown in Fig 2; from the trend of the two roles, the university and the enterprise play the role of the dominant main body in the process of different categories of knowledge and information management, respectively. The higher the degree of knowledge transfer-ability, the more prominent the dominant role of the institution; the lower the degree of knowledge transfer-ability, the more prominent the dominant role of the enterprise should be. The trend of the role of the leading body is similar to a "U" curve, which makes the SEC do a "pendulum movement" back and forth between the two endpoints of the school and the enterprise. Since the curves of the role of institutions and the role of enterprises cross at one point, there are relatively few categories of two-principle dominance and more categories of single-principle dominance in university-

enterprise cooperation.

4.2. Relationships between content and subjects' Closeness of SEC

From the perspective of cooperation willingness of university and enterprise, as mentioned before, in university-enterprise cooperation, from the perspective of enterprise's standpoint, the higher the degree of transfer-ability of knowledge information, the lower the willingness of enterprise to participate in university-enterprise cooperation; the lower the degree of transfer-ability of knowledge information, the higher the willingness of enterprise to participate in university-enterprise cooperation; whereas the willingness to participate in university-enterprise cooperation of one side of the university is relatively high and stable. Therefore, the lower the degree of transfer-ability of knowledge information is, the higher the willingness of

university-enterprise cooperation is and the more conducive it is to build a closer cooperative relationship; the higher the degree of transfer-ability of knowledge information is, the more inconsistent the willingness of university-enterprise cooperation is and the more difficult it is to build a closer cooperative relationship.

From the perspective of different categories of knowledge generation, the higher the degree of transfer-ability of knowledge information, the wider the scope of applicable industries, the wider the scope of access required for knowledge information generation, and the lower the degree of direct utilization of knowledge information; and the lower the degree of transfer-ability of knowledge information, the smaller the scope of applicable industries, the smaller the scope of access required for knowledge information generation, and the higher the degree of direct utilization of knowledge information, as shown in Table 1.

Table 1. Scope of application and generation of knowledge

Features Categories	Scope of application	Degree of transfer-ability	Degree of accessibility	Degree of utilization
Knowledge of general skills	Multi-Industry	High	High	Low
Knowledge of transferable skills	Single Industry	Middle	Middle	Middle
Knowledge of non-transferable skills	Single Enterprise	Low	Low	High

According to the strength of the relationship, social network relationships can be categorized into weak and strong relationships, and through the efforts of various scholars, weak relationship theory[21] and strong relationship theory[22] were formed. Although weak and strong relationship theories were initially studied in terms of interpersonal relationships, as the research progressed, weak and strong relationship theories were also applied to the relationships between individuals and organizations and between organizations. A weak relationship is a brief social contact between two actors[21], has an extensive[23], heterogeneous[24], inter-mediated[25], and unstructured[21] characters, and a weak relationship is more capable than a strong relationship of acting as a bridge across its social boundaries to access information and other resources, exposing people to different social circles, and allowing them to reach out to a wider range of people across a greater social distance[21]; a strong Relationships are social relationships between two actors established through long-term cooperation; strong relationships have longevity[22], stability[26], mediation[27], and high creditworthiness[28], and are an important source of information that can be directly utilized[29].

Therefore, the higher the degree of knowledge transfer-ability, the more the relationship between school and

enterprise is adapted to the weak relationship theory; the lower the degree of knowledge transfer-ability, the more the relationship between school and enterprise is adapted to the strong relationship theory.

4.3. Construction of SEC model types

As the overall guiding strategy of SEC, the correct selection of the model type is particularly important in the process of multi-principal cooperative cooperation, which should not only grasp the essence of the content of SEC, but also be conducive to the development of the content of cooperation between the school and enterprise sides. This study advocates that the selection of the type of SEC model needs to be comprehensively analyzed from the overall perspective of the SEC supply chain and the local perspective of different types of SEC.

Firstly, from the overall perspective of the vocational education supply chain, since SEC is a collaborative and cooperative system project involving multiple subjects from government, industry, academia, research and utilization, the position and role of each subject in the vocational education supply chain together constitute the personnel cultivation process of the vocational education supply chain, as shown in Fig. 3.

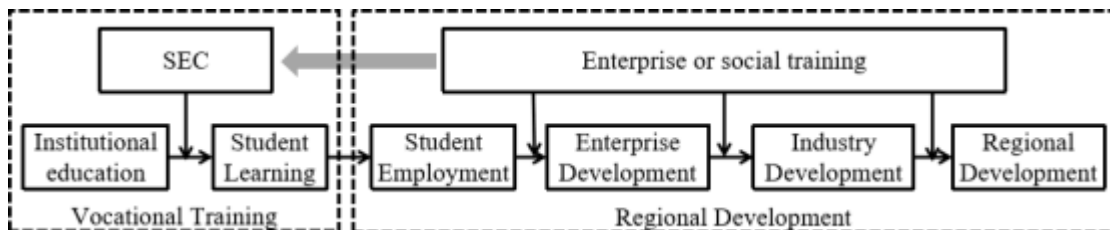


Figure 3. Personnel cultivation process of SEC supply chain

In Fig. 3, SEC refers to a way of educating people by incorporating enterprise or social training for employees in the process of regional development into the process of

institutional vocational education. And from the perspective of the development of vocational education, because the enterprise or social skills training can not adapt to the

enterprise, industry and economic development of the demand for personnel, and then the enterprise and social skills training combined with higher education evolved into the current institutions of vocational education; institutions of vocational education in the past, present and even the future for a long period of time in the training of skilled personnel will still play a major role in the cultivation of personnel. Therefore, the essence of SEC is a way of educating people adopted by vocational education to adapt to social development. Whether government-run schools, enterprise-run schools or vocational education group-run schools, vocational education needs to respect the law of development of personnel can not be separated from the public welfare of vocational education, need to adopt the overall dominant mode of institutions, SEC is no exception. The institution-led model is the overall guiding strategy for SEC.

Secondly, analyzing from the local perspective of different types of SEC, in the SEC with knowledge information management as the main content of cooperation, based on the

degree of transfer-ability of knowledge information, the categories of knowledge information are different and the specific platforms of SEC are different; on the contrary, the specific platforms of SEC are different, and the categories of knowledge information are different with different degrees of transfer-ability. And the degree of transfer-ability of knowledge information determines the dominant role of school-enterprise parties and the closeness of the cooperative relationship. Therefore, different types of SEC platforms should choose different specific model types, and the specific model type dimension of SEC platforms consists of the dominant role of school and enterprise parties and the closeness of the cooperative relationship.

To summarize, in the SEC with multi-body synergy, in view of the nature and category of the content of SEC, this study believes that the SEC should adopt the type of multi-platform classification model under the overall dominant model of vocational colleges and universities as shown in Fig. 4.

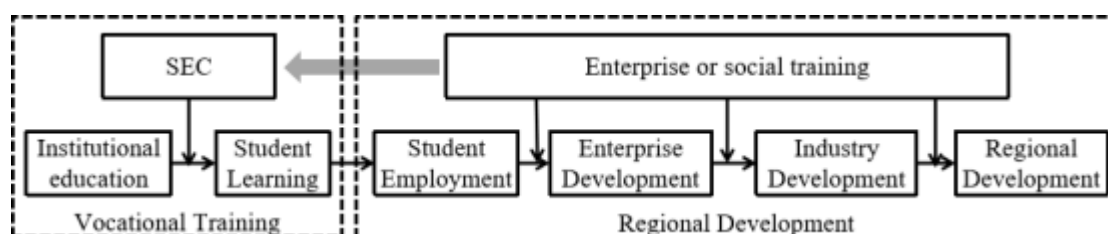


Figure 4. Model construction of SEC

5. Conclusion

This study investigates the supply chain and model construction of SEC from the perspective of the supply chain of VET SEC, and the conclusions of the study are shown below.

First of all, SEC, as a systematic project with the synergy of government, industry, academia, research and utilization, is a supply chain that promotes the development of enterprises, industries and regional economy by educating people. In the supply chain of vocational education SEC, the product flow mainly refers to the student flow, the information flow mainly refers to the knowledge flow between schools and enterprises, and the capital flow mainly refers to the education capital flow; each process plays different roles in the process of SEC, and constitutes the cooperative content of SEC.

Secondly, SEC should adopt the multi-platform model construction method under the overall domination of institutions. Based on the nurturing nature of SEC, VET SEC should follow the general law of nurturing and adhere to the overall dominant mode of the institution; based on the diversity of sub-platforms for SEC, sub-platforms can be constructed based on the different degrees of knowledge transfer-ability of different knowledge categories, and the dimensions of the construction of the mode types should be constituted by the dominant roles of the school and the enterprise and the closeness of the relationship between the two sides.

Thirdly, SEC should be handled correctly according to the degree of transfer-ability of knowledge categories. The higher the degree of knowledge transfer-ability, the more the relationship between school-enterprise parties is adapted to the weak relationship theory; the lower the degree of

knowledge transfer-ability, the more the relationship between school-enterprise parties is adapted to the strong relationship theory. The construction and maintenance of the cooperative relationship between school-enterprise parties should correctly deal with the roles of internal and external factors of SEC, with internal factors referring to the degree of transfer-ability of knowledge categories, and external factors referring to the relevant policies and measures of SEC.

This study mainly explores the model construction of SEC from a theoretical perspective, and the shortcoming of the study is the lack of necessary data support, which also constitutes a future research direction. In the future, we will empirically validate the model construction method proposed this time through the questionnaire research on students, teachers and enterprises.

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