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Research on the Construction of Blockchain Enabling Industry and Education Fusion Symbiosis in Higher Vocational Colleges

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Abstract: ***The construction of the integration of industry and education in higher vocational education is the internal requirement of the deep integration of industry and education, and it is also the top priority to improve the adaptability of vocational education. In the process of the integration of industry and education in higher vocational colleges, the difficulties, such as poor coordination of symbiotic units, unideal symbiotic mode, and symbiotic environment to be improved, hinder the construction of the integration of industry and education. As a new technology of information development, blockchain provides a new tool for the construction of the integrated symbiosis of higher vocational industry and education. In order to fully tap the technical advantages of blockchain, the symbiosis theory can be the research perspective, the symbiosis unit, symbiosis mode and symbiosis environment as the foothold, and the dilemma of the integration of vocational industry and education as the logical follow, and explore the technical suitability and strategy of blockchain empowerment.***

Keywords: Symbiosis theory, Block, Integration of production and education, Higher vocational education.

1. Introduction

With the advent of the digital age, industrial development has gradually become digitalized and intelligent. The demand for talent in industrial transformation has shifted from simple skills to compound high-tech skilled talents who can adapt to the development of the digital age, have innovation capabilities and the ability to handle complex tasks. As a type of education that spans the industry and education sectors, vocational education should focus on the integration of industry and education to achieve the precise connection between the education chain, industrial chain, talent chain and innovation chain. In the new era of pursuing high-quality and connotative development of vocational education, it is necessary to promote the formation of a new development pattern of benign interaction between industry and education and complementary advantages between schools and enterprises [1]. Promoting the deep integration of industry and education in higher vocational education is a complex project involving multiple stakeholders. The construction of an industry-education integration symbiosis cannot be separated from the collaborative governance of multiple subjects. In the process of practice, there are problems such as interest games among multiple subjects, poor resource connection and unclear boundaries of rights and responsibilities, which hinder the construction of an industry-education integration symbiosis in higher vocational education. Blockchain, as a new point-to-point connection technology with great openness, security and independence, provides new ideas and new tools for solving the problem of industry-education integration in higher vocational education, and provides an internal governance drive for the digitalization and high-quality development of vocational education. Therefore, based on the inherent needs of the current development of industry and education, in order to effectively realize the docking of the "four chains" and form a new ecology of industry-education integration in higher vocational colleges with benign interaction, complementary advantages and win-win cooperation, this study takes the practical problems in the practice of industry-education integration in higher vocational colleges as the starting point, and focuses on the problems such as lack of coordination among symbiotic units, unsatisfactory symbiotic models, and the need to improve the symbiotic environment. It explores the technical advantages and appropriateness of blockchain, and seeks ways to empower the construction of a symbiotic body of industry-education integration in higher vocational colleges with blockchain.

2. The Logic of Blockchain Empowering the Construction of a Symbiotic Integration of Industry and Education in Higher Vocational Education

The integration of industry and education in higher vocational education places vocational education in the macro-social and economic context, aiming to achieve the integration and coordinated development of both sides through the mutual circulation and complementary advantages of various resource elements between industry and education. Its essence is to pursue a symbiotic relationship. "Symbiosis" was first proposed in the field of biology. In 1879, German ecologist De Berry pointed out that symbiosis is "a beneficial phenomenon generated by the interaction and interdependence of two or more organisms in life" [2]. In the middle of the 20th century, it was developed and improved by experts and scholars such as Soviet Van Minter and German Paul Buchner to form the symbiotic theory [3]. This theory takes symbiotic units, symbiotic patterns and symbiotic environments as its constituent elements, and advocates that the joint action of the three elements can effectively promote the generation and development of symbionts, and the formation of symbiotic relationships within the system is based on common interests and resource dependence. It is a symbiotic relationship formed by symbiotic units in a certain symbiotic environment according to a certain symbiotic pattern [4]. In view of this, taking the symbiosis theory as the research perspective, viewing the integration of industry and education in higher vocational colleges as a symbiotic body, and taking blockchain as the logical starting point to empower

the solution of the dilemmas in its symbiotic development, can provide new perspectives and new tools for the research on the deep integration of industry and education in higher vocational colleges.

2.1 Improving Synergy by Following the Compatibility of Symbiotic Unit Quality Parameters

The symbiotic unit is the basic unit and material condition for energy generation and exchange in the symbiotic body. The symbiotic theory believes that whether the symbiotic unit of the symbiotic body can produce a symbiotic effect depends on the compatibility of the quality parameters in the symbiotic unit. The compatibility of quality parameters is an internal factor affecting the synergy of the symbiotic unit. Therefore, in order to effectively improve the obstacles caused by the poor coordination between symbiotic units in the current process of higher vocational industry-education integration, it is urgent to clarify the dependence of multiple subjects on multiple resources in the higher vocational industry-education integration, and participate in it according to the energy level of multiple subjects themselves, promote the balance of the relationship between symbiotic units [5], and take the compatibility of quality parameters between symbiotic units as the functional follow-up of blockchain empowering the construction of higher vocational industry-education integration symbiotic bodies. In view of this, on the one hand, it is necessary to clarify the symbiotic units in the integration of industry and education in higher vocational colleges; on the other hand, it is necessary to find the multiple resource elements that form a symbiotic relationship between the symbiotic units, promote the compatibility of quality parameters and quantity between the symbiotic units, and ultimately focus on how to give full play to the technical advantages of blockchain in promoting the docking of complementary resources between symbiotic units, use blockchain to generate symbiotic energy that is conducive to the construction of symbiosis, and provide solid and strong internal energy support for the construction of symbiotic bodies integrating industry and education in higher vocational colleges.

The integration of industry and education in higher vocational education is a complex project involving multiple stakeholder groups, including industrial groups dominated by enterprises, educational groups dominated by higher vocational colleges, various government departments at all levels, industry organizations, and social media. According to Mitchell's classification of stakeholders based on the three dimensions of legitimacy, power, and urgency, stakeholder groups are divided into three types: definite, expected, and potential [6]. Higher vocational colleges, enterprises, and local governments play the most obvious role in the integration of industry and education in higher vocational education, and they belong to the definite stakeholders. In view of this, higher vocational colleges, enterprises, and local governments are the most critical symbiotic units in the symbiotic integration of industry and education in higher vocational education. As a factor that determines the inherent nature and changes of symbiotic units [7], whether there is compatibility within the symbiotic unit is the key to affecting the symbiotic relationship between the three symbiotic units of government, schools, and enterprises in the integration of industry and education in higher vocational education. The compatibility of quality parameters determines the depth and breadth of cooperation between symbiotic units. In the symbiotic integration of industry and education in higher vocational education, the common demand of symbiotic units for compound high-tech skilled talents provides a prerequisite for the compatibility of quality parameters. Among them, as the main supplier of high-skilled talent training, scientific research and development, and teachers with high theoretical level, higher vocational colleges have talent supply, technology research and development, and knowledge resources as their main quality parameters; as the primary position of manufacturing, production and practice, enterprises have advanced production equipment, strong technicians, and dynamic industrial change information as their main quality parameters; local governments are the direct executive agencies of the industry-education integration policy, and can provide a series of financial support and policy guidance for the industry-education integration of higher vocational colleges. These financial and policy resources are their main quality parameters. Based on this, the compatibility of quality parameters in the symbiotic body of industry-education integration of higher vocational colleges mainly refers to the dependence between the symbiotic units in human, material, financial, and technical resource elements, and their respective quality parameters can be expressed to each other, and there is a certain correspondence. At the same time, through the circulation and integration of quality parameters, resources between different units can be complemented, and the symbiotic energy that promotes the symbiotic body of industry-education integration of higher vocational colleges can be generated in an effective resource feedback closed loop (Figure 1). The construction of the symbiotic body of industry-education integration of higher vocational colleges is inseparable from the internal support of symbiotic energy. Therefore, it is very important that the needs of the three symbiotic units and the input and output of various resource elements can be timely and effectively connected. However, since local governments, higher vocational colleges and enterprises belong to different social organizations, there are differences in fundamental interests and social status, which leads to information resource asymmetry and game in the process of energy and resource exchange among multiple parties, resulting in the real demands of enterprises being obscured and the real situation of colleges being difficult to feedback, which hinders the actual problems of coordination. However, the consensus mechanism in the blockchain can provide a solid foundation for cooperation between symbiotic units. The openness of the blockchain and the technical characteristics of point-to-point docking provide a new method for realizing the point-to-point docking of complementary resources between symbiotic units. Therefore, we should give full play to the technical advantages of the blockchain, promote the effective docking of multiple elements between symbiotic units and the timely communication of complementary resources as a practical guide, and then generate symbiotic energy to promote the construction of a symbiotic body integrating industry and education in higher vocational colleges.

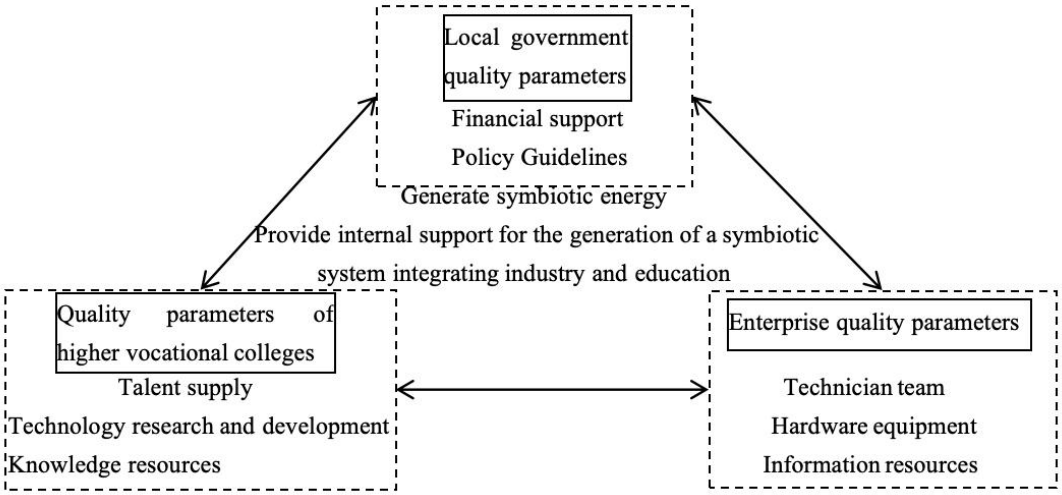

Figure 1: Quality parameter compatibility mechanism between symbiotic units

2.2 Building an Ideal Symbiotic Model with the Goal of "Integration-symmetric Reciprocity"

Symbiosis theory believes that the symbiotic model is the way and intensity of interaction between symbiotic units and the exchange relationship of materials, information and energy between them [8]. It is an important internal factor affecting the construction of symbiosis and the key to ensuring the generation of symbiosis. In view of this, the construction of higher vocational industry-education integration symbiosis cannot be separated from the close connection formed between symbiotic units and the support of the symbiotic model with high integration of knowledge, technology, information and other resources. According to the classification of symbiotic models in symbiotic theory, there are four organizational symbiotic models: point symbiosis, intermittent symbiosis, continuous symbiosis and integrated symbiosis, as well as four behavioral symbiotic models: parasitism, partial mutualism, asymmetric mutualism and symmetrical mutualism. Among them, the organizational symbiotic model of "integrated symbiosis" and the behavioral symbiotic model of "symmetrical mutualism" are the most stable symbiotic models in symbiosis, which are the ideal state for achieving complementary advantages, interest coupling and resource sharing between symbiotic units. At present, the integration of industry and education in higher vocational education in China has not reached an ideal state. It is mainly characterized by an organizational symbiosis model of intermittent symbiosis and a behavioral symbiosis model of asymmetric mutualism. Just as the number of industrial colleges as a new model of industry-education integration has gradually increased in recent years, their development is still constrained by the lack of a sound system, imperfect governance structure, and overall loose development scale [9], and they have failed to achieve integrated symbiosis. For example, according to a survey, employment priority, professional and technical support, and employee training are the top three needs of school services and support that enterprises hope to obtain [9]. However, due to the untimely acquisition of talent information between colleges and enterprises, the needs of enterprises have not been well met, and "symmetrical mutualism" has not been achieved. Therefore, to build a symbiotic body of industry-education integration in higher vocational education, we must follow the "integration-symmetric mutualism" symbiosis model as the goal, and find the technical advantages and enabling paths of blockchain in promoting the realization of the "integration-symmetric mutualism" symbiosis model.

The degree of coupling between the goals and interests of the symbiotic units is the key to the symbiotic model and the basis for the generation of the symbiosis. The degree of consistency between the goals of the symbiotic subjects will directly determine whether the symbiotic relationship in the symbiotic body can be formed and the effect of the integration of industry and education in higher vocational colleges. The degree of coupling between the interests of the symbiotic subjects is an important factor affecting the degree of resource interdependence between them and the key to ensuring the integration of resources between the symbiotic units. At present, the participating subjects in the integration of industry and education in higher vocational colleges are not cooperating and building on the basis of a community of shared destiny, but a non-equivalent cooperative relationship formed by interests as a bond [10]. Therefore, in order to promote the realization of the symbiotic model goal of "integration-symmetrical mutual benefit", on the one hand, it is necessary to clarify the common goals and interests of the symbiotic subjects, and on the other hand, it is necessary to find the technical advantages of blockchain in promoting the practice of common interests. The common goals and interests of higher vocational colleges, enterprises and local governments for high-skilled talents have made the three exclusive original bodies appear to have combinable factors, which is the basis for the establishment of a symbiotic relationship between the three units. The talent chain is the link point for the precise connection between the industrial chain and the education chain in the integration of industry and education in higher vocational colleges, and is the key link for the construction of the symbiotic integration of industry and education in higher vocational colleges. In view of this, it is necessary to promote the establishment of an integrated symbiotic organizational model with a variety of quality parameters that are closely integrated and mutually integrated for a long time between higher vocational colleges, enterprises and local governments, and continuously move towards the "Pareto optimal" resource allocation and highly complementary and symmetrical mutualistic behavior model with highly coupled interests. The key lies in meeting the needs of different symbiotic units for compound high-quality

skilled talents required for the development of enterprises, society and education in the new era of digitalization, promoting the balance between the supply side of high-skilled talents in higher vocational colleges and the demand side of industrial and regional economic development, and moving towards the "integrated-symmetrical mutual" symbiotic integration model of higher vocational industry and education on the basis of meeting the needs of multiple symbiotic units for high-skilled talents and common interests, so as to give birth to the symbiotic integration of industry and education in higher vocational colleges.

In summary, this article will fully explore the technical advantages of blockchain in promoting the "four connections" of higher vocational colleges: connecting professional settings with job requirements, curriculum design with work content, teaching process with work process, and talent evaluation with job standards. By connecting the talent training process with the entire industrial development process, the symbiotic foundation for the construction of the symbiosis will be ensured, and the goal of the "integration-symmetric and mutual benefit" symbiotic model of higher vocational industry-education integration will be promoted to provide solid internal support for the construction of a symbiotic body of higher vocational industry-education integration.

2.3 Improving the Symbiotic Environment by Building and Promoting Multi-party Governance as the Value

Symbiotic environment refers to all external factors that can affect the construction of symbiosis, including external political, economic, cultural and other factors, in addition to the internal symbiotic units. It mainly affects the symbiotic units through the exchange of materials, information and capabilities [11], and is an important external guarantee for the construction of symbiosis. Based on the proposition of symbiotic theory, there is an interactive relationship between symbiotic environment and symbiotic construction. The more ideal and perfect the symbiotic environment is, the more helpful it is to promote the construction of symbiotic integration of industry and education in higher vocational colleges. A good symbiotic environment can effectively promote the interaction between symbiotic units in the integration of industry and education in higher vocational colleges, promote the improvement of the symbiotic degree between symbiotic units, and form a benign interactive development trend between the symbiotic environment and symbiotic units, ensuring the improvement of the level of integration of industry and education in higher vocational colleges and forming external guarantees for the construction of symbiosis. The integration of industry and education in higher vocational colleges is a complex project involving multiple subjects, and its symbiotic construction is inevitably inseparable from the joint participation and governance of multiple symbiotic subjects. Therefore, it is essential to build an external symbiotic environment that helps realize the co-governance of multiple subjects in the industry-education integration symbiosis. In the process of empowering the construction of the industry-education integration symbiosis in higher vocational education, blockchain should always follow the value of promoting the construction of a co-governance environment of multiple subjects, and use a good external field to provide environmental guarantees for the formation of an idealized symbiotic model and the deep compatibility of quality parameters between symbiotic units.

The policy environment in the symbiotic environment of industry-education integration in higher vocational colleges is the soil for the formation of the symbiotic environment of industry-education integration in higher vocational colleges. The construction of an ideal symbiotic environment of industry-education integration in higher vocational colleges is inseparable from the guidance and incentives of supporting policies. Since the State Council promulgated the "Several Opinions on Deepening Industry-Education Integration" (hereinafter referred to as the "Opinions") in 2017, local governments and relevant functional departments of industry-education integration have issued policy texts, which have provided certain direction guidance for the implementation of the practice of industry-education integration in higher vocational colleges, and also provided good external policy guarantees for promoting the formation of a symbiotic body of multi-subject co-governance. However, due to the complexity and cross-border nature of the symbiotic units involved in the integration of industry and education in higher vocational colleges, the formulation of the policy of industry-education integration in higher vocational colleges is inseparable from the vertical connection between central and local government departments and the horizontal coordination between various functional departments. In reality, due to the influence of the traditional bureaucratic management model and the fragmented administrative system, there are deviations in the policy connection and coordination between the central and local governments and functional departments at all levels, resulting in the problem of "poor connection between the top and the bottom, and poor coordination between the left and the right" in policy formulation. Specifically, the overall structure and content of the policy have problems such as insufficient supporting policies, insufficient policy incentives and single incentive tools, and lack of clarity and pertinence in the policy content. These problems affect the precise implementation of the industry-education integration policy by the symbiotic units and the mutual connection between the symbiotic units to a certain extent, thus hindering the construction of the industry-education integration symbiosis. The deviation in the implementation of the above policy lies in the fact that due to the lack of secure point-to-point connections between government departments, the governance coordination between vertical and horizontal departments is poor. The independent technical characteristics and distributed ledger technology in the blockchain provide technical support for the realization of collaborative governance among government departments. In addition, the policy environment is dynamically developing, and the complete policy system includes policy design, policy implementation, policy evaluation, policy supervision, policy improvement and other contents. The lack or imperfection of any content will affect the effectiveness of the policy [12]. In view of this, in order to better ensure the scientific nature of the industry-education integration policy of higher vocational colleges, its relevant policies should absorb the opinions and needs of multiple symbiotic units in accordance with the changes in the external social and economic environment and the changes in the main contradictions and obstacles of industry-education integration,

and appropriately adjust the industry-education integration policy of higher vocational colleges. In the process of policy adjustment, we should take the feedback information obtained as the cornerstone, give full play to the technical advantages of blockchain in promoting the connection of information resources, and ensure the accuracy of the feedback information obtained from the supervision and control of the policy of integration of production and education in higher vocational education. In the process of blockchain promotion and creation of a more perfect policy environment, we should ensure the multi-governance in the symbiosis, and give play to the positive incentive effect of the symbiotic environment on the realization of the ideal symbiotic model goals and the compatibility of the quality parameters of the symbiotic units.

3. The Technical Suitability of Blockchain in Enabling the Construction of a Symbiotic Integration of Industry and Education in Higher Vocational Education

Blockchain was first proposed in 2008 by a scholar with the pseudonym "Satoshi Nakamoto". With the development of information technology, it has gradually been applied to the field of education and has been hailed as the "new cornerstone of educational informatization". Blockchain is a distributed database technology that uses a combination of technologies such as point-to-point docking, timestamps, and distributed ledgers to package the corresponding data into "blocks" and then connect them in chronological order to form a "chain" [13]. With openness, security, and independence as its main characteristics, it can effectively ensure that multiple subjects are free from dependence on third-party intermediaries, promote equal trust and communication among multiple subjects, and make cooperation simple and autonomous. At the same time, the internal technology and main characteristics of blockchain can provide new technical support for solving the problems of poor coordination of symbiotic units, unsatisfactory symbiotic models, and the need to improve the symbiotic environment in the current process of higher vocational industry-education integration. For example, on the basis of ensuring the compatibility of the inter-quality parameters of the symbiotic units, energy exchange and new energy generation between the symbiotic units can be realized, and the coordination among multiple subjects can be enhanced; on the basis of ensuring that the supply of the talent chain meets the demand, the connection between the industrial chain and the education chain, as well as the talent chain and the innovation chain can be ensured, to promote the formation of an idealized symbiotic model; a symbiotic environment conducive to a multi-governance model can be constructed, and under the joint action of the three elements, the technical advantages of blockchain in empowering the construction of a symbiotic body integrating industry and education in higher vocational colleges can be brought into play (Figure 2).

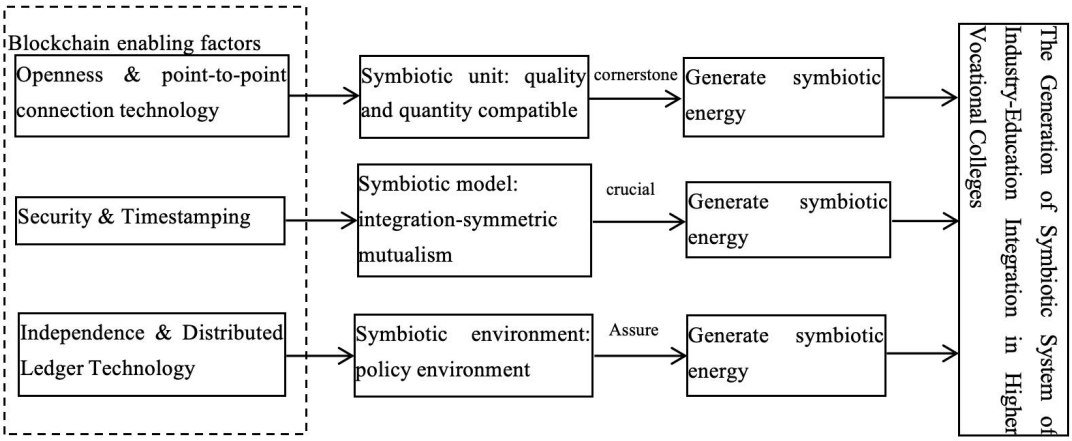

Figure 2: Analysis of the suitability of blockchain empowerment

3.1 Openness and Point-to-point Docking Technology Enable Quality Parameter Compatibility between Symbiotic Units

Based on the functional compliance of blockchain empowering the compatibility of quality parameters between symbiotic units in the construction of the symbiotic body of industry-education integration in higher vocational colleges, blockchain should give full play to its technical advantages in promoting the deep compatibility of quality parameters within the three symbiotic subjects of higher vocational colleges, enterprises and governments, so as to stimulate the symbiotic energy that promotes the construction of the symbiotic body of industry-education integration in higher vocational colleges and achieve the symbiotic effect of total output being greater than total input. At the same time, the compatibility of quality parameters is based on the information symmetry between symbiotic subjects, and the mutual expression and integration of quality parameters are the key; the open characteristics of blockchain and point-to-point docking technology provide support for the dynamic information resource sharing between symbiotic units, and promote the improvement of the compatibility of quality parameters between multiple symbiotic units on the basis of information symmetry.

In the process of building a symbiotic body of industry-education integration in higher vocational colleges, the effective docking of information resources between symbiotic subjects is the premise for ensuring the deep compatibility of quality parameters. The openness of blockchain allows the private information of the subjects participating in the transaction to be encrypted, and other information data of the platform is open to the public. Openness can effectively ensure the sharing of information resources among multiple subjects in the integration of

industry and education in higher vocational colleges [13]. In addition, the point-to-point docking technology allows the data on the block chain to be transmitted and exchanged one-to-one, which can make the information resource docking between symbiotic subjects more direct and convenient. The openness of blockchain and the point-to-point docking technology enable the compatibility of quality parameters between symbiotic units. First, it helps to share information such as talent needs, scientific research and development, and teaching staff between the two major symbiotic units of higher vocational colleges and enterprises. As two units with different social attributes, higher vocational colleges and enterprises can freely enter the block and obtain shared and public information in the block through the openness of blockchain [13]. In addition, the point-to-point docking technology can promote the "face-to-face" information resource docking between the school and the enterprise. With the dual support of open technical features and point-to-point docking technology, as two main nodes in the blockchain, higher vocational colleges and enterprises can directly upload their own quality parameter-related information requirements for practical training hardware equipment and enterprise training technicians that they want to obtain from enterprises to the "block". At the same time, higher vocational colleges can also form data for enterprises to refer to, such as their own talent training situation, the unique advantages of colleges and universities, and the quality parameter information of teachers' level. On the basis of direct docking of the quality parameter information resources of both parties, a good symbiotic relationship between industry and education is established, providing a prerequisite for the compatibility of quality parameters between the two symbiotic units of school and enterprise. Second, it helps the government to achieve the docking of policy and financial information resource supply and demand with higher vocational colleges and enterprises respectively. As the leading institution of macroeconomic regulation, the government mainly provides higher vocational colleges and enterprises with policy guidance on industry-education integration and financial support for two quality parameter resources. With the help of the open characteristics of blockchain and point-to-point docking technology, it can provide direction guidance for the government to directly transmit the industry-education integration policy plan to the two major subjects of higher vocational colleges and enterprises and effectively implement it, and to a certain extent reduce the deviation of policy implementation caused by untimely transmission of policy information. At the same time, it provides a direct channel for higher vocational colleges and enterprises to express their financial support needs, which helps local governments provide first-hand practical data references for formulating financial incentive systems that meet the needs of local economic development and the integration of industry and education.

In summary, the open characteristics of blockchain and its point-to-point docking technology provide support for the docking of information resources in multiple quality parameters among the three symbiotic entities of higher vocational colleges, enterprises and the government, and enable the construction of quality parameter compatibility mechanisms among symbiotic units on the basis of quality parameter information symmetry, which is highly appropriate for enabling symbiotic energy generation.

3.2 Security and Timestamp Technology Enable the Formation of an "Integration-symmetric Mutual Benefit" Symbiotic Model

The common goals and interests of vocational colleges, enterprises and the government in the cultivation of high-skilled talents are the key factors affecting the realization of the goal of the "integration-symmetric mutual benefit" symbiotic model. Therefore, we should fully tap the technical advantages of blockchain in balancing the supply side of high-skilled talents with the demand side of enterprises and governments; and the foothold of blockchain empowering the realization of the goals and interests of high-skilled talent cultivation lies in promoting the "four connections" between the professional settings, curriculum design, teaching process, talent evaluation of vocational colleges and the industrial needs, work content, work process, and job standards of enterprise development, so as to achieve the balance of supply and demand of talent cultivation in the close connection of the whole process of talent cultivation. The security and timestamp technology of blockchain provide new help in eliminating the concerns of enterprises about data leakage and achieving the balance of supply and demand of high-skilled talent cultivation.

First, blockchain has a unique data protection method. The loss of data in any or even multiple nodes in the database will not lead to the loss of the entire data, so it has extremely strong security. This provides a basic guarantee for both higher vocational colleges and enterprises to upload information on talent needs, the entire process of talent training, and talent training results, and promotes the openness and transparency of information on the process and results of high-skilled talent training. Secondly, the blockchain's timestamp technology stores the data in the block in chronological order, generates a time sequence for the data, and any blocks are linked by cryptography. Any block can be traced back to the data information of other blocks, which has strong traceability and verifiability. [14] This provides a new channel for enterprises to timely and deeply understand the coherent talent training plans, talent training methods, and talent training quality of higher vocational colleges. Based on the security and openness of blockchain, it can effectively ensure that enterprises can directly obtain a variety of intuitive data information such as pictures, videos, and audio generated in the talent training process of higher vocational colleges, and provide a basis for higher vocational colleges to dynamically adjust professional settings, curriculum design, teaching methods, and talent evaluation systems according to the development needs of enterprises. Finally, the security, traceability, verifiability and timestamp technology of blockchain can completely eliminate the possibility of student learning data being tampered with from a technical level, greatly reduce fraud in the practice of industry-education integration teaching [15], ensure the openness and transparency of the entire process of talent cultivation in higher vocational industry-education integration, and thus improve the quality of high-skilled talent cultivation in higher vocational industry-education integration. In view of this, the security characteristics of blockchain and timestamp technology can help the precise matching of needs between

multiple symbiotic units in the whole process of high-skilled talent cultivation and the dynamic adjustment of talent cultivation plans, and provide real and reliable technical support for the realization of talent cultivation and demand goals and interest demands of multiple symbiotic units in the symbiotic body of higher vocational industry-education integration.

3.3 Independence and Distributed Ledger Technology Enable the Construction of a Symbiotic Environment that Promotes Multi-party Governance

The coordination of the overall structure of the policy of industry-education integration in higher vocational education, the specific operability of the policy content, and the advancement of the policy are important factors that jointly constitute the ideal and perfect policy environment for industry-education integration in higher vocational education. Therefore, in order to better play the incentive role of the policy environment in the construction of the symbiotic body of industry-education integration in higher vocational education, it is necessary to promote the vertical connection and horizontal coordination between relevant departments in the process of formulating the policy of industry-education integration in higher vocational education, and to ensure the basis of multi-information feedback in the process of policy improvement. In view of this, the independence characteristics of blockchain and distributed ledger technology can, to a certain extent, promote direct contact and information connection between the central government and local governments, between various functional departments, and between the government and multi-party symbiotic units, ensure the timely and effective feedback of needs and information among multiple subjects, and ensure the relative stability and adaptability of the policy of industry-education integration in higher vocational education.

First, the coordination of the overall policy structure is inseparable from the mutual cooperation between multiple functional departments horizontally. It is necessary to ensure the supply of supporting policies for the integration of industry and education in higher vocational education under the mutual cooperation of multiple functional departments. The distributed ledger technology in the blockchain does not need to rely on the control of a third-party entity, but distributes the functional departments in different nodes of the blockchain, and realizes the verification, connection and management of information between nodes based on the accounting system and storage unit. In order to effectively avoid the lack of communication, inefficiency and information islands caused by the complexity of functional departments and the consideration of their own functional interests, a flat organizational structure is established between various functional departments. Secondly, the specific operability of the policy content must ensure the effective connection of information between the central and local governments vertically. Since the release of the "Opinions" in 2017, local governments have issued local implementation opinions on the integration of industry and education. However, due to the problem that the information transmission between the central and local governments involves multiple levels of departments and many intermediate procedures, local governments have the problem of copying central policy documents. At this time, the distributed ledger technology in the blockchain can help the central government directly pass the requirements of the higher vocational integration policy to local governments through text and visual information transmission methods, so that the central government can directly supervise the policy text plan of local governments and ensure the effective connection between the central and local governments. Finally, the improvement of the policy of industry-education integration in higher vocational colleges requires government departments to keep pace with the times and listen to the new demands of symbiotic units, improve the specific content of policy incentives according to the needs of symbiotic units, and adopt incentives that combine positive rewards with negative penalties to stimulate the enthusiasm and initiative of symbiotic subjects to participate in the integration of industry and education in higher vocational colleges. To this end, each block in the blockchain has a certain degree of independence. In the construction of the symbiotic body of industry-education integration in higher vocational colleges, multiple symbiotic unit subjects can independently calculate and store data without being controlled by the center. In the process of formulating the policy of industry-education integration in higher vocational colleges, the use of blockchain can not only effectively improve the efficiency of data transmission and exchange, but also make data information more transparent, and at the same time help higher vocational colleges and enterprises directly feedback their demands to government departments. Compared with traditional data information systems, blockchain can also effectively ensure the authenticity of the data of each symbiotic unit, and there will be no falsification, so that the government can collect real, effective and timely information, and provide accurate front-line information for policy improvement.

4. The Path of Blockchain Empowering the Construction of a Symbiotic Integration of Industry and Education in Higher Vocational Education

4.1 Building an Information Platform Based on the Compatibility of Symbiotic Unit Quality Parameters

Blockchain is a distributed ledger data technology that relies on a multi-party information platform. In order to better play the functional goal of blockchain empowering the quality and parameter compatibility of the symbiotic unit of industry-education integration in higher vocational colleges, it is urgent to build a blockchain information platform based on the premise of demand docking between symbiotic subjects and effective compatible circulation of resources, and provide information operation platform support for the release of internal technical functions of blockchain empowering the symbiotic body of industry-education integration in higher vocational colleges. At the same time, with the help of the information platform, the advantages of blockchain's openness and point-to-point docking technology can be brought into play to achieve timely docking of information and resources and data structure upgrades among multiple subjects of industry-education integration in higher vocational colleges.

The "Action Plan for Blockchain Technology Innovation in Higher Education Institutions" issued by the Ministry of Education in 2020 clearly pointed out that by 2025, a number of blockchain technology innovation bases will be built in colleges and universities, supporting the cooperation between colleges and universities and national science centers such as Beijing, Shanghai, Hefei, and Shenzhen, as well as relevant units and localities, to promote the transfer and transformation of blockchain technology breakthroughs in colleges and universities to the field of education [16], and provide impetus for the integration of industry and education. As the key subject of higher vocational education and an important part of higher education institutions, the transformation of blockchain technology in colleges and universities, the construction of the symbiotic integration of higher vocational education, and the compatibility of the quality parameters within the symbiotic unit are all inseparable from the blockchain information platform to provide a prerequisite guarantee. In view of this, it is urgent to build an information platform to promote the compatibility of the quality parameters of the symbiotic unit from multiple channels. On the one hand, with the government's financial support and publicity and promotion as the main focus, and the design and application of third-party science and technology industries as the supplement, a national data docking information assurance platform with enterprises, higher vocational colleges, government departments, and third-party industry organizations as nodes should be built. On the other hand, based on the actual needs of the symbiotic units in the integration of industry and education in higher vocational colleges, and guided by the deep compatibility of the symbiotic units with quality parameters such as talents, technology, and knowledge, a targeted blockchain information platform is built, which is led by higher vocational colleges and enterprises with cooperative relationships and assisted by the technical advantages of third-party technology industries. At this time, the blockchain nodes are "settled" by the subjects directly involved in the integration of industry and education in higher vocational colleges. In addition, the technical functions in the blockchain information platform are the key to ensuring the compatibility of quality parameters between symbiotic units. In the quality parameter docking of the symbiotic units in the integration of industry and education in higher vocational colleges, the blockchain symbiotic subjects achieve point-to-point compatibility of quality parameters between multiple subjects by uploading, storing and transmitting the data of their respective resource information. Therefore, the symbiotic units should improve the various functional modules such as the business middle platform, the technical middle platform, and the data middle platform in the process of building the blockchain information platform, so as to realize the information linkage between the data layers, so that the quality parameter information in the symbiotic units can be compatible and interoperable, and give full play to the open technical characteristics of the blockchain and the technical advantages of point-to-point docking. At the same time, in order to improve the usability and convenience of the blockchain information platform, the terminal applications of the higher vocational industry-education integration blockchain information platform should cover common smart devices such as smartphones, computers, and tablets, and the external ports should be connected to common Internet platforms such as portals and vertical classified information websites [17].

4.2 Building Smart Contracts to Cultivate High-skilled Talents

The formation of the "integration-symmetric mutual benefit" symbiotic model is centered on the balance of supply and demand of high-skilled talents. The docking of information resources in the whole process of high-skilled talent training is the key to ensuring the balance of talent supply and demand. Smart contracts are the core technology to ensure the dynamic docking of multi-subject resources in the whole process of talent training. They can integrate the demands of symbiotic units in a digital form to form a computer protocol. In view of this, the construction of smart contracts with the goal of cultivating high-skilled talents is the cornerstone of the formation of the "integration-symmetric mutual benefit" symbiotic model.

Smart contracts are customizable smart contracts built by embedding digital codes into blockchains or tokens in the blockchain contract layer. They can be automatically executed without going through a third party under preset rules and conditions, and the effectiveness and termination of the contract require the consent of more than 51 % of the nodes on the node, which can effectively avoid the phenomenon of one party's interests dominating. It can be seen that the construction of the symbiosis of industry-education integration in higher vocational colleges cannot be separated from the internal support of smart contracts, and whether the smart contract is effective depends on the consensus and execution of the symbiotic units in the symbiosis. Therefore, in the process of formulating smart contracts for the cultivation of high-skilled talents, the following three principles must be strictly followed. First, ensure the consensus of smart contracts. The consensus between symbiotic units is a prerequisite for the generation of smart contracts. Smart contracts for the integration of industry and education in higher vocational colleges need to comprehensively consider the interests of multiple symbiotic units, so as to maximize the interests of high-skilled talent cultivation in the symbiotic integration of industry and education in higher vocational colleges, and give full play to the open characteristics of blockchain data in the early stage of smart contract generation, and determine the rights, responsibilities and positions of each party in the process of high-skilled talent cultivation according to the resource advantages and interests of different subjects. Second, highlight the central role of smart contracts and take the central task as the guide in the whole process of industry-education integration. The formulation of the content of smart contracts should be closely aligned with the common interests of the symbiotic units - the supply and demand balance goal of high-skilled talent training, and the high-skilled talent requirements required by the industry should be placed at the core of the practice of industry-education integration. Formulate reasonable and clear contract content to promote the precise connection between the industrial chain and the education chain. For example, the government uses the market demand of the industry as a guide to help higher vocational colleges set up emerging majors and adjust existing majors; higher vocational

colleges design a reasonable curriculum system based on industry requirements, and keep close to the work process of employment positions during teaching, so as to guide and regulate the behavior of multiple subjects in the process of higher vocational industry-education integration. Third, maintain the rigor of smart contracts. Smart contracts will be automatically executed during execution. Therefore, it is necessary to ensure the rigor and professionalism of the terms before formulating smart contracts. On the one hand, on the basis of integrating the different needs of multiple symbiotic units for high-skilled talent training, clarify the rights and obligations of each node in the blockchain in the whole process of talent training. On the other hand, at the beginning of the formulation of smart contracts, it is necessary to strictly control the reward and punishment clauses involving multiple symbiotic subjects, and provide dynamic guidance for their behavior in the whole process of talent training.

4.3 Establishing an Operating Model Based on the Value of Promoting Multi-party Governance

Only by building a perfect symbiotic environment for the integration of industry and education in higher vocational colleges can the positive incentive effect of the symbiotic environment on the symbiotic body of the integration of industry and education in higher vocational colleges be brought into play, which is inseparable from effective and executable policies for the integration of industry and education. In view of the problems of the current policy environment for the integration of industry and education in higher vocational colleges, such as poor vertical connection, poor horizontal coordination, and untimely feedback of policy improvement information, it is urgent to establish an operation mode for the integration of industry and education in higher vocational colleges that adapts to the characteristics of blockchain technology, give full play to the advantages of blockchain in promoting information docking between vertical government departments, horizontal functional departments, and multiple symbiotic subjects, and provide technical support for improving the policy of the integration of industry and education in higher vocational colleges. As a distributed ledger technology for data storage, point-to-point transmission and communication, blockchain builds an operation mode with the value of promoting the co-governance of multiple subjects. The key lies in uploading, storing, and distributing information and needs on the policy of the integration of industry and education in higher vocational colleges around governments at all levels, various functional departments, and various symbiotic subjects, so as to improve the top-level design of the integration of industry and education in higher vocational colleges, build a policy system and action guide for the integration of industry and education in higher vocational colleges with vertical connection and horizontal coordination, improve the policy environment of the integration of industry and education in higher vocational colleges, and enhance the execution of the policy of the integration of industry and education in higher vocational colleges. Therefore, all parties involved in the formulation of the policy of industry-education integration in higher vocational colleges should always regard the uploading and storage of information that affects the implementation of the industry-education integration policy as a key task. In terms of vertical connection, when local governments formulate industry-education integration policies that are in line with the development of local regional economy, they should connect with the central government's policy guidelines on industry-education integration in higher vocational colleges, and refine local industry-education integration policies according to local conditions. In terms of horizontal coordination, in the process of formulating the incentive mechanism for industry-education integration in higher vocational colleges, it is necessary to give play to the information interaction between functional departments such as the Ministry of Personnel, the Ministry of Finance and the Ministry of Education, and form incentive policies on finance, land and taxation that are closely followed by higher vocational colleges and enterprises through the uploading and storage of information between nodes. In terms of improving the policy of industry-education integration in higher vocational colleges, as the two fundamental subjects of industry-education integration, higher vocational colleges and enterprises should promptly upload the problems that they encounter in the practice process that cannot be solved and need the help of government departments to the blockchain nodes, so that government departments can promptly formulate plans to improve the policy of industry-education integration. On the basis of the joint efforts of multiple parties, the relevant policies of industry-education integration in higher vocational colleges should be improved, and a symbiotic environment of industry-education integration in higher vocational colleges should be constructed.

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