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## Research on Credit Mechanism of Electronic Honor Certificate System Based on Blockchain

(Full Paper)

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### ABSTRACT

The problem of dishonesty in the workplace has been one of the serious problems in business management practice for a long time, and this phenomenon is especially obvious in the recruitment link of the talent market. In order to effectively solve the problem of false resumes in the current talent market, based on the investigation and analysis of the reasons for talents' dishonesty, a solution of trusted electronic honor certificate system based on blockchain is proposed, and the effectiveness of the model is verified by using game theory analysis method. Thus, it provides a credit guarantee scheme based on blockchain technology for electronic honor certificates and other archives without official credit guarantee, which overcomes the problems of unilateral way dimension and high labor cost faced by traditional background investigation and provides a new approach for solving the problem of resume fraud in the recruitment scene of the talent market.

*Keywords:* credit mechanism, blockchain, game theory, nonacademic records, electronic certificate

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### INTRODUCTION

Dishonesty in the workplace has long been one of the serious problems in business management practice. Authenticity and accuracy are essential to the effective operation of an organization, but dishonesty (in the form of lying, misrepresentation, and fraud) is still prevalent in organizational life (Leavitt & Sluss, 2017). Among them, the recruitment stage is the hardest hit area of workplace dishonesty with the cases of false resumes (Levashina & Campion, 2009). Especially for nonacademic information such as the honorary certificate, which has no official endorsement, the cost of counterfeiting is low, the identification is difficult, and the harm is great. However, traditional solutions such as background checking have some problems such as incomplete dimension, long time-consuming, and high price. Therefore, this study attempts to apply blockchain technology, which is born to solve the trust problem, to workplace recruitment, and to explore a technology-based solution to the problem of false resume.

Blockchain technology has recently attracted attention as a method of transferring data between participants based on the "distributed ledger" model, which provides completely transparent and non-changing data transaction records (Cai *et al.*, 2018). As a special decentralized distributed database, blockchain uses a chain structure composed in chronological order to store data and ensures that the data in the distributed ledger cannot be tampered with through the combination of multiple technologies (Yuan & Wang, 2016). The core advantage of blockchain is to realize decentralized credit in the distributed system where nodes do not need to trust each other (Miraz, 2017), thus providing a new perspective and solution to the problems of centralized credit, such as low efficiency, security risks, high trust cost, and limited capacity. These features are in part achieved through advanced cryptography, providing a security level greater than any previously known record-keeping system (Hjálmarsson *et al.*, 2018). In conclusion, blockchain technology, as a distributed storage technology that can be maintained by multiple parties and can generate disintermediation trust, can just meet the needs of multi-party authentication for multi-party storage of nonacademic data.

However, the combination of technology and scenario does not mean the end of the research. There is still a large space for us to study between the introduction of blockchain technology and the solution to the problem. Blockchain technology has attracted tremendous attention in both academia and the capital market (Cai *et al.*, 2018). With the vigorous development of blockchain technology in academia and industry, there are too many followers in the application of blockchain. Many scenes that cannot be successfully carried out are trying the blockchain solution as well, which put the promising technology at a tendency of serious froth. This has led people to question the validity of the blockchain project. Although blockchain technology can solve many problems existing in traditional centralized systems, the hype about blockchain has seriously exaggerated the actual ability and the application value of the technology, which may lead to the lack of rational thinking on the application scenarios and the limitations of blockchain technology. Finally, it cannot achieve the purpose of reducing cost and increasing efficiency, but also cause resource waste and efficiency reduction, technical security vulnerabilities, and many other issues. Therefore, it is very important to fully explore the necessity and effectiveness of using blockchain technology before applying it. At present, Swiss blockchain researchers Kurl Wust and Arthur Gervais have proposed a structured model to determine whether a certain scenario is suitable for using blockchain technology and which blockchain is suitable by answering six questions about data storage and

system participants (Wust & Gervais, 2018). However, this qualitative judgment depends on the experience of system developers and cannot directly compare the benefits before and after using blockchain technology. Therefore, based on the perspective of game theory, this study selects the recruitment scenario of the talent market as an example and demonstrates the effectiveness and necessity of using the blockchain system from the perspective of quantitative analysis.

To sum up, this study specifically takes college students and practitioners as the research object and constructs an electronic honor certificate system based on blockchain technology. By recording the honor and experience of college students and practitioners and other nonacademic records, the e-honorary certificate is used to prove the personal qualification of job seekers in the recruitment stage, so as to solve the problem of dishonest resume fraud in the recruitment scene. Moreover, based on the perspective of game theory, this paper demonstrates the feasibility and effectiveness of this scheme by taking the recruitment scenario of the talent market as an example.

### LITERATURE REVIEW

At present, most of the researches on the problem of dishonesty are divided into three categories (Ercegovac & Richardson, 2004). One is from the perspective of qualitative research; it analyzes and summarizes the behavior performance, current situation, behavior characteristics, causes, adverse effects and main hazards of talent dishonesty. (Lu, 2011; Klein, 2011) Second, from statistical analysis, empirical analysis is conducted on the current situation and influencing factors of talent dishonesty through questionnaire survey data and puts forward countermeasures and suggestions. (Ma *et al.*, 2007). Third, from the perspective of game theory analysis, (Briggs *et al.*, 2013) based on different game conditions, build a variety of game models among different subjects, deduce the reasons and countermeasures of talents' dishonesty from the perspective of quantitative analysis, and put forward corresponding countermeasures and suggestions according to the game results. However, the existing research, the final proposed solutions are countermeasures and suggestions, and the solutions are more general and less implementable. Therefore, this study will analyze the causes of talent dishonesty from information asymmetry and propose solutions to the e-honor certificate system, to provide feasible solutions for solving talent dishonesty in the talent market recruitment scene.

The research on blockchain at home and abroad started in 2013. After the initial development and exploration stage, countries have successfully carried out the basic research on blockchain technology and blockchain application in diversified scenarios since 2016. There has been an explosive growth of literature, and then the trend of exponential increase. So far, it is still in the period of the rapid development of blockchain. Blockchain is a distributed database comprising records of transactions or digital events that have been executed and shared among participating parties. Each of these transactions is verified by the consensus of a majority of the participants in the system (Casado *et al.*, 2018), thus enabling the creation of a distributed consensus in the digital, online world. Blockchain technology facilitates systems to develop a democratic, open, and scalable digital economy. The characteristics of blockchain technology include superior features such as smart contracts and smart property. Its potential financial applications include private securities, insurance, Internet finance, etc., while its non-financial applications include the Internet of Things, decentralized data storage, notary documents, anti-counterfeit solutions, etc. (Wang *et al.*, 2016).

As far as the research of its application scenarios is concerned, China has done some researches on copyright protection, electronic medical records, academic certification, etc., but there is no research and application exploration in the recruitment scene. Through the project investigation, it is found that there has been some exploration of education and credit certification system based on blockchain technology. What is more well-known at the government level is that the Kenyan government and IBM have cooperated in establishing a diploma network publishing and management platform based on blockchain technology, trying to realize the transparent production, transmission, and inspection of academic certificates. What is more famous at the school level is that Holberton School has cooperated with bit proof to become the first school in the world to use blockchain technology to record academic qualifications. MIT and learning machine software company jointly released block certs, a certificate verification system based on blockchain. However, there are still many deficiencies in the existing solutions to the problem of fake resumes of college students and practitioners in the recruitment scene of the talent market: first, the education certification system based on blockchain is mainly endorsed by the government or universities and other official organizations who issue certificates, and the recorded information type is not comprehensive enough, mainly on the issued degree certificates. At present, xuexin.com and university archives can be verified in China, so there is insufficient power to promote its reform and use similar new systems. However, training experience, internship experience, scholarship, and other non-academic information that can reflect the overall quality of job seekers are not provided with recording and verification services. Therefore, for these honorary certificates, which have no official institutions to provide inspection services but play an important role in personal qualification certification, we should explore how to ensure their authenticity, reliability, and credibility, and the blockchain technology is conducive to guarantee the above. Second, existing research is from news reports. Except for block certs, which provide code download, there is no open-source or system for external members of the organization to access or make use of. Therefore, there is no system that can be directly used and needs independent research and development. However, the block certs issue certificates based on bitcoin lead to the system's poor flexibility and high cost of issuing certificates. Therefore, it is necessary to explore new blockchain technology solutions and independently develop an electronic honorary certificate system that can reduce the cost of issuing certificates and improve the flexibility of the system. Third, most of the current systems only consider the use of a centralized organization scenario and do not consider the needs of multi-center management and cooperation in reality, which leads to the problems of single certificate type, limited use scenarios, and insufficient application value. Therefore, it is necessary to explore how to fully utilize blockchain technology to build an electronic honor certificate system for multi-party cooperation and use.

Based on the above research status, the electronic honorary certificate system based on blockchain technology designed by this research is a certificate storage system that can be maintained by multiple parties and used to record nonacademic honors and experiences. The system integrates the issuance, storage, verification, and use of electronic honorary certificates, and disintermediates trust based on blockchain technology, which is not endorsed by official organizations. Records and verification services are provided for academic, honor, and experience information to meet the needs of personal qualification certification in various scenarios, such as enrollment and job search.

### **ANALYSIS OF THE REASONS FOR TALENTS' DISHONESTY**

In the problem of dishonesty in job hunting, job seekers package themselves falsely to get jobs and favors from enterprises. At present, the dishonest behaviors of college students and practitioners in job hunting are mainly manifested in the following three aspects: first, forging degree certificates. For example, making false academic certificates, forging false scholarships, honorary certificates, and other awards and even certificates not obtained during the University. The second one is a fake experience. They make up their school and in-service positions, make up their social practice and activities, and exaggerate their working ability and achievements. Third, the interview fraud, in the interview process to conceal their own adverse information, do not objectively introduce their own situation, and even provide their own favorable false information, exaggerate their ability and quality. Therefore, in the current recruitment stage, due to the incomplete credit system of college students and practitioners and the limited data dimension, most of the nonacademic records such as honor and experience in students' careers cannot be verified, resulting in serious information asymmetry between job seekers and recruiters.

Information asymmetry will lead to adverse selection problems, forming a market of "bad money drives out good money." In the recruitment process, there are a large number of high-quality job seekers and low-quality job seekers. There is a huge difference. In the recruitment process, the recruiter cannot understand the true level and type of job seekers. Therefore, to obtain better returns, the low ability talents will act misleading through deception and concealment. As both the employment system and social integrity status appear at a low level, the low ability job seeker's fake cost is low. Once the income obtained through the interview is large, the low-level talents are likely to get better returns. They are willing to carry out opportunistic behavior. Simultaneously, to reduce the recruitment risk caused by information asymmetry, the recruiter will try to reduce the salary at the average wage of the talent market. Because the average wage is lower than the expectation of the talents with high ability but higher than the talents with low ability, the high-level talents will very likely put down the less-competitive offer and quit the application, thus leave the low-level talents with higher income; this resulted in the talent market for the appearance as "bad money drives good money."

According to the theory of adverse selection, three conditions need to be met: first, the buyer does not know the real quality of the product or service; second, the cost of the inferior product is lower than that of the high-quality product and has a relative price advantage; third, the inferior product can be disguised as a high-quality product, and the total cost of camouflage is lower than the average market price. In the current recruitment scenario, the above three conditions can be met. First of all, the recruiter does not know each job seeker's true level and ability, so it is difficult to predict the true level and ability of the job seeker due to the impossibility of verifying the authenticity. Secondly, the low ability of talents has a price advantage. Compared with the high ability job seekers, the low ability job seekers have a lower expected salary. The recruiters tend to recruit talents at a lower price, which will make the low ability talents have a certain price advantage. Finally, the low ability talents can disguise themselves as the high ability talents with low cost since the recruiters can hardly figure out what is true and what is false based on non-verified documents. Therefore, in the current situation of information asymmetry between the two sides of recruitment, the cost of dishonesty is low, and the income of dishonesty is high. For their own interests, job seekers take advantage of their own information to damage the interests of the recruiters.

### **ANALYSIS OF TALENT DISHONESTY SOLUTION BASED ON BLOCKCHAIN**

To solve information asymmetry between job seekers and recruiters, the solution proposed in this study is to build a trusted electronic honor certificate system based on blockchain technology. The system is a nonacademic record storage platform, mainly used to record nonacademic honor and experience information without credit endorsement and verification provided by official institutions. It records students' activities and experiences in school and in-service and generates electronic honorary certificates for employers as personal qualification certificates in the recruitment stage. Information transparency can reduce the cheating behavior of job seekers. The advantages of blockchain technology in cost saving have been verified by extensive industry practice (Ko *et al.*, 2018). With the help of blockchain technology, it is expected to solve cumbersome process problems, difficult verification of authenticity, and high hidden cost in verifying students' and practitioners' qualifications, to achieve the goal of eliminating job seekers' fraud.

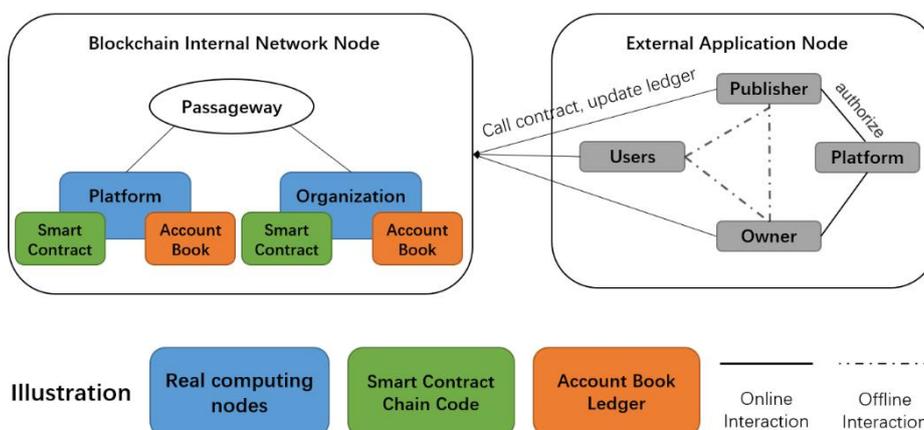
The system's final implementation needs the participation of the owner, publisher, user, and a platform of the e-honor certificate. The e-honor certificate owner refers to the recipient of honor and experience, mainly the individual user of the guarantor. On the one hand, the guarantor can upload the stock paper certificate obtained before the system goes online to the system, to solve many disadvantages of the paper certificate; on the other hand, he or she can also participate in the activities organized by the issuer in the system to obtain a new e-honor certificate. Publishers refer to the Awarders of honors and experiences and can add honor and experience records for participants by publishing the system's activities. The user refers to the employer who needs to view the honor and experience, such as the colleges and universities at home and abroad, and the recruitment enterprises. The

owner provides the link or two-dimensional code of the electronic honor certificate. The employer can view the honor and experience information stored by the guarantor on the blockchain. The system platform party refers to the third-party organization responsible for its daily operation and maintenance and currently refers to the system developer. As the role of normal operation and maintenance of the system, the platform side deploys a node by default. Other publishers, users, and other participants who can provide computing power can choose whether to act as nodes in the alliance chain according to their needs to maintain the e-honor certificate system jointly.

The e-honor certificate system proposed in this study mainly includes two core business processes: one is the stock chain, which refers to that the guaranteed user uploads the paper certificate obtained before using the system to the system to form the electronic honor certificate, which mainly solves the problems of paper certificate missing, damaging and difficult to transfer. This stage is mainly based on blockchain's technical characteristics, such as the difficulty of tampering and traceability, which makes false information permanently recorded and cannot be deleted. Second, incremental file and certificate chain, which refers to the electronic honor certificate added by the publisher by registering in the system to participate in the activities held by the publisher, to ensure that the whole process of honor or experience generation is open, transparent, and well documented, and the electronic honor certificate is recorded on the blockchain since its birth, to ensure the authenticity and credibility of the incremental honor of the new link from the source. On the one hand, the system can record the guaranteed person's nonacademic record information to play the voucher value in the recruitment process. In this way, the guaranteed person needs to participate in real activities if he wants to obtain the qualification certificate. On the other hand, the students' false resume cannot be proved in the system to crowd out the dishonest job seekers. They have no word of mouth in the talent competition market. Providing a verifiable verification platform for employers can greatly provide the detection probability of job seekers' dishonesty and fraud and deter talents from choosing trustworthy behaviors.

**DESIGN OF ELECTRONIC HONORARY CERTIFICATE SYSTEM BASED ON BLOCKCHAIN**

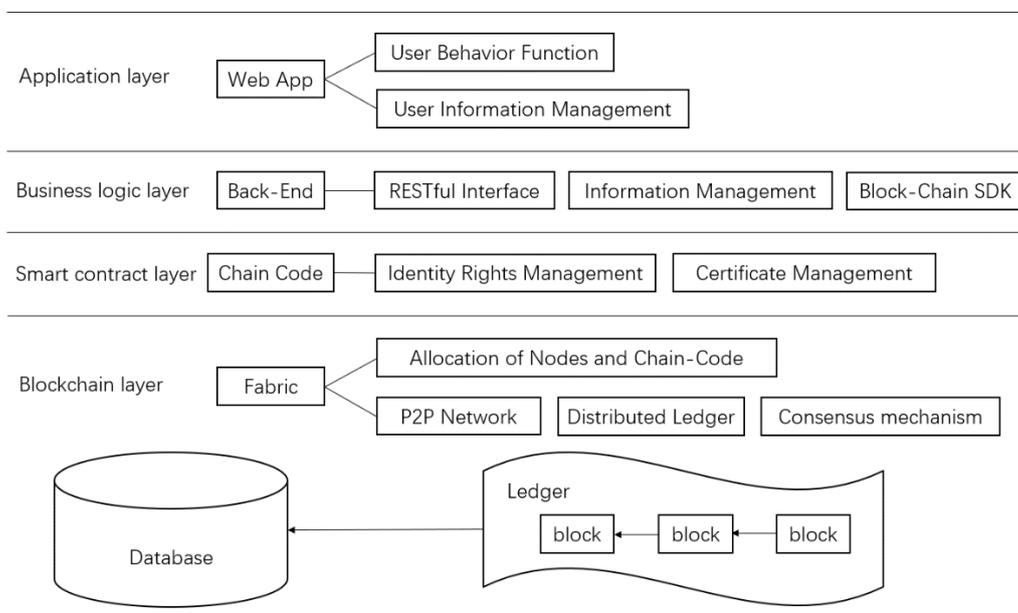
According to the usage scenario of the e-honor certificate and the fabric blockchain network's node architecture, the e-honor certificate system's organizational structure is designed, as shown in Figure 1. According to the blockchain application system's characteristics, this system's real roles can be divided into two categories: internal nodes and external application nodes. Internal nodes refer to computing nodes that need to provide computing power to participate in blockchain network management. In contrast, external nodes refer to client nodes that do not participate in blockchain network management and only use applications. The internal nodes of the blockchain network in the figure show the alliance chain composed of the organizations. Each organization contains four types of nodes in the fabric network. All nodes of the three organizations maintain the same certificate account book on the same channel. In the development stage, only the platform side, i.e., the system developer providing computing resources to act as nodes in the alliance chain. In the later stage, with the online and use of the system, organizations that need and can provide computing resources can apply to become computing nodes in the blockchain network. This system's external application node, namely the client node, includes publisher, user, owner, and platform. The issuing party refers to the organization or department that has the power to issue various qualification certificates; the owner refers to the guaranteed person who needs to store certificates of honor or activity experience, mainly college students and practitioners; the user refers to the enterprise or department that needs to measure the comprehensive quality of students according to the certificates; the system platform side refers to the management side of the certificate storage platform. After being authorized by the platform through identity authentication, the publisher and the owner can exercise their rights by calling the corresponding smart contract. After obtaining the owner's authorization, the user can query the user's electronic honor certificate on the blockchain through this platform. In the absence of the platform, the contact between the publisher, the owner, and the user mainly occurs in real life. The circulation is carried out through paper certificate mailing and other ways. The system structure is shown in Figure 1.



Source: This study.

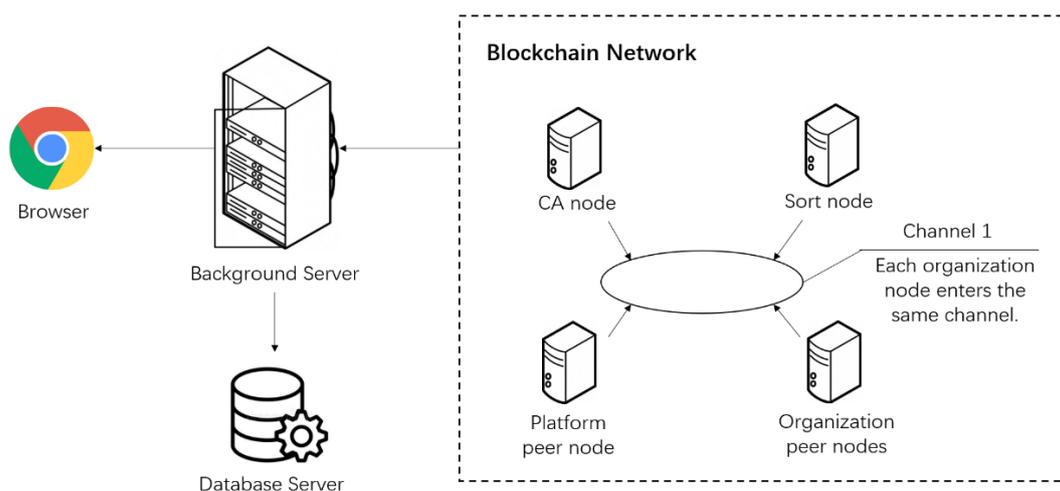
Figure 1: Organization Chart of E-Honor Certificate System.

This study's e-honor certificate system is divided into three parts: Web application front end, back-end server, and blockchain server. The web application side adopts B / S architecture. Users can use e-honor certificate upload, query, activity distribution, and other services after registering and logging in to the e-honor certificate system through the browser; the back-end server receives and processes the user's request at the application end and calls the MySQL database. Simultaneously, it is necessary to call the fabric's SDK to communicate with the blockchain server for data communication; the blockchain server receives the application side's core business data and completes the consensus by calling the smart contract to perform addition and query operations. After the consensus result is packaged into blocks, it is distributed to each node and written into the blockchain account book to complete the blockchain's data storage. Each node in the alliance chain needs to deploy a blockchain server, and multiple nodes jointly form a distributed blockchain network, the logical architecture of the system is shown in Figure 2.



Source: This study.  
Figure 2: Logical Architecture of E-Honor Certificate System.

The physical architecture of the system is shown in Figure 3. The system users use the e-honor certificate system through the browser. When using the system's certificate storage and other functions, the system stores the relevant data and files to the local database through the background server. It stores the hash value of the key data and files to the blockchain. In the blockchain network development stage, the system developer provides a peer node, CA node, and sorting node to ensure the normal operation of the blockchain network function.



Source: This study.  
Figure 3: Physical Architecture of E-Honor Certificate System.

**VALIDITY ANALYSIS OF BLOCKCHAIN E-HONOR CERTIFICATE SYSTEM BASED ON GAME THEORY**

Due to the information asymmetry in the recruitment process, job seekers and recruiters have a game problem between them to maximize their own utility. As the main body of independent decision-making and rational "economic man" (Grampp, 1948), job seekers will ponder according to the cost-benefit principle in the process of job hunting. In the recruitment process, it is a game process whether a job seeker takes dishonest behavior to fake his honor and experience (Litzenberger, 2002). Job seekers will weigh the utility of keeping faith and breaking faith according to their own utility function and choose their own strategies according to the principle of maximizing the utility of their own behavior. Therefore, from the perspective of game theory, this section will explore the different types of games under different conditions of job seekers and recruiters, analyze the reasons for talent dishonesty through the game model, and explore the impact of the electronic honor certificate system based on blockchain technology on the game conditions and game results. From the perspective of theoretical deduction, the electronic honor certificate system's necessity and effectiveness to solve the problem of fraudulent resumes of talents in recruitment scenarios are explored.

From the perspective of pure strategy Nash equilibrium (Litzenberger, 2002), the recruitment process is abstracted as a scenario where there are only one recruiter and one job seeker. There are two strategies for enterprises, Employment, and Non-employment, and two strategies for talents, Keeping promise and Breaking promise, namely, whether to fake their own experience or reputation.  $V1$  represents the trustworthy income of talents, that is, the jobs and salaries obtained under their true abilities;  $V2$  represents the income of enterprises' recruiting trustworthy talents, that is, the benefits brought by talents with matching abilities and positions;  $-V2$  represents the loss of nonemployment of trustworthy talents;  $I1$  represents the dishonest income of talents, that is, the high income obtained by fraud; and  $V1 < I1$  represents fraud Job seekers will get more profits.  $L2$  represents the loss of dishonest talents employed by enterprises: the loss caused by the recruitment of talents whose ability is not consistent with the position. And  $V2 < L2$  means that the loss of employing dishonest talents is greater than that of not employing trustworthy talents. The payment matrix of the model is shown in Table 1.

Table 1: payment matrix without blockchain system.

		Talent	
		Keeping promise	Breaking promise
Enterprise	Employment	$(V2, V1)$	$(-L2, I1)$
	Non employment	$(-V2, 0)$	$(0, 0)$

Source: This study.

The Nash equilibrium of the game is (no employment, dishonesty), and the income is  $(0, 0)$ . The result is that there will be no contractual agreement between the job seeker and the recruiter, the social benefit is 0, and the human resource cannot be allocated effectively. That is to say, in a game, job seekers have no motivation to keep their promise and only focus on maximizing their immediate interests. Therefore, choosing non-compliance is the strategy of maximizing utility. Similarly, recruiters have no sufficient reason to be sure that job seekers will keep their promise. Therefore, for them, choosing not to hire is a strategy to reduce the risk of recruitment and ensure the maximum utility of the enterprise. Therefore, in a game, because the promise of keeping the promise is not credible, it is impossible to form a set of equilibrium strategies, which makes it difficult to guarantee trustworthy behavior in recruitment.

The model reflects the current reality of recruitment. On the one hand, due to information asymmetry, the cost of personnel fraud is almost zero, which can be ignored. Job seekers can package themselves as high-quality talents in recruitment. However, due to the fact that background investigation needs to consume more human resources and time, it will not conduct background checking on all talents on a large scale at present; On the other hand, due to the incomplete construction of the social credit system, even if fraud is found, the impact on talents is very small, so that the winners and losers will not be punished, and the trustworthy will not be rewarded. On the contrary, due to the cheating of the dishonest, the recruiter will discount the credibility of the trustworthy person, thus damaging the interests of the trustworthy person, and the enthusiasm of the talent to keep his promise is damaged in the end. Those who keep their promise also tend to be fake, forming a vicious circle, which leads to the phenomenon of large-scale falsification of resumes. In the current situation of job seekers' fraud on a large scale, the reason why employment relationships can still occur is mainly that the enterprise undertakes the risk and loss on talents' fraud and still employs job seekers with the possibility of dishonesty. However, this does not form a virtuous circle of talents. When job seekers find that counterfeiting applicants can still be employed and obtain higher income, they will rush for it, thus, opportunistic behavior is promoted. Therefore, in order to break the vicious circle of talents' dishonesty, it is necessary to prevent the dishonesty of talents so as to effectively allocate human resources and solve talents' fraud from the root up.

In order to solve the above problems, this study proposes an electronic honor certificate system based on blockchain. By recording the honors and experiences of talents in school and in-service, on the one hand, it can reduce the information asymmetry between job seekers and recruiters. By recording students' activities and experiences in school, the system can provide more personal information about job seekers and help the recruitment judge the qualification of job seekers, so as to reduce the cost of verification for enterprises to find personnel fraud, expand the scope of talent qualification audit, and facilitate the detection of personnel fraud, so as to punish the dishonest talents such as dismissal, thus deter the counterfeiting behavior of talents; On the other hand, it can increase the cost and difficulty of personnel fraud; Job seekers are no longer just relying on the oral fabrication to package themselves, but they need to participate in activities to acquire the proof of electronic honor certificate,

thus squeezing the dishonest people out of the competitive market. Therefore, this paper takes into account the recruitment game model after introducing an electronic honor certificate system based on blockchain and analyzes the impact and function of the system. Suppose that the model variables after using the blockchain system are shown in Table 2.

Table: 2 model variables.

Job seeker	Recruitment company
V1 income of keeping promise	V2 income of recruiting trustworthy talents -V2 loss of non-recruiting trustworthy talents
I1 dishonest gains	I2 gains from fraud detection
C1 counterfeiting cost	C2 verification cost
L1 dishonest punishment	L2 loss of recruiting dishonest talents
P1 fraud probability	P2 fraud detection probability

Source: This study.

The payment matrix is shown in Table 3. The mixed strategy Nash equilibrium of the model is  $P1^* = \frac{C2}{I2+L2}$ ,  $P2^* = \frac{I1-V1-C1}{L1}$ . That is, talents choose to fake with probability of  $\frac{C2}{I2+L2}$ , Enterprises choose to check with the probability of  $\frac{I1-V1-C1}{L1}$ . The proportion of fake job seekers in the market can also be understood as  $\frac{C2}{I2+L2}$ . There are  $1-\frac{C2}{I2+L2}$  ratio of people chooses not to fake; enterprises randomly check the  $\frac{I1-V1-C1}{L1}$  proportion of talent information authenticity.

Table 3: game model after using blockchain system.

		Talent	
		Breaking promise P1	Keeping promise 1-P1
Enterprise	Detecting P2	(I2-C2, I1-C1-L1)	(V2-C2, V1)
	Cannot detecting 1-P2	(-L2, I1-C1)	(V2, V1)

Source: This study.

It can be seen from  $P1^* = \frac{C2}{I2+L2}$  that the probability of dishonesty of talents P1 is an increasing function of variable C2. The higher the verification cost of enterprises, the greater the probability of dishonest behavior of talents. Due to the high cost of enterprise inspection, to reduce the cost, only a small number of key positions are checked, while most of the posts are not checked. Therefore, job seekers will risk more opportunistic behaviors, which will increase the probability of dishonesty. Therefore, reducing the cost of enterprise verification is an important way to solve talent dishonesty. P1 is a minus function of variables I2 and L2. The greater the profit of an enterprise to detect dishonest behavior, the greater the loss of employing dishonest talents is, and the probability of dishonest behavior is smaller. For the enterprise's key positions, such as leadership or management positions, because such positions play important roles, it has a great impact on the decision-making and development of the enterprise. Once the recruitment of talents, whose ability is inconsistent with the position, is caused by fraud, the enterprise will suffer great losses. Therefore, the loss of such dishonest talents is large, and the dishonest talents can obtain greater profits. Reducing the probability of talent's dishonesty will reduce the probability of talent's dishonesty before the investigation. It can be seen that if the background checking can be carried out for all recruitment posts, the information provided by the job seeker will be checked in advance. If false information or honor is found to be false, it will deter talents to a certain extent and make them take trustworthy behavior. This system will provide a convenient and quick platform for employers to check talent information, which can greatly reduce the cost of talent verification, thus making the realization of large-scale background investigation possible. Therefore, the system can reduce the probability of dishonesty P1 of job seekers by reducing the cost of verification C2 and promote talents to take trustworthy behavior.

It can be seen from  $P2^* = \frac{I1-V1-C1}{L1}$  that the probability of fraud detection P2 is a minus function of L1, C1, and V1. That is, the greater the punishment for talent dishonesty, the higher the cost of fraud, the higher the income of keeping a promise, and the smaller the probability of enterprise inspection. On the one hand, when the counterfeiting cost and dishonesty punishment are high enough, the increase of fraud difficulty will increase the counterfeiting cost, and the increase of punishment will have a certain deterrent to talents; on the other hand, when increasing the income of keeping a promise, deducting the above losses will greatly reduce the income of dishonesty, and even make the income of dishonesty lower than that of keeping a promise. Therefore, as a rational economic person, job seekers will choose to be trustworthy, reduce fraud so that enterprises reduce the probability of inspection. It can be seen that increasing the cost of counterfeiting and the punishment of dishonesty, at the same time, giving certain rewards to the trustworthy talents and increasing the income of keeping promises, will promote the talents to keep their promise. P2 is an increasing function of I1. That is, the higher the income of talent dishonesty, the greater the probability of enterprise inspection. When the dishonesty can obtain a higher income, the job seeker will choose to make a fraud with a greater probability, and the enterprise will choose to check more. From the above analysis, it can be seen that employers would like to reduce the verification probability P2 for the sake of cost-saving, and the ways to reduce P2 include increasing the fraud cost C1,

the punishment intensity  $L1$  and the trustworthy income  $V1$ , and reducing the dishonest income  $I1$ . The use of this system can eliminate oral fabrication and packaging by recording the honor and experience of job seekers in school and in-service. High false cost, by recording the dishonest behavior of talents in the chain, dishonest behavior of talents will not only be punished by the current enterprise, but also be punished by the future enterprise not to be employed, to increase the punishment intensity  $L1$ , and improve the credibility income of talents by providing privileged services for long-term trustworthy talents, to achieve the purpose of reducing the enterprise verification probability.

From the above analysis, it can be seen that in the case of an imperfect social integrity system, on the one hand, it is impossible to record the historical behavior of talents truthfully, which greatly reduces the cost and difficulty of job seekers' counterfeiting, so that job seekers can make up their past honors and experiences, while the recruiters have no evidence to check and cannot verify; on the other hand, the dishonest behaviors of talents cannot be recorded. It reduces the punishment of dishonesty, not deterring job seekers, but also damages the interests of the trustworthy. The electronic honorary certificate system based on blockchain developed by the research institute can record the nonacademic honor and experience talents so that all resumes can be traced and documented. On the one hand, it increases the cost and difficulty of counterfeiting. On the other hand, by reducing the verification cost of enterprises and reducing the probability of dishonesty, job seekers who apply for any ordinary post can use the system to issue certificates of honor and experience and can conduct a wide range of verification for ordinary posts, to deter the fraud of talents and greatly reduce the probability of dishonesty.

### CONCLUSION

Given the practical pain point of dishonest resume fraud existing in the current recruitment scene of the talent market, on the one hand, this paper proposes a solution of electronic honor certificate storage system based on blockchain technology and designs a trusted electronic honor certificate system based on the characteristics of blockchain technology, such as disintermediation trust, multi-party maintenance, and hard to tamper with. The electronic honor certificate records the nonacademic honor and experience information obtained by students in school and in-service. It is used as a personal qualification certificate in the recruitment process. It can reduce the information asymmetry between the recruitment parties, increase the cost of fraud, increase the difficulty of fraud, and increase the punishment and risk of dishonesty, to deter talents from taking trustworthy behavior. The blockchain system solves the two difficulties of the nonacademic record storage system. Firstly, there are many kinds of nonacademic records. The sources are different, so it needs multi-party information exchange; secondly, public credit institutions' lack of endorsement makes it difficult to verify nonacademic records.

On the other hand, based on game theory, we dive deep to analyze the changes in the game environment brought by the blockchain system and then demonstrate the effectiveness and necessity of using blockchain technology in the talent market recruitment scenario. Through quantitative analysis to explore the applicability of blockchain technology in the project, we can compare the benefits brought by the use of blockchain technology directly and objectively analyze the principle of the role of blockchain technology from the theoretical level.

Although this research has carried on a thorough analysis of the talent dishonesty problem in the recruitment scene through the static game analysis, it proposed a solution to construct the electronic honor certificate system. However, with the further extension of the recruitment scene in the talent market, it is necessary to further analyze from the perspective of the dynamic game when it comes to dishonest behaviors such as breaking the contract after signing a contract, not hiring or concealing information by the recruiter, and even extending to multiple social recruitment scenarios in the whole working life of talents, to encourage job seekers and recruiters to take trustworthy behaviors from the beginning to the end. Therefore, in the next stage of the study, the game decision-making order conditions will be added to the game model deduction to further explore the recruitment game of the whole working life of talents from the perspective of the dynamic game (Myerson, 2013), further to improve the recognition and credibility of electronic honorary certificates.

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