A New Management Architecture for College Graduate Employment Based on the Electronic Employment Agreement

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Abstract — College graduates are human resources of great value and managing their employment is an important part of public management of the Chinese government. With the rapid development of higher education in China, college graduate numbers are increasing yearly. Improving the quality of managing graduate employment has become a major issue of social concern. In this paper we analyze current graduate employment management issues and discuss the ‘electronic employment agreement’. Based on this ‘agreement’ and employment management model, a framework of electronic employment platform is discussed in terms of future implications. We describe a management architecture to construct a system to achieve dynamic real-time monitoring of graduate employment. The proposed college graduate employment management architecture can solve problems such as disseminating information, complex process and difficult monitoring in their employment management. The proposed electronic employment management architecture can improve the efficiency of the management process, make decisions more scientific and promote graduate employment quality.

Keywords - college graduate; Electronic employment agreement; employment management architecture; monitoring system

I. INTRODUCTION

As the increasing number of college graduates in China (shown in table1), the total employment pressure is coexisting with structural contradictions. Currently, the difficulties in college graduate employment have become the focuses and hot spots of social concern. In particular, the Chinese Government Work Report in the year of 2016 has pointed out that employment is of vital importance to people's livelihood. It should be market-oriented to make innovation of the employment management means and improve the management efficiency and employment quality.

<table>
<thead>
<tr>
<th>Year</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of graduates/million</td>
<td>6.80</td>
<td>6.99</td>
<td>7.27</td>
<td>7.49</td>
<td>7.65</td>
</tr>
</tbody>
</table>

With the development of the information technology and the improvement of the information level, the employment management is now transforming from traditional model to electronic model. Relevant departments at all levels of government and graduate employment departments in colleges have built their employment platform, just with the function of Information Dissemination or Initial Interaction. There is still a big gap between the level of information and the employment management demand:

● The problem of information connection, transmission and sharing between heterogeneous platforms of college employment has become the biggest bottleneck and obstacle.

● Information asymmetry between supply and demand in college employment is widespread.

● Current employment platforms only with function of information collection, releases or query, are lack of real-time monitoring.

College Graduate Employment Management Architecture discussed in this paper aims to apply the emerging technology such as electronic employment agreement, which is the basis for employment collaborative management and construct the architecture of college graduate employment management platform, to solve the problems such as disseminating information, complex process and difficult monitoring in graduate employment management.

In this paper, we discuss the related work about electronic employment agreement in Section 2, and then we propose the college graduate employment management model, the college graduate employment management framework, the college graduate employment management architecture based on electronic employment agreement in Section 3, Section 4 and Section 5. Implementation results are shown in Section6, and we conclude this paper in Section 7.

II. ELECTRONIC EMPLOYMENT AGREEMENT

In the traditional management pattern of employment, it mainly applies paper Employment Agreement, paper Report Card and other paper material, colleges issued the paper Employment Agreement, and graduates and enterprises signed and sealed in the one. Then, colleges collect the agreement and input the paper information into the computer, make the Employment Programs and print Report Card, also make non-real time analysis on employment
situation, to be reported to the Education Department. The above process leads to the complexity, high cost and low efficiency, which make it difficult to guarantee the authenticity of employment information. It is also hard to make information sharing to achieve dynamic monitoring and automation of the employment management.

Electronic employment agreement is an important basis for transform from the traditional employment management to electronic one, which is the conversion of paper employment agreement to achieve the dynamic and high-effective management with various forms for different categories of college graduates. Electronic employment agreement should comply with the electronic design principles to implement the classification management and format design of electronic employment agreement.

A. Design principles of electronic employment agreement

Safety and Reliability Principle

1) Safety and Reliability Principle

It focuses on the authentication, non-repudiation and accountability. Authentication means that the third part could not forge the identity of graduates, colleges, enterprises or government. Non repudiation means that the subject of electronic employment agreement must be responsible for their own behavior. Accountability refers to that when there are the electronic employment agreement disputes, it could be solved by acquiring the historical information. Accountability is based on Non repudiation and is the further demand of security management.

2) Authentic Principle

Data in the electronic employment agreement must be true. When the enterprise invites the graduate, the enterprise information in the electronic employment agreement must be true. When the graduates invite the enterprises, the graduate information in the electronic employment agreement must be true. Information certification mechanism and automatically audit mechanism could ensure all data in electronic employment agreement is reliable.

In general, the information audit mode is divided into artificial audit and computer audit. Artificial audit is mainly used for data of unstructured and semi-structured, while computer audit is mainly used for the structured data. Electronic employment information audit should rely on both artificial audit and computer audit to simplify the process of information audit and assure the audit quality. Information audit certification system is consisted of the enterprise information audit mode and the college graduate information audit mode. The enterprises information audit mode comprises provincial and city (county) personnel departments (or the entrusted intermediaries) and the enterprise, which is multilevel network, shown as figure 1 and figure 2. Enterpise information audit mode adopts the centralized classification management and authorizes the right to use electronic seal for electronic employment agreement to ensure the enterprise information reliable. The college graduate information audit mode is a three level system. Compared with the enterprises information audit mode, it is more mature and applied in many employment management systems.

Electronic seal can be applied in college graduates employment management to audit the electronic employment agreement. The steps of using the electronic seal is shown as below:

Step1: Enterprise registers in seal management center and submits the scanning copies of enterprise business license, organization code certification and the identity of legal representative. The seal management center audits the above materials.

Step2: Seal management center audits the above materials which submitted by the enterprise and allowed the enterprise to check and use the electronic seal if the material is correct.

Step3: If the enterprise has checked the electronic agreement and needs the seal, it will require the seal to the seal management center.

Step4: Seal management center will parse and audit the request which it received. If the enterprise is legal, the seal management center allows the following steps, otherwise it will sent failure message.

Step5: Seal management center automatically generates electronic seal by embedding a special image which can reflect the characteristics information, mainly including information such as user ID, the name of enterprise, the MD5 of employment agreement document, signature time and electronic seal and the seal usage record.
Step6: Electronic seal will be inserted into the electronic employment agreement.

If other roles in the system want to see the agreement, the validity of the agreement can be checked by the following steps.

Step1: The electronic seal is separated from the electronic employment agreement.

Step2: The abstracts of seal-owner identity information, signature time and document are extracted by electronic seal.

Step3: The abstract of seal-owner identity information is recalculated and compared to the one extracted from electronic seal to ensure the validity of electronic employment agreement.

Step4: Checking the seal usage record of the enterprise in seal management center to ensure the validity of electronic employment agreement.

Step5: The abstract of document is recalculated and compared to the one extracted from electronic seal to make sure the validity of electronic employment agreement.

Step6: Open and show the agreement correctly.

3) Simple Management Principle

Design of electronic employment agreement should adapt to the employment management with various forms of employment. A set of generalized electronic employment agreements of the unified code includes formal agreement, engage agreement and other types, which can be chosen by graduates according to the employment category.

4) Real-time Statistic Principle

Electronic employment agreement can effectively reduce the information asymmetry, make the data flow between the graduates, colleges, enterprises and government more quick and convenient and favor the real-time statistical monitoring of the relevant functional departments to obtain the first hand data and implement effective early warning and control, so as to guide the future work of graduates employment.

B. Classification management and format design of electronic employment agreement

Compared with the traditional paper employment agreement, classification and design of electronic employment agreement can be more flexible and more applicable to the various forms of employment management. The electronic employment agreement can be divided into four types according to the employment forms.

1) Electronic Formal Agreement

Corresponding with the National Unified Employment Agreement format, it is the most typical one. Electronic Formal agreement clears the rights and obligations of college graduates, enterprises, colleges and government departments in the process of employment. Colleges issue the registration card and residence migration card and transfer the college graduate archives according to the agreement.

2) Electronic Engage Agreement

Electronic Engage Agreement clears the rights and obligations between college graduates and enterprises, which is not linked with the household registrations and archives.

Design of engage agreement should focus on the college graduate destination information.

3) Electronic Flexible Agreement

Flexible employment refers to the general term of various forms of employment, which is different from the traditional mainstream employment in the aspects of labor time, income compensation, workplace, insurance benefits, and labor relations, etc. Flexible employment mainly include labor dispatching industry, miniature production enterprise, community services, and independent service, such as street vendors, part-time, freelancers, intermediary brokers, advertising, design, online shop personnel, independent business personnel. Electronic Flexible Agreement is mainly used in the form of flexible employment.

4) Electronic Special Agreement

In addition to the above agreement, there are other special employment forms such as study abroad, continue education, civil servants etc. Special agreement is simple enough to clear the college graduate destination information.

III. COLLEGE GRADUATE EMPLOYMENT MANAGEMENT PROCESS SYSTEM BASED ON ELECTRONIC EMPLOYMENT AGREEMENT

With the supports of employment policy and technical system, electronic employment process system is adapted in the network system of employment and be the whole-process management based on the electronic employment agreement. The subjects of electronic employment management are extended from the government departments and colleges to the graduates, enterprises and the related intermediary agencies. Through the electronic employment management process system, the government departments can overcome the low-efficiency of the compartmentalization separate operating and achieve the high-efficiency of a clear division of labor sharing collaborative management resources, the graduates and enterprises can realize self-management in job-hunting and recruitment, the colleges can reduce the employment management work and focus on the employment ability improving of graduates, intermediary agencies can improve the ability of market regulation.

Electronic employment management throughout the whole process of employment is shown in figure 3.
Electronic employment monitoring management is a very important part of electronic employment management, mainly for real-time monitoring the employment status.

A. Pre-employment management stage

In the pre-employment management stage, the college supplies the employment guidance service, the enterprise release recruitment information, and the college graduate provides resumes, is recommended and interviewed. Pre-employment management includes the college graduate management, the enterprise management and job search service management. The unified public information service platform can realize college graduate information audit and enterprise information audit to guarantee the information correct and reliable and solve the problem of information asymmetry.

B. Mid-employment management stage

Mid-employment management is also known as electronic employment agreement signing management, mainly related to the electronic employment agreement contract management, electronic employment agreement change management, electronic employment agreement certification management and electronic employment agreement archiving management. Relying on electronic employment agreement signing platform, the electronic agreement signing and certification can be realized. Electronic employment agreement with the same functions of paper employment agreement is the basis of employment and dispatch. Electronic employment signing platform is the core of electronic employment management.

C. Post-employment management stage

Post-employment management includes employment registration management and employment monitoring management. The employment registration management is related to employment management of colleges and government such as printing electronic registration card, forming college employment scheme, transferring college graduates archives, settling management for the graduate. Employment monitoring management is related to graduate information changed monitoring, violation or termination of contract monitoring and employment status monitoring, to achieve the whole processes monitoring and promote policies for the scientific development of college graduate employment service by monitoring the supply and demand situation of graduates employment to switch the enrollment plan, adjust and optimize the major structure and improve the quality of teaching.

IV. COLLEGE GRADUATE EMPLOYMENT MANAGEMENT FRAMEWORK BASED ON ELECTRONIC EMPLOYMENT AGREEMENT

A. The Application System Framework

Based on the electronic agreement and the college graduate employment management process system discussed previously, the application system framework of electronic employment management is constructed as figure 4:

![Figure 4. The application system framework of electronic employment management](image)

According to the application of the electronic agreement, the application system framework of electronic employment management can be divided into three levels, namely the electronic pre-employment information services management, the electronic employment agreement management, and the electronic employment tracking service management.

Electronic pre-employment information services management: This process is mainly related to the government and college employment guidance information services, the recruitment company information services, the graduate interview, recommendation, resume information services.

Electronic employment agreement management: This process is mainly related to the signing management of electronic agreement, the changing management of electronic agreements and the archive management of employment agreement.

Electronic post-employment tracking service management: This process is mainly related to the electronic employment statistics, the electronic employment data analysis, the electronic forecast and tracking services.

B. The Application of Electronic Agreement

1) Electronic employment agreement signing and cancelling

Electronic employment agreement signing can be categorized into the graduate-led signing and the employer-led signing. The graduate-led signing refers to that the graduate sends the invitation to the employer based on the previous candidates and interview firstly and then the employer decides to agree the invitation, after that the graduate sends the invitation to the employer based on the previous candidates and interview firstly and then the employer decides to agree the invitation, after that the college and government department audit the electronic employment agreement. The employer-led signing means that the employer sends the invitation to the graduate and the graduate decides to agree the invitation, then the college and government department audit the electronic employment agreement. Similarly, electronic employment agrees canceling can be categorized into the graduate-led canceling and the employer-led canceling.
In the traditional employment management, employment agreement is issued by the college. Because of the loopholes in management, the phenomenon of breaking contract and falsification is difficult to monitor. This paper proposes a kind of college graduate employment management model based on electronic employment agreement to achieve high-effective online contracting management. The basic principle is that the graduate employment will be described as a uniform code of a group of the employment agreement and set the priority of operation rules to achieve agreement signing, agreement change and the different state transitions of agreement. It needs to record operator, operation type and operating time for each step of operation in order to track the agreement. It needs to record operator, operation type and the different state transitions of agreement. The signing of electronic agreement is a multi-stakeholder involvement. Agreement signed status reflects the main indicator of the employment process, which can be divided into three categories, that is, not to be about, effect and void. After employer sending invitation to graduate, the status of electronic agreement is not to be about. At this point, if the employer refuses to withdraw the invitation or graduate refuses the invitation, the electronic agreement status is "Void"; if the graduate accepts the invitation, the agreement entered into "Effect". The status of "Void" also contains "Revocation", "Refuse", "Agree to termination and cancellation". "Effect" contains 5 seed statuses: "Acceptation", "Audit record by the relevant department", "Audit record by the college", "Applied to termination", "Refusing to termination and cancellation". Conversion Relationship between these states is as figure5.

3) Monitoring management of electronic employment agreement

In the traditional employment monitoring system, the Education Ministry acquires the employment situation data through layer upon layer system. This means that the initial data from the colleges just carries out a simple information process, such as data import, data export and statistical analysis. It is lack of intelligence and automation. Due to the different submission time of the employment agreement, it is also difficult to achieve dynamic monitoring. The current employment data statistical analysis is generally once a year, because of the backwardness of monitoring means, so that the analysis results of the college graduate employment are challenged.

In the college graduate employment management framework base on electronic employment agreement, it establishes the information audit mechanism to ensure that the identity information of the employment subject is true and reliable. This paper proposed an information audit mode in Section 2, which is constructed by establishing the enterprise information auditing mode and the college graduate information auditing mode. It can ensure the authenticity and accuracy of employment information and monitoring data. For example, the enterprise information auditing mode comprises provincial and city (county) personnel departments (or the entrusted intermediaries) and the enterprise, which is multilevel network. It adopted the classification of centralized management method to certify the employment subject and grant the right to use the electronic seal. The college graduate information audit mode is a three level system of the government, the college and the graduate. Compared with the enterprises information audit mode, it is more mature and applied in many employment management systems.

In the traditional mode of employment management, the validity of the employment agreement depends on the agreement signed and sealed by the parties. It usually needs to spend a lot of time to get signed and sealed. While in the electronic mode of employment management, the validity of the electronic employment agreement depends on the electronic seal in the agreement. This paper also discussed a light type of electronic seal system to audit the employment information.

The government can monitor the whole process of electronic employment management through the electronic employment agreement to regulate the enrollment plan and adjust the major structure to apply to the employment market demand and make the scientific policy to promote the college employment. Table II shows the monitoring indexes indicated in electronic employment agreement.

<table>
<thead>
<tr>
<th>Monitoring indexes</th>
<th>If the index can get through the electronic employment agreement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real time signing number of each college (school/major)</td>
<td>Yes</td>
</tr>
<tr>
<td>Real time signing number of each enterprise</td>
<td>Yes</td>
</tr>
<tr>
<td>Real time signing number of each area</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Real time signing number of each academic degree | Yes |
---|---|
Real time signing number of each enterprise kind | Yes |
The whole employment rate | Indirect to get |
Employment rate of each college (school/major) | Indirect to get |
Employment rate of each academic degree | Indirect to get |
Employment rate of each gender | Indirect to get |
Graduate direction | Yes |

The functions of the monitoring management of electronic employment agreement include: the electronic report card generation and printing, the employment program generation, college graduate archive migration, the report for duty and settle down monitoring, the graduate source change monitoring, the agreement violation or termination monitoring and so on. The monitoring subject can realize the real-time dynamic monitoring by setting arbitrary point in time in the platform to automatically get the college graduate employment situation information. Various types of employment rate can be calculated automatically. The monitoring data are more accurate and timely. The monitoring results are more true and objective. The monitoring management of electronic employment completely solves the problem such as the employment monitoring time point setting, and implements the real-time dynamic, whole and automatic monitoring.

V. COLLEGE GRADUATE EMPLOYMENT MANAGEMENT ARCHITECTURE BASED ON ELECTRONIC EMPLOYMENT AGREEMENT

College graduate employment management adopts four layer architecture, including platform layer, technology layer, application layer and presentation layer. The Architecture is shown as figure 6.

Platform layer: The platform layer provides the development, operation and management of the application service, which is based on the infrastructure development. The platform layer of college graduate employment management architecture is based on the cloud computing.

Technology layer: The technology layer includes big data, statistical learning, optimization algorithm, search engine, real-time, network security and so on. Especially, the electronic employment agreement technology plays an important role in college graduate employment management.

Application layer: The application layer includes information acquisition, information auditing, information release, information retrieval, information monitoring and information feedback, which are based on the electronic employment agreement.

Presentation layer: The presentation layer is shown as the platform of college graduate employment management.

![Figure 6. College Graduate Employment Management Architecture Based on Electronic Employment Agreement](image)

The topology structure of College Graduate Employment Management Architecture is shown as figure 7:

- We constructed a unified College Employment Management platform based on Electronic Employment Agreement, including the applications of information acquisition, information monitoring, information feedback, information retrieval, and information audit.

![Figure 7. The topology structure of College Graduate Employment Management Architecture](image)

VI. IMPLEMENTATION RESULTS

Since the year of 2014, the above college graduate management platform has begun to pilot testing in Zhejiang Province. The graduates and the enterprises participating in the pilot testing apply the electronic employment agreement to make contract. The information and data in the agreement can be real-time saved in the cloud database servers. In the platform, the colleges and the education administrators can monitor the employment indexes discussed in TABLE II.

College graduate employment management platform based on electronic employment agreement can not only retain the advantages of traditional employment mode, but also enable the monitoring department to monitor the college graduate employment situation in real time.

Compared with the traditional college graduate employment management mode, the electronic college
graduates employment management has more advantages discussed in TABLE III.

TABLE III. THE COMPARATIVE ANALYSIS OF THE TRADITIONAL MODE AND THE ELECTRONIC MODE

<table>
<thead>
<tr>
<th>Compared items</th>
<th>Traditional mode</th>
<th>Electronic mode based on electronic employment agreement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real-time</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Decision-support</td>
<td>Once a year</td>
<td>At all times</td>
</tr>
<tr>
<td>Reliable</td>
<td>Not guaranteed</td>
<td>Guaranteed by information audit</td>
</tr>
<tr>
<td>Ease of data usage</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Adjustment of specialties offered and teaching mode</td>
<td>Lagging behind</td>
<td>In time</td>
</tr>
</tbody>
</table>

Specially, in the pilot testing, the college can grasp the changing demand of the enterprises through the platform, and adjust the course content and teaching mode in the next academic year timely. So the platform also provides the guidance for teaching reform in the college.

In the future, the main work of the project is to launch the platform nationally.

VII. CONCLUSION

Electronic employment management is based on the electronic agreement and electronic report card to support collaborative management instead of the traditional employment management. It realizes the whole process of electronic management and the innovation of management concepts, management means and methods, which has a big realistic implications and guiding significance.

The information audit system in electronic employment management is conducive to the establishment of electronic employment management operations mechanism and employment information sharing mechanism. Taking the advantage of the electronic employment agreement and signing online to construct the platform of electronic employment management can realize office automation in employment management services and dynamic and real-time employment status monitoring management such as employment statistics to provide data for decision dynamics, which is timely and accurate. Through the monitoring management in electronic employment management, it can regulate the enrollment plan and adjust the major structure to apply to the employment market demand and make the scientific policy to promote college employment.

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REFERENCE