Developing Graduate Employability Indicators for the Chinese Information Technology Industry

Li-xin MA and Ben-qing DONG

School of Computer and Software, Dalian Neusoft University of Information, Dalian, 116023, China

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Abstract. This paper studies the employability requirements from the IT industry’s perspective. As the Chinese IT industry experiencing the development bloom, the Chinese IT graduates are also facing the higher standard of their comprehensive competency by the Chinese IT company employers. Based on a previously published IT employability indicator model, this research has conducted an industry-wide survey to further verify the validity of individual indicators. The research result shows that the proposed IT employability indicators can meet the industry requirements, but there is still room for improvement. The research findings can contribute to the university IT program development or serve as a benchmark tool across institutes.

Introduction

Many researchers such as Wang, Liu and Lai suggest that the Chinese IT labor market is still in the situation of oversupply; however, the matching degree of market supply and demand gap have become larger, which is due to the insufficient cultivation of the Chinese IT graduates’ employability [1]. Therefore, providing a sufficient number of computing graduates to meet the industry needs and improving their employability to enable them to meet industry and job requirements and make them better qualified for the job is of great significance for individuals and the industry. From the perspective of the use of human resources, solving the employment problem of computing graduates is conducive to promoting the rational allocation of human resources [2].

This research intends to evaluates the impact of several important employability indicators and the degree of university students’ performance based on the perspective of the company and to clarify the gap between them. This article proposes the method and approach to improve the employability of IT major graduate and reduce the employment gap, hoping to provide the new indicators for the improvement of employability of IT major graduate and the quality of employment.

Literature Review

Overview of the IT / Computer Industry in China

The main focus of this research is the graduate employability related to the demand of the Chinese IT industry. In recent years, the Chinese IT industry have started the industrial-level upgrading through integrating the various new generation information, communication, and computer technologies [3]. According to the statistics of 2017, the employment number of Chinese IT industry had increased 200,000 comparing to the statistics of the last year and had reached a total number of 6 million employee, which shows the talent demand had increased more than 3.4% [4]. However, the general employability of those employees is not satisfying to the IT industry. The IT industry still experience the shortage of the high-level IT talent who are equipped with innovation, management, leadership skill as well as the comprehensive knowledge of both technology and industry, which causes concern over the sustainable development of the rapid growth of Chinese IT industry [3]. According the joint government report by the Ministry of Education, the Ministry of Human Resources and Social Security, and the Ministry of Industry and Information Technology, the Chinese IT industry have high demand for the next general IT talent with comprehensive capabilities. According to the report, by the year 2020 and 2025, the demand of IT talent will reach
18 million and 20 million respectively, and the gap of IT talent will reach a significant number of 7.5 million and 9.5 million respectively. Therefore, the understanding of IT graduate employability is important for improving the IT education system to prepare the IT graduate for the industry demand and solve the IT talent shortage.

Predecessors' Definition of Employability

Fugate, Kinicki [5] define employment ability as personality traits, and regard personal traits as the most important factor in employment ability. Employment ability is a combination of personal traits and other human capital and other factors. Bowe [6] define it as a comprehensive ability, thinking that employability is the comprehensive ability reflected in the interaction with the environment, such as knowledge, skills, attitudes, etc. The International Labour Organization once stated the ability to employ: it is the ability of the individual to obtain work, progress on the job, and respond to changes that occur at work [7]. Most scholars in China start to analyze from the perspective of their employers and define employability as post competency, skills as the core factor, and human resources as orientation, emphasizing employment needs and employment matching degree [1, 8]. With regard to the constituent elements of employability, many scholars have put forward different views. Education, Dearing [9] pointed out that no matter what types of jobs college graduates will engage in in the future, their key capabilities for obtaining future job success can be summarized into four categories: computational capability, communication skills, information technology application ability and learning capability. McQuaid and Lindsay [10] stated that the construct of employability mainly includes the individual qualities of the employees (diligence, self-confidence, attitude), convertible skills (divided into basic, critical, and high-level skills), and related educational background (education level, mastery skills, work experience), and the essential attributes of workers (basic social skills, trustworthiness, etc.). Gokuladas and Menon [11] summed up previous studies and suggested that practitioners in the computer industry need deeper knowledge than other professional college students. IEEE [12] also provided analysis for the IT professional course system and stated that the four professional capabilities are necessary for the IT talent, such as computational thinking, algorithm design and analysis, programming skill and program implementation capabilities.

Previous Published IT-specific Employability Indicator Modal

Based on the existing studies on employability indicators, this research is conducted based on a previous published IT-specific employability indicator model [13], as a result of 18 participants Delphi-study and survey as shown below:

Table 1. Indicator model of IT-specific employability.

| No | Measurement Elements | Measurement indicators |
|----|-----------------------|------------------------|
| 1  | Professional ethics and Responsibility | Pressure resistance |
| 2  | Professional ethics | |
| 3  | Sense of responsibility | |
| 4  | Career achievement | |
| 5  | Basic and Development ability | Executive ability |
| 6  | Learning ability | |
| 7  | Creativity | |
| 8  | Planning ability | |
| 9  | Career planning ability | |
| 10 | Teamwork | |
| 11 | Communication and coordination | |
| 12 | Using social relations capabilities | |
| 13 | computer Professional ability | Basic knowledge of computer |
| 14 | Cognitive and operational capability of computer | |
This research aims to use a wide-scale survey to investigate the priority and relevance of these indicators from Chinese IT companies’ point of view. The finding of this research can directly contribute to the IT education reform in China.

**Research Design and Methodology**

**Survey Design**

According to the purpose of the survey, the questionnaire mainly includes three aspects. The first is the basic identification information of respondents, including eight issues such as gender, age, education level, occupation, and higher education, etc., which all use the form of multiple choice questions.

Followed by the survey of employability of IT major graduates, respondents were asked to evaluate the importance of certain indicators and to evaluate the overall performance of the certain indicators of IT major graduate. This study was based on 23 items of the third-level indicators and applied the Likert 5-point scale as the test method. The questionnaire survey asked the respondent to evaluate the importance and performance of the employability of IT major graduate in the actual job search process and to use the symbol √ in the corresponding score. The indicators with “1” score are very dissatisfied/very less important; the indicators with “3” score are average satisfaction/importance; the indicators with “5” score are very satisfied/very important.

The third aspect is to investigate the interviewee's own job search process and the final employment situation, including the time spent on job search, the way to obtain job information, the type and size of the job search unit, the factors influencing the selection and determination of work, and the impact on employment results. The factors, etc., are answered by multiple-choice questions or by filling in blank questions.

**Survey Data Collection**

The target recipient IT industry practitioners, such as the senior enterprise manager, the manager of IT project or program, the officials from government or social organization of IT industry, and teachers in IT profession. The composition of the survey participants represents the complex and extensive nature of the IT industry participants, and the survey are completed with all targeted types of IT participants. The survey is conducted from the beginning of March 2018, and is distributed through three methods:

The first method is distribution through an online electronic questionnaire with the help of Association of Fundamental Computing Education in Chinese Universities. The second method is distribution through e-mails and social communication tools to the direct contacts of the author. The third method is distribution through work visit of the company to the university.
The survey finished collection by March 31, 2018, and 2031 questionnaires were collected. The preliminary examination of the questionnaire is conducted. There are 189 questionnaires that do not meet the standard of survey, therefore deleted from the data sets. The main reasons for the deleting are incomplete questionnaire, insufficient survey time, same answer for significant number of questions and identical questionnaires. After the preliminary examination, a total number of 1842 effective survey were collected with a recovery rate of 85.44%.

Data Analysis and Result

In order to ensure the validity of the questionnaire, the validity of the pre-survey questionnaire was analyzed by Kaiser-Meyer-Olkin (KMO) measure and Bartlett Spherical test value. The indicators with larger KMO value (closer to 1) will have the more common factors. The data sets with lower static correlation coefficient will be the more qualified for the further analysis. The general criterion for the factor analysis of the KMO value is usually at least 0.6 or more, and 0.9 or more is very suitable [14, 15]. Through analysis, the KMO values of the three first level indicators were 0.915, 0.932, and 0.929, respectively, and all larger that the KMO criteria. The significant probability value was 0.000<0.05. Therefore, the data sets from the survey are suitable for further analysis.

In addition, the IBM SPSS Statistics 22.0 statistical software was used to test the internal consistency coefficient (α coefficient) of the pre-survey questionnaire. Usually, Cronbach’s alpha is between 0 and 1. If it is greater than 0.60, it can be accepted. Between 0.80-0.90, the questionnaire is very reliable [16]. The Cronbach’s alpha of the survey data is 0.927 which show the questionnaire and the data sets have suitable reliability.

Table 2 shows analysis results of 23 employability, such as importance of the indicator, performance of the indicator, the score difference of importance and performance, T value, and two-tailed significant probability. From Table 2, the two-tailed significance probabilities of the 23 indicators were all less than 0.05, which shows statistically significant correlation between these factors under the 95% confidence interval. Secondly, the I-P value, which is the difference between importance and performance, are all positive. This means that the participants of the survey generally consider a lower performance score comparing to importance score for all indicators. Lastly, the average performance values of all indicators is 3.184, and individual average score of each indicators fall in the interval of 2.706 and 3.725. It shows that the employability of IT majors can basically meet the needs of enterprises and their own expectations, but there is still room for improvement.

| No | Measurement Elements | Measurement indicators | I value | P value | I-P value | T value | Two-tailed significance probability |
|----|----------------------|------------------------|--------|--------|----------|--------|----------------------------------|
| 1  | Professional ethics and Responsibility | Pressure resistance | 4.198  | 2.998  | 1.200    | 18.175 | 0.000 |
| 2  | Professional ethics | 4.097  | 3.489  | 0.608   | 15.910 | 0.000 |
| 3  | Sense of responsibility | 4.193  | 3.114  | 1.079   | 20.860 | 0.000 |
| 4  | Career achievement | 4.069  | 3.547  | 0.522   | 16.319 | 0.000 |
| 5  | Executive achievement | 4.186  | 3.214  | 0.972   | 19.726 | 0.000 |
| 6  | Learning ability | 4.266  | 3.526  | 0.740   | 19.818 | 0.000 |
| 7  | Creativity | 4.210  | 3.025  | 1.185   | 16.172 | 0.000 |
| 8  | Planning ability | 4.207  | 3.114  | 1.093   | 17.628 | 0.000 |
| 9  | Career planning ability | 4.162  | 3.145  | 1.017   | 21.217 | 0.000 |
| 10 | Teamwork | 4.219  | 3.662  | 0.557   | 15.997 | 0.000 |
| 11 | Communication and coordination | 4.164  | 3.111  | 1.053   | 21.539 | 0.000 |
| 12 | Using social relations capabilities | 3.149  | 2.832  | 0.317   | 12.764 | 0.000 |
Conclusion and Recommendations

This study adopts empirical research methods to evaluate the employability of Chinese IT graduate. This research also uses a combination of qualitative analysis and quantitative research such as literature analysis, questionnaires and statistical analysis. On the basis of previous established employability model, this study adopts survey method to collect the first-hand data of the opinion of IT industry participants about the current status of IT graduate employability. Then the survey data are analyzed in depth to provide a comprehensive understanding of employability and its indicators. This study found that while the IT industry found the performance of the IT graduates are generally acceptable, the performance is generally not satisfying to the demands of IT industry and require improvement. Thus, this research provides a systematical evaluation of IT major graduate from the perspective of IT industry.

Through the adjustment of curriculum and teaching objectives, strengthening the teaching of experimental courses, carrying out multi-modal teaching, and strengthening the guidance of college students' learning attitudes, the employability of IT major graduates can be improved. At present, there is a big gap between the practical innovation ability of computer professionals and the social needs. It is necessary to carry out reforms and upgrades from the talent training mode, teaching content, teaching methods, and teacher system. From the perspective of the demand side of enterprises, the awareness of college students' career planning is weak, the value orientation of students is biased and utilitarian, and colleges and universities lack specificity in career planning education orientation. This requires long-term attention, training and promotion of society, schools and themselves. In addition, the modern higher education and training system focus on the

|   | Professional ability |   |   |   |   |
|---|---------------------|---|---|---|---|
| 13 | Basic knowledge of computer | 4.093 | 3.200 | 0.893 | 19.942 | 0.000 |
| 14 | Cognitive and operational capability of computer components and hardware | 3.826 | 3.276 | 0.550 | 15.945 | 0.000 |
| 15 | Cognitive and operational capability of software theory | 4.331 | 3.725 | 0.606 | 18.549 | 0.000 |
| 16 | Computational thinking and modeling capabilities | 4.090 | 3.257 | 0.833 | 17.828 | 0.000 |
| 17 | Algorithm design and analysis capabilities | 4.129 | 2.706 | 1.423 | 21.091 | 0.000 |
| 18 | Ability of computer software design and program development | 4.119 | 2.821 | 1.298 | 20.903 | 0.000 |
| 19 | Basic design capability of computer application system | 3.857 | 3.169 | 0.688 | 20.881 | 0.000 |
| 20 | Capability to apply computer for implementing apply system and conducting development and innovation | 3.840 | 3.170 | 0.670 | 18.579 | 0.000 |
| 21 | Computer system development capabilities | 3.600 | 3.009 | 0.591 | 15.894 | 0.000 |
| 22 | Design capability of computer hardware | 3.357 | 2.885 | 0.472 | 11.539 | 0.000 |
| 23 | General ability to use and maintain computer application systems | 3.944 | 3.245 | 0.699 | 20.181 | 0.000 |
| 24 | Mean | 4.013 | 3.184 | 0.829 | 18.150 | 0.000 |
cultivation of hard abilities based on knowledge and skills, while ignoring the soft ability training represented by responsibility, resilience, planning ability, communication and coordination. This requires a targeted promotion strategy from the macro-policy mechanism level, school education and social management at the middle level, and the micro-individual development level.

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