The impact of artificial intelligence on job insecurity: A moderating role based on vocational learning capabilities

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Abstract. In order to explore the psychological impact of artificial intelligence on the job insecurity of manufacturing employees, a quantitative model of artificial intelligence (AI) on employees' job insecurity was constructed by using vocational learning ability as a moderating variable. This paper constructs the measurement model of artificial intelligence on the job insecurity of employees, and makes statistical analysis of the data by using SPSS22.0. The results show that artificial intelligence has no significant negative influence on the job insecurity at present. However, the interaction items between vocational learning ability and artificial intelligence have significant negative effects on job insecurity, and vocational learning ability has a significant moderating effect on job insecurity. This paper has theoretical guidance and practical significance for the government, enterprises and employees to take active measures to solve the structural unemployment problem caused by the development and application of artificial intelligence in the labor market.

1. Introduction

With the decrease of the proportion of labor force and the increase of labor cost, the prospect of traditional manufacturing industry relying on manpower development is not optimistic. At present, artificial intelligence technologies such as computer vision, natural language understanding, cloud computing, smart home and so on are increasingly widely used in the manufacturing industry [1-2]. With the further construction of the industrial chain, it will lead to a wider range of longer-lasting industrial changes. From the Worker's point of view, artificial intelligence has an inevitable impact on the survival of their work or work characteristics, the increase of production efficiency will force manufacturing enterprises to eliminate certain sectors, and reduce the degree of the human-post fitness as well. In this case, workers are required to have a clear understanding of their future career planning and learning abilities. And job insecurity will occur when the anxiety caused by the intervention of new technologies reaches a certain level, which affects the employee's status and work efficiency. Employees’ job insecurity has a great negative effect, which is not conducive to the physical and mental health of the employees, but also to the productivity and organization stability of the enterprises [3-4]. Therefore, it is of great significance to analyze the psychological impact of AI on employees' job insecurity from the perspective of labor force for employees' employment, job performance and the development of enterprises.

2. Research status at home and abroad
2.1. Current state of artificial intelligence
The most widely recognized term of Artificial Intelligence (AI) is "the ability of an agent to achieve a goal in a complex environment" (Goertzel et Al., 2007). It is estimated that China's intelligent industry is one of the fastest growing industries in the world. The market size is expected to reach 71 billion yuan in 2020, with an average annual growth rate of 44.5 percent since 2015. The AI industry has two important characteristics: economies of scale and knowledge intensity (Goldfrab, 2018), such as manufacturing, where the role of intelligent technology is to reduce labor and achieve low-cost customization. Cheng et Al. (2019) conducted a survey of Chinese enterprises and employees [5-7]. The results show that there are significant differences in the application rate of intelligent technology among different industries. The larger the production scale, the higher the capital-labor ratio of the enterprises, the more the demand for the application of artificial intelligence technology. If manufacturing enterprises want to adapt to the uncertain future, they need to abandon the backward mode of production capacity, reduce the dependence of production mode on manpower, step-by-step transformation of enterprise production model (Guan Hao, 2020).

2.2. The impact of artificial intelligence on job insecurity
The employment impact of AI as a compatible new technology will be broader, more powerful and longer lasting than previous technological revolutions (Ford, 2015). Frey and Osborne (2017) argue that artificial intelligence will directly replace 13% of jobs, including those that are more brain-intensive and more financially rewarding, such as finance, accounting and senior management. Many scholars regard the intervention of new technology as the external factor of the organization, which will threaten the stability of the employee's working state. If the organization does not take the corresponding adjustment measures in time, the employee's anxiety will have a negative impact on the organization [8-9]. Greenhalgh and Rosenblatt (1984) originally defined this emotion as job insecurity, the inability of employees to maintain the status quo when threatened at work. In response to the idea that perceived stress at work is the source of employee job insecurity, Hobfoll (1989) proposed a resource protection model, in which the worker, when the external factors of the organization change, they tend to strive to maintain and protect the status quo, and when they perceive uncertainty about access to resources, or their own inability to protect resources, personal stress in response to environmental change translates into job insecurity.

Hu sanman and Li Zhongbin (2010) believed that employees' job insecurity resulted from subjective threat, and different behavioral outcomes resulted from individual differences and job-dependence differences, and summed up the job insecurity of employees in Chinese enterprises into five-dimensional structure, they include job holding insecurity, job performance insecurity, pay promotion insecurity, excessive competition insecurity and Interpersonal Insecurity 9. Further analysis in Dengzhou shows that AI is different from general technological progress, the impact on employment will be more far-reaching, inevitably resulting in a decline in the share of employees' labor income or even changes in the employment structure, this is related to job insecurity, pay promotion insecurity and excessive competition insecurity. On the basis of this theory, the following research in this paper will focus on the individual differences of employees and select the three dimensions of Job Insecurity, Compensation Promotion Insecurity and excessive competition insecurity in the five-dimensional model, the moderating effect of vocational learning ability is explained, and the psychological influence of artificial intelligence on job insecurity is discussed.

2.3. The moderating effect of vocational learning ability
Vocational learning ability can reflect the individual's ability to deal with the challenges brought by the change of environment. Vocational learning ability is directly proportional to the employee's ability to adapt to the change of environment (Wang Yifu, 2016), enhancing employees' ability to accept new knowledge and skills is beneficial to reducing the pressure in the workplace. Employees' understanding of their position, salary level and work focus is directly influenced by their level of vocational learning ability [10-12]. Many employees' job anxiety comes from their unclear self-
positioning in the workplace, lack of active awareness of the changes in the organizational environment, always passive to bear the pressure brought by external factors, resulting in work psychology and work status affected.

3. Research design

3.1. Scale construction

The questionnaire used in this study consists of two parts. The first part is basic information collection, including six items: "Sex, age, highest educational level, nature of unit, household registration, number of children". The second part is made up of the questionnaire of Investigation and research variables, which selects the mature scale of the existing research, and makes some modifications according to the research contents of this paper, the artificial intelligence scale is based on the scale utilization scale for industrial robots developed by Wang Cai (2019) and the work insecurity scale developed by Hu Sanman and Li Zhongbin, the vocational learning ability scale is based on the vocational learning ability scale developed by Wang Yifu and others, which adopts Likert-5 scoring method. The classification and contents of the scale are shown in Table 1:

| Scale | Dimensions                              |
|-------|-----------------------------------------|
| Artificial Intelligence                 | Artificial Intelligence Cognition       |
| Job Insecurity                         | Job Holding Insecurity                  |
|                                              | Pay Promotion Insecurity                |
|                                              | Excessive Competition Insecurity        |
| Vocational Learning Ability              | Vocational Learning Ability             |

Control Variables: Sex, age, education, unit nature, household registration and number of children.

3.2. Research assumptions

According to the model of Job Insecurity, which was proposed by Greenhalgh and others, it can be concluded that the measures taken by employees to deal with the objective threat come from their subjective cognition of the threat factor, this model is discussed from two aspects: The severity and the staff's sense of powerlessness. Through simple communication with the survey subjects, we can see that the effect of artificial intelligence on employees' job insecurity is not significant at present, mainly because of the influence of individual differences such as employees' knowledge and skill level, vocational learning ability, and work experience, etc., the more limited employees' knowledge of new technology, the more powerless they feel and the more stressed they are, and the more likely they are to have anxiety. Therefore, this paper proposes the following assumptions (Table 2):

| Hypothesis | Assumed Fractal Dimension |
|------------|---------------------------|
| Artificial intelligence has a negative impact on employees' job insecurity | The more comprehensive employees' knowledge of AI, the lower their job insecurity |
| | The more comprehensive employees' knowledge of AI, the lower their excessive competition insecurity |
| | The more comprehensive the employee's knowledge of AI, the less their excessive competition insecurity |
| Vocational learning ability plays a moderating role between artificial intelligence and job insecurity | Vocational learning ability mediates between artificial intelligence and job insecurity |
| | Vocational learning ability plays a moderating role between artificial intelligence and insecurity of salary promotion |
| | Vocational learning ability mediates between artificial intelligence and over-competitive insecurity |
3.3. Model architecture
According to the current situation of the application of artificial intelligence technology in the manufacturing industry, the causes, nature, consequences of organizational behavior and the impact of the application of artificial intelligence technology on employees’ job insecurity, etc., the vocational learning ability is selected as the moderating variable to construct the model frame as shown in Figure 1.

![Diagram of Research Model Framework]

Figure 1. Research Model Framework.

4. Empirical Analysis

4.1. Data sources
The data in this study were collected mainly through online survey. A total of 225 questionnaires were collected from the manufacturing and production-related employees of Hunan Shengxiang Science and Technology Co., Ltd. and Sinopharm Holdings Hunan Co., Ltd., after screening the questionnaire which does not accord with common sense, a total of 206 valid questionnaires were obtained, the questionnaire has an efficiency of 91.56%.

4.2. Statistical analysis methods
This study used SPSS 22.0 to analyze and test the collected data. Then, the results of data analysis are used to test the hypothesis proposed in this study, and to explore the relationship between the variables and the degree of influence.

4.3. Reliability test of the scale
In this study, the Crunbach's Alpha Coefficient (referred to as the Alpha Coefficient below) was used to test the reliability of each variable (Table 3):

| Variable                | Dimensions                  | Cronbach’s Alpha | Number of terms |
|-------------------------|-----------------------------|------------------|-----------------|
| Artificial intelligence | Artificial Intelligence cognition | 0.903            | 6               |
|                         | Job Holding Insecurity      | 0.874            | 3               |
|                         | Pay Promotion Insecurity    | 0.856            | 3               |
|                         | Excessive Competition Insecurity | 0.860            | 3               |
| Vocational Learning Ability | Vocational Learning Ability | 0.888            | 2               |

The above five items are all >0.8, indicating good reliability and do not need to be revised, the reliability of this questionnaire is good.

4.4. Validation of the scale
First, KMO and Bartlett tests were performed on the scale, and then factor analysis was performed on the basis of the first test. The KMO value greater than 0.5 was used as the retention criterion (Table 4).
4.5. Correlation analysis

The linear correlation is analyzed using Pearson product-moment Correlation Coefficient R, as shown in Table 5.

**Table 4. Validation testing.**

| Variable                  | Dimensions                        | KMO   | Approximate chi-square | Df   | Sig   | Number of terms |
|---------------------------|-----------------------------------|-------|------------------------|------|-------|-----------------|
| Artificial intelligence   | Artificial Intelligence cognition  | 0.905 | 711.131                | 15   | 0.000 | 6               |
| Job insecurity            | Job Holding Insecurity            | 0.731 | 317.088                | 3    | 0.000 | 3               |
|                           | Pay Promotion Insecurity          | 0.721 | 281.479                | 3    | 0.000 | 3               |
|                           | Excessive Competition Insecurity  | 0.733 | 282.840                | 3    | 0.000 | 3               |
| Vocational Learning Ability | Vocational Learning Ability     | 0.500 | 207.175                | 1    | 0.000 | 2               |

**Table 5. Correlation Analysis.**

| Variable                          | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10    | 11    |
|-----------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1 Sex                             | 1     | -     |       |       |       |       |       |       |       |       |       |
| Sig                               | -     |       |       |       |       |       |       |       |       |       |       |
| Sig)                              | 0.166*|       |       |       |       |       |       |       |       |       |       |
| 2 Age                             |       |       |       |       |       |       |       |       |       |       |       |
| Sig                               | 0.003 | 0.161*|       |       |       |       |       |       |       |       |       |
| Sig)                              |       |       |       |       |       |       |       |       |       |       |       |
| 3 Educational background           |       |       |       |       |       |       |       |       |       |       |       |
| Sig                               |       |       |       |       |       |       |       |       |       |       |       |
| Sig)                              |       |       |       |       |       |       |       |       |       |       |       |
| 4 Length of service               |       |       |       |       |       |       |       |       |       |       |       |
| Sig                               | -0.106| 0.838**| 0.006 |       |       |       |       |       |       |       |       |
| Sig)                              |       |       |       |       |       |       |       |       |       |       |       |
| 5 Post                            |       |       |       |       |       |       |       |       |       |       |       |
| Sig                               | -0.014| 0.269**| 0.380**| 0.164*|       |       |       |       |       |       |       |
| Sig)                              |       |       |       |       |       |       |       |       |       |       |       |
| 6 Vocational Learning Ability     |       |       |       |       |       |       |       |       |       |       |       |
| Sig                               | 0.008 | -0.137*| 0.475**| 0.199**| 0.152*|       |       |       |       |       |       |
| Sig)                              |       |       |       |       |       |       |       |       |       |       |       |
| 7 Artificial Intelligence cognition|       |       |       |       |       |       |       |       |       |       |       |
| Sig                               | -0.049| 0.259**| 0.441**| 0.361**| 0.133 | 0.527**|       |       |       |       |       |
| Sig)                              |       |       |       |       |       |       |       |       |       |       |       |
| 8 Interactive term                |       |       |       |       |       |       |       |       |       |       |       |
| Sig                               | -0.012| -0.145*| 0.542**| -0.224**| 0.243**| 0.930**| 0.772**|       |       |       |       |
| Sig)                              |       |       |       |       |       |       |       |       |       |       |       |
| 9 Job Holding Insecurity          |       |       |       |       |       |       |       |       |       |       |       |
| Sig                               | 0.042 | 0.383**| 0.416**| 0.311**| 0.389**| 0.434**| -0.032 |       |       |       |       |
| Sig)                              |       |       |       |       |       |       |       |       |       |       |       |
| 10 Pay Promotion Insecurity       |       |       |       |       |       |       |       |       |       |       |       |
| Sig                               | 0.004 | 0.192**| 0.414**| -0.116 | -0.332 | 0.557**| 0.180**| -0.496**| 0.759**|       |       |
| Sig)                              |       |       |       |       |       |       |       |       |       |       |       |
| 11 Excessive Competition Insecurity|       |       |       |       |       |       |       |       |       |       |       |
| Sig                               | 0.008 | 0.273**| 0.446**| -0.192**| 0.377**| 0.508**| -0.163**| -0.467**| 0.795**| 0.831**|       |
| Sig)                              |       |       |       |       |       |       |       |       |       |       |       |
| Mean value                        | 1.549 | 2.238 | 1.917 | 2.180 | 1.524 | 3.100 | 3.689 | 11.806 | 2.6974 | 3.0146 | 3.0728 |
| Standard value                    | 0.499 | 0.935 | 0.910 | 0.953 | 0.859 | 0.944 | 0.750 | 4.977 | 0.901  | 0.860  | 0.936  |

Note: *p<0.05; **p<0.01; N=206
4.6. Regression analysis

First, the four models that regression analysis needs to use are explained:

Model 1: Regression of control variable to result variable.

Model 2: Regression of independent variable and control variable to result variable.

Model 3: Regression of independent variables, moderating variables and controlling variables to the outcome variables.

Model 4: Independent variable, adjustment variable, product of independent variable and adjustment variable and regression of control variable to result variable.

The results of the regression analysis are shown in tables 6, 7, 8 and 9.

Table 6. Regression analysis of Model 1.

| Variable                  | Job Holding Insecurity | Sig  | Pay Promotion Insecurity | Sig  | Excessive Competition Insecurity | Sig  |
|---------------------------|------------------------|------|--------------------------|------|----------------------------------|------|
| Sex                       | -0.001                 | 0.275| -0.012                   | 0.477| -0.019                           | 0.454|
| Age                       | -0.158                 | 0.000| -0.067                   | 0.003| -0.108                           | 0.000|
| Educational background    | -0.312                 | 0.000| -0.334                   | 0.000| -0.350                           | 0.000|
| Length of service         | -0.144                 | 0.000| -0.030                   | 0.048| -0.067                           | 0.003|
| Post                      | -0.204                 | 0.000| -0.182                   | 0.000| -0.204                           | 0.000|
| R2                        | 0.314                  | 0.215| 0.275                    |      |                                  |      |
| F                         | 18.309                 | 10.952|                         |      |                                  | 15.203|

In Model 1, the data showed that age, educational background, length of service and position all had significant negative effects on job insecurity and inhibited job insecurity, the effect of gender on job insecurity is not significant.

Table 7. Regression analysis of Model 2.

| Variable                  | Job Holding Insecurity | Sig  | Pay Promotion Insecurity | Sig  | Excessive Competition Insecurity | Sig  |
|---------------------------|------------------------|------|--------------------------|------|----------------------------------|------|
| Artificial intelligence (M) | -0.206                 | 0.324| -0.056                   | 0.005| -0.053                           | 0.009|
| Sex                       | 0.005                  | 0.275| -0.017                   | 0.477| -0.024                           | 0.454|
| Age                       | -0.150                 | 0.000| -0.074                   | 0.003| -0.115                           | 0.000|
| Educational background    | -0.339                 | 0.000| -0.309                   | 0.000| -0.326                           | 0.000|
| Length of service         | -0.127                 | 0.000| -0.045                   | 0.048| -0.082                           | 0.003|
| Post                      | -0.206                 | 0.000| -0.180                   | 0.000| -0.202                           | 0.000|
| R2                        | 0.316                  | 0.217| 0.277                    |      |                                  |      |
| F                         | 15.351                 | 9.192| 12.723                   |      |                                  |      |

Table 8. Regression analysis of Model 3.

| Variable                  | Job Holding Insecurity | Sig  | Pay Promotion Insecurity | Sig  | Excessive Competition Insecurity | Sig  |
|---------------------------|------------------------|------|--------------------------|------|----------------------------------|------|
| Artificial intelligence (M) | 0.238                  | 0.324| 0.152                    | 0.005| 0.129                            | 0.009|
| Vocational Learning Ability (N) | -0.498                | 0.000| -0.581                   | 0.000| -0.509                           | 0.000|
| Sex                       | 0.008                  | 0.275| -0.014                   | 0.477| -0.021                           | 0.454|
| Age                       | -0.215                 | 0.000| -0.151                   | 0.003| -0.182                           | 0.000|
| Educational background    | -0.171                 | 0.000| -0.114                   | 0.000| -0.155                           | 0.000|
| Length of service         | -0.108                 | 0.000| -0.023                   | 0.048| -0.062                           | 0.003|
| Post                      | -0.204                 | 0.000| -0.176                   | 0.000| -0.199                           | 0.000|
| R2                        | 0.475                  | 0.433| 0.443                    |      |                                  |      |
| F                         | 25.628                 | 21.595|                         |      |                                  | 22.521|
Table 9. Regression analysis of Model 4.

| Variable                  | Job Holding Insecurity | Sig | Pay Promotion Insecurity | Sig | Excessive Competition Insecurity | Sig |
|---------------------------|------------------------|-----|--------------------------|-----|----------------------------------|-----|
| Artificial intelligence (M) | 0.594                  | 0.324 | 0.153                    | 0.005 | 0.259               | 0.009 |
| Vocational Learning Ability (N) | 0.141               | 0.000 | -0.578                  | 0.000 | -0.275              | 0.000 |
| Interactive term (M×N) | -0.889                 | 0.000 | -0.003                  | 0.000 | -0.325              | 0.000 |
| Sex                      | 0.017                  | 0.275 | -0.013                  | 0.477 | -0.017              | 0.454 |
| Age                      | -0.174                 | 0.000 | -0.150                  | 0.003 | -0.167              | 0.000 |
| Educational background   | -0.174                 | 0.000 | -0.114                  | 0.000 | -0.156              | 0.000 |
| Length of service        | -0.109                 | 0.000 | -0.023                  | 0.048 | -0.063              | 0.003 |
| Post                     | -0.159                 | 0.000 | -0.176                  | 0.000 | -0.183              | 0.000 |
| R2                       | 0.491                  | 0.433 | 0.445                   |      |                    |      |
| F                        | 23.760                 | 18.800 | 19.774                 |      |                    |      |

Table 10. Regulatory Effect of Vocational Learning Ability.

| Variable                  | R2 of Model 3 | R2 of Model 4 | △R2 |
|---------------------------|---------------|---------------|-----|
| Job Holding Insecurity   | 0.475         | 0.491         | 0.016 |
| Pay Promotion Insecurity | 0.433         | 0.433         | 0.000 |
| Excessive Competition Insecurity | 0.443 | 0.445 | 0.002 |

In Model 2, the results showed that the correlation between job holding insecurity and AI, pay promotion insecurity and AI, excessive competitive insecurity and AI are all not significant.

Comparing the results of regression analysis of model 3 and model 4 summarized in Table 10, it is found that R2 of model 4 is slightly higher than R2 of model 3, and the partial regression coefficient of MN between artificial intelligence variable and vocational learning ability variable is significant. It can be concluded that employees' vocational learning ability plays an obvious moderating role in the relative relationship between artificial intelligence and job insecurity, and the moderating role of vocational learning ability strengthens the correlation between them, it shows that the introduction of the adjusting variable is reasonable.

4.7. Results

Using Tables 11, the results of the above hypothesis tests are summarized as follows:

Table 11. Hypothesis test results.

| Hypothesis | Result |
|------------|--------|
| H1a: Artificial intelligence has a negative impact on employees' job insecurity | Support |
| H1b: The more comprehensive employees' knowledge of AI, the lower their job holding insecurity | Support |
| H1c: The more comprehensive the employee's knowledge of AI, the less their excessive competition insecurity | Support |
| H2a: Vocational learning ability mediates between artificial intelligence and job holding insecurity | Support |
| H2b: Vocational learning ability plays a moderating role between artificial intelligence and insecurity of salary promotion | Support |
| H2c: Vocational learning ability mediates between artificial intelligence and over-competitive insecurity | Support |
5. Conclusions
In this paper, the employee's job insecurity is regarded as the outcome variable of artificial intelligence, and the job insecurity is divided into three dimensions. Firstly, the influence of artificial intelligence on job insecurity in different dimensions is assumed; secondly, the moderating effect of vocational learning ability on the two is assumed. The results show that AI has no significant negative effect on the job holding insecurity, salary promotion insecurity and excessive competition insecurity. Generally speaking, there is no significant negative influence of artificial intelligence on employees' job insecurity. Although the main effects of AI and job insecurity were not significant, vocational learning ability, as a moderator variable, played an important role in clarifying the negative effects between them. The interaction items of vocational learning ability and artificial intelligence have significant negative influence on job insecurity, and they showed significant negative correlation, vocational learning ability had a significant moderating effect on the effect of AI on job insecurity. The clearer the cognition of AI is, the stronger the vocational learning ability is, the weaker their job insecurity is, the healthier their work psychology is, and vice versa, the more ambiguous the artificial intelligence cognition and the weaker their vocational learning ability are, the stronger the job insecurity is and the less optimistic their working state is. Therefore, the government, enterprises and employees should consider the development and application of artificial intelligence to the possible structural unemployment in the labor market and take active measures to deal with it, to achieve the harmonious and win-win situation of employment and job performance of employees and enterprise development.

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