An Empirical Analysis of Employment Motivation and Career Choice of Graduates of Master of Engineering ——Based on Principal Component Factor Analysis and Binary Logit Regression Model

Wei Liu

e-mail: liuwei052040087@163.com

Shaoyang University, Shaoyang, China

Abstract: Taking 205 graduates of Masters of Engineering as the survey objects, their employment motivation, career choice and training evaluation were analyzed by principal component factor analysis and binary logit regression model. The study found that: the average year-end employment rate of the 2015-2020 engineering master students reached 99.31%; Factors, such as the industry background and guidance frequency of the tutor, the development and investment of professional practice, the course setting and teaching method, the patent acquisition situation, satisfaction with the professional level as well as knowledge and skills, have a significant impact on the employment motivation and career choice of graduate students of engineering masters.

Keywords: Graduates of Engineering Masters; Employment Motivation and Career Choice; Influencing Factors; Principal Component Factor Analysis; Binary Logit Regression Model

1 Introduction

Since the start of postgraduate education in engineering in 1998 in our country, more than 800,000 high-level applied engineering talents have been trained for economic and social development and industrial transformation and upgrading. Therefore, this paper selects graduate students of Engineering Master's degree as the research object, investigates the employment motivation and career choice of graduates, and analyzes the influencing factors of the training process, trying to explore and think about the training characteristics of Engineering Master's degree graduate students through the window of employment motivation and career choice.

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2 Research design

2.1 Selection of Research Data and Samples

The data of this research comes from the year-end employment data of non-directed engineering master graduates who have established employment units in S University from 2015 to 2020 and filled in and verified in the Employment Office Information System of Graduates of Colleges and Universities in Hunan Province. In the past six years, S University has a total of 205 graduates of the Master of Engineering who have found employment units, including 143 males (69.76%) and 62 females (30.24%); the professional categories are distributed among mechanical engineering 105 (51.22%), food Engineering 100 people (48.78%).

In March 2022, through the Internet electronic questionnaire, an online census of "Occupational Choice and Training Evaluation Feedback for Master of Engineering Graduates" was carried out on 205 graduates of engineering master's degree, including practical experience, course offering and teaching, patent application and publications, employment motivation and career choice, etc.

The proportion of males and females in this survey sample is basically similar to the overall situation of 63.4% male and 37.6% female graduates of Engineering Master's degree announced by Hunan Province in 2015, so the sample of this survey is representative to a certain extent.

2.2 Research Framework and Research Methods

According to the literature research, it is found that the employment motivation and career choice of postgraduates are related to background factors such as individual characteristics, career preferences, and other training effect factors such as knowledge level and practical ability. Meanwhile, some factors in the training process, such as the background and guidance of tutors, and course learning, also have certain influence on their employment motivation and career choice. Therefore, based on the questionnaire data of graduates and the actual training situation of Engineering Master's students, this research established the research framework of Figure 1. Using principal component factor analysis, we first simplified and clustered some of the highly correlated factors in the questionnaire, then analyzed the influencing factors of the career choices of graduates of engineering masters through binary logit regression model, and finally summarized the employment motivation and the overall status and characteristics of career choices of graduates of Engineering Masters.

2.3 Selection and Processing of Variable Measurements

This paper uses the principal component factor analysis method to analyze the questionnaire samples, and excavates the influencing factors of the employment destination and career choice of Engineering Master's graduates. Before factor analysis, the KMO value was 0.861 by KMO test and Bartlett sphericity test, and the Bartlett sphericity test was significant, indicating that it is suitable to use principal component factor analysis to explore the potential mathematical relationship and structure between these subjective evaluations in the questionnaire.

Principal Component Factor Analysis

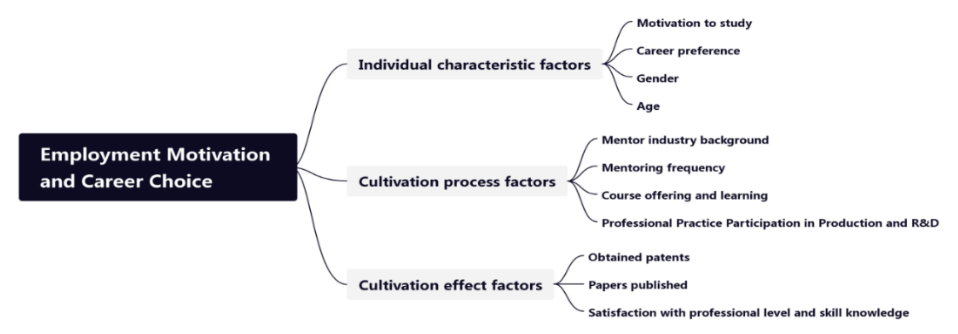

Figure 1 An Analysis Framework of the Influencing Factors of Employment Motivation and Career Choice of Engineering Master's Graduates

Rotate the variables $X_{1,}X_2$ of the coordinate system in the sample counterclockwise by θ degrees to obtain a new coordinate axis Y_1, Y_2. The formula is as follows:

$$\begin{Bmatrix} Y \\ Y \end{Bmatrix} = \begin{Bmatrix} cos\theta & sin\theta \\ -sin\theta & cos\theta \end{Bmatrix} \begin{Bmatrix} x \\ x \end{Bmatrix} = U'x \tag{1}$$

$$U' = U^{-1}, \quad U'U = I \tag{2}$$

After rotation, the information in the questionnaire achieves the purpose of dimensionality reduction. From the factor analysis results, 19 factors can be clustered into 3 common factors, and the sum of the variances of the 3 common factors accounts for 86.854% of the total variance. The principal components are named according to the absolute value of the correlation coefficient. They are: individual characteristic factors, training process factors, and training effect factors. (see Table 1)

Table 1 Factor analysis results

Name of Factors	Common Factors		
	Y_1	Y_2	Y_3
Learning Motivation	.379	.404	.538
Occupational Preferences	.676	.734	.761
Gender	.836	.039	.017
Age	.202	.130	.176
Whether the mentor has an industry background	.897	.851	.846
Guidance Frequency of the Mentor	.762	.801	.814
Mentors provide guidance on career planning and employment	.906	.903	.919
How helpful the courses are to professional practice	.809	.812	.852
Teachers' Emphasis on Teaching and Teaching Methods	.752	.743	.774

Professional Practice Participation in Production, Research and Development	.725	.979	.939
Course Assessment	.522	.615	.506
Thesis Proposal and Mid-term Assessment	.503	.614	.620
Dissertation Evaluation and Defense	.551	.598	.582
Patent Acquisition	.846	.901	.916
Number of Papers Published and Type of Publications	.203	.377	.259
Degree of Satisfaction of Master of Engineering Graduates with Professional Level and Knowledge and Skills	.904	.955	.967
Satisfaction with Career Guidance and Services	.918	.964	.973
Satisfaction with School Book and Literature	.541	.642	.631
Satisfaction with Financial Support for Awards and Professional Practice	.491	.513	.506

Correlation Analysis: Correlation analysis is a statistical method to judge the degree of correlation between research variables by correlation coefficient. Whether the correlation coefficient is significant, the size and range of the sig value can further determine whether the influence of which variables are more significant for a specified variable. Further research can be done for other statistical methods such as regression analysis to provide prediction and control [1]. Using the Pearson Correlation Coefficient formula, X, Y are the variables, COV (X, Y) is the covariance, and the standard deviation is the expected value of the variables X, Y.

$$\rho x, y = \frac{COV(X,Y)}{\delta_X \delta_Y} = \frac{E[(X-\mu_X)(Y-\mu_Y)]}{\delta_X \delta_Y} \quad (3)$$

After importing the control variable data into the SPSS26 software, the correlation analysis of the variables can be carried out. The analysis results are shown in Table 2.

Table 2 Correlation Analysis of Employment Motivation and Career Choice with Individual, Training and Other Factors

Independent Variable Factor		Correlation Coefficient with Employment Motivation and Career Choice	Sig Value
Individual Characteristic Factor	Learning Motivation	0.717**	.009
	Professional Preferences		
	Gender		
	Age		
Training Process Factor	Mentor’s Industry Background	0.765**	.000
	Mentor’s Guidance Frequency		
	Professional Practice Particpation in Production, Research and Development		
	Course Setting and Learning Situation		
Training Effect Factor	Patent Acquisition	0.747**	.003
	Papers Published		

	Satisfation with Professional Level and Knowledge Skills		

Note: ** indicates a significant correlation, and a sig value <0.01 indicates a significant difference

The analysis results show that the correlation coefficients between employment motivation and career choice and individual characteristic factors, training process factors and training effect factors are all above 0.7, and the sig value is less than 0.01, which indicates that the three independent variables are related to the target factors of employment motivation and career choice. There is a high correlation between the two factors and the differences between the index factors are significant, which is suitable for regression analysis, which also shows the rationality of the design of this research framework to a certain extent.

3 Analysis of influencing factors of employment motivation and career choice

3.1 Binary Logit Regression Model Construction

Using the survey data, a number of variables such as individual characteristic factors, training process factors, and training effect factors were included in the binary logit regression model in an orderly manner. The specific formula is as follows:

$$P_i = F(Z_i) = f(\alpha + \beta X_i + \mu) = \frac{1}{1+e^{z_i}} \tag{4}$$

$$\ln \frac{p_i}{1-P_i} = Z_i = \alpha + \beta X_i + \mu \tag{5}$$

The formula$P_i$is the employment motivation of engineering graduates, X_i=1, 2, and 3 are the three explanatory variables of individual characteristic factor, training process factor and training effect factor, in which μ are error terms and β are estimated parameters.

3.2 Analysis of Model Results

Using the computing software Eviews8 to perform regression analysis on the sample data, the results are shown in Table 3. Personal background factors, training process and training effect factors have a significant impact on the employment motivation and career choice of engineering graduates. It can be seen from the regression analysis results (see Table 3)

Table 3 Binary Logit Regression Analysis of Employment Motivation and Influencing Factors of Career Choice of Engineering Master Students

	Independent Variables		P_i: Employment Motivation and Career Choice
Individual Characteristic	Learning Motivation	Motivation of Scientific Research	-0.046**

Factor		Get a Better Job Opportunity	0.068***
	Professional Preferences	Professional Technical Occupation	0.054***
		Non-Professional Technical Occupation	0.023*
	Gender	Male (female is the reference category)	0.017***
	Age	Over 30 Years Old	0.005
		Below 30 Years Old	0.002
Training Process Factors	Whether the mentor has an industry background	Yes	0.320***
	Mentor's Guidance Frequency		0.240***
	Number of Subjects Involved		0.208
	Professional practice participation in production and research and development		0.455***
	Course Setting and Learning Condition		0.336***
Training Effect Factors	Patent Acquisition		0.362***
	Papers Published		0.308
	Satisfaction Degree with Professional Level and Knowledge and Skills		0.320***

Note: *** means significant level p<0.01, ** means significant level p<0.05, * means significant level P<0.1.

First, the influence of individual characteristic factors on employment motivation and career choice. The gender, study motivation and career preference of engineering master's graduates have significant effects on employment motivation and career choice, while age has no significant effect on dependent variables. Male engineering master graduates are significantly higher than women; the stronger the scientific research motivation of engineering masters, the lower their employment motivation [3]; engineering masters are more inclined to professional and technical occupations in terms of occupational preferences.

Second, the influence of training process factors on employment motivation and career choice. Factors such as the tutor's industry background and instruction frequency, the satisfaction of course offering and learning, and professional practice participation in production and R&D have a significant impact on employment motivation and career choice. The number of engineering graduate students participating in projects has no significant impact on the dependent variable.

Third, the effect of training effect factors on employment motivation and career choice. The training effect factors such as patent acquisition, professional level, knowledge and skill satisfaction of engineering master students have a significant impact on the dependent variable, while the publication situation has no significant impact on the dependent variable. Under the control of individual characteristics and training process factors, the more patents obtained by engineering master students, the stronger their willingness to be employed; the higher the satisfaction with their professional level, knowledge and skills, the higher the employment satisfaction of engineering master students [4], as well as the degree of professional counterpart and technical counterpart of career choice.

4 The overall situation and characteristics of employment motivation and career choice

Affected by individual characteristic factors, training process and training effect factors, the employment destination and career choice of graduates of engineering masters show the following characteristics:

First, according to the year-end employment and unemployed statistics of engineering graduates (Table 4): 205 engineering graduates were employed from 2015 to 2020, the average year-end employment rate for six consecutive years was 99.31%, and 2 were suspended., the average suspended employment rate was 0.97%. Among them, the year-end employment rate for five consecutive years from 2015 to 2019 was 100%; the employment rate for the 2020/2021 school year was the lowest, only 95.83%, but the year-end employment rate and the average 6-year employment rate both exceeded 95%.

Table 4 Statistics on Year-end Employment and Employment Suspension of Graduates of Engineering Masters

Academic Year	Employment (person)	Employment Rate (%)	Employment Suspesion (person)	Employment Suspesion Rate (%)
2015/2016	33	100%	0	0%
2016/2017	34	100%	0	0%
2017/2018	33	100%	0	0%
2018/2019	27	100%	0	0%
2019/2020	32	100%	0	0%
2020/2021	46	95.83%	2	4.17%

The Occupational Classification of the People's Republic of China (2007 Supplement) divides China's occupations into 8 major categories, 66 middle categories, 413 subcategories, and 1838 subcategories (that is, specific occupations) [2]. When coding the sample data in the research process, take the nature of the actual job as the standard, comprehensively consider the type of employment, the nature of the unit and the distribution of the industry. Continuing to study for a doctoral degree is classified as an academic occupation; professional and technical work in enterprises, public institutions and government agencies is classified as professional and technical occupations; the rest are non-professional and technical occupations, including government agencies, enterprises and institutions engaged in administrative work, joining the military and self-reliance Entrepreneurship, etc.

Second, from the distribution of career choices of engineering graduates (Figure 2), it can be seen that the proportion of people who choose professional and technical occupations is the highest. From 2015 to 2020, the total number of engineering graduates engaged in professional and technical occupations was 155, accounting for 75.61% of the total, and the total number of non-professional and technical occupations was 9, accounting for only 4.39% of the total number.

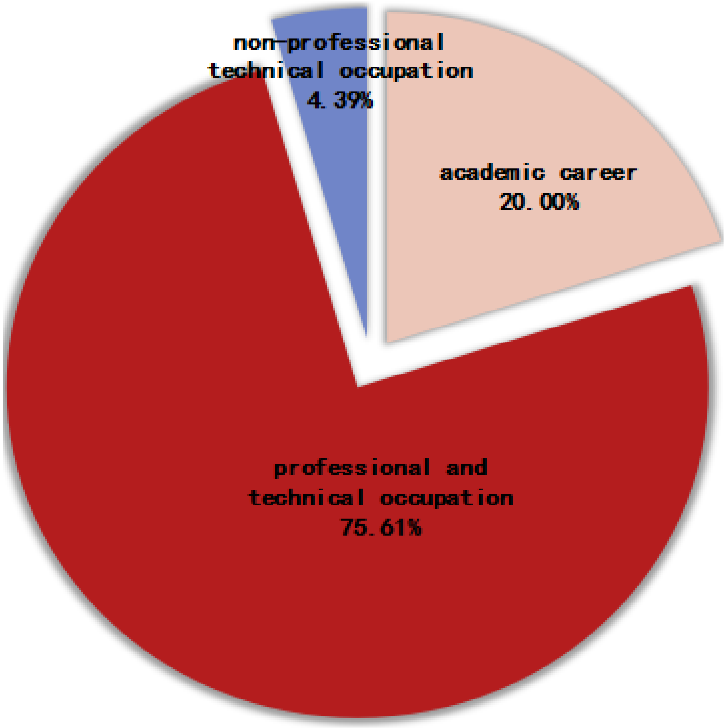

Figure 2 Statistical Chart of Different Types of Career Choices for Engineering Graduates

Third, the characteristics of employment localization are obvious, and municipalities directly under the Central Government have become new hot spots. The distribution of occupational choices of graduates of engineering masters by province (Figure 3) shows that 130 graduates are employed in Hunan Province, and Guangdong, Henan, and Jiangsu are the three provinces outside the school territory where graduates are most employed. At the same time, Shanghai, Beijing and Chongqing have become new hotspot cities for graduate employment. This shows that the localized employment of engineering graduates is obvious, and 63.41% of graduates are employed in Hunan Province; municipalities such as Shanghai, Beijing and Chongqing have become new employment hotspots, and 6.34% of graduates have chosen to work here in the past five years. employment in three municipalities, which also shows that engineering graduates are more likely to seek job opportunities in cities with relatively more developed economies.

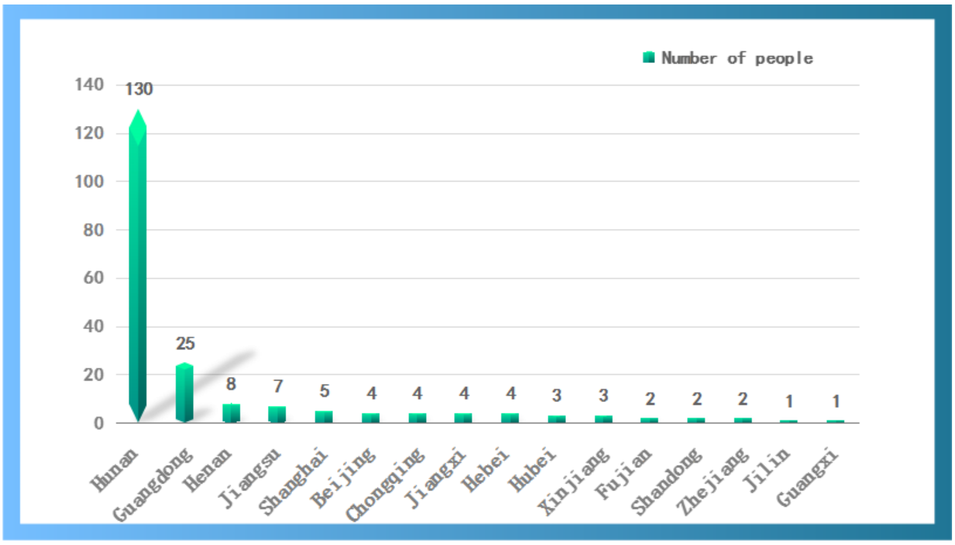

Figure 3 Distribution Map of Provinces Where Graduates of Engineering Masters Choose Their Careers

5 Consideration

5.1 Strengthen employment guidance and focus on professional master's career development

Schools should carry out targeted employment guidance at the time of admission according to the characteristics of professional categories and industry talent needs, combined with students' job-seeking willingness and abilities, to interpret national policies, analyze the employment situation and industry talent needs [5], and guide students at the same time. Combine theoretical learning and professional practice experience and ability demonstration to carry out personalized career planning to prepare for career choice. Tutors should also teach students in accordance with their aptitudes and research directions, design career development paths individually, and provide targeted career development guidance.

5.2 Meet social needs and formulate study plans and career development plans in a timely manner

In the training of professional masters, training objectives and quality evaluation standards should be increased according to the characteristics of different occupations [6]. The employment expectation is for postgraduates engaged in professional and technical work in enterprises and institutions. In addition to cultivating professional practical ability and technological innovation ability, it is necessary to expand humanistic knowledge such as management, legal affairs and culture, and to enhance the ability of language expression and representation of problems. Degree From the topic selection to the content, the thesis should be closely related to the core practice of engineering technology such as technological innovation or product development in the production line of enterprises. Graduate students whose employment is expected to be academic research should pay more attention to cultivating their teaching ability, scientific research ability and interdisciplinary research ability.

5.3 Improve the guiding power of public opinion on employment

Local governments and employers should adhere to the correct principles of employment, and not "only based on academic qualifications" to give graduates of engineering masters the opportunity to demonstrate their professional abilities. Enterprises and institutions should provide suitable talent recruitment positions according to the number and scale of technological innovation projects to avoid waste of human resources; scientific research units in colleges and universities should help graduates build channels and paths for career development and academic growth, and ensure engineering graduates. Apply what you have learned, and learn from each other.

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