

# Research on the Evaluation Model of Automotive Talents Based on Factor Analysis Method

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## ABSTRACT

With the rapid development of the automotive industry, the demand for high-quality talents is increasing day by day. This article uses factor analysis method to construct an automotive talent evaluation model, aiming to help enterprises select and cultivate talents more effectively through the analysis of talent characteristics. The research results indicate that professional basic theories, professional technical skills, innovative thinking ability, project management skills, and market & industry development awareness are key factors affecting the identification evaluation of automotive talents.

## KEYWORDS

Factor analysis; Automotive talents; Evaluation model; Ability

## 1. INTRODUCTION

In recent years, research on talent evaluation has gradually increased, especially in the automotive industry. Many scholars use different methods to analyze talent characteristics, but there is relatively little systematic research. Factor analysis, as an effective data dimensionality reduction technique, can help researchers identify potential talent characteristics [1-2].

Currently, there are various methods for talent assessment, including but not limited to performance evaluation, ability testing, 360 degree feedback evaluation, etc. These methods have their own advantages and disadvantages, but in practical operation, they often have certain limitations, such as single indicators and strong subjectivity. Factor analysis method, as a multivariate statistical technique, can effectively handle multivariate data, reveal the potential structure and patterns of the data, therefore it has been widely used in the field of talent assessment.

The talent evaluation model for the automotive industry is a systematic method used for selecting, cultivating, and evaluating the abilities of various professional talents in the automotive industry. The research on the evaluation model of automotive talents based on factor analysis method is an interdisciplinary topic involving multiple fields such as human resource management, automotive engineering, and data analysis. Some studies focus on building a talent capability model for the automotive industry, using factor analysis to identify key factors that affect career success, such as technical ability, teamwork ability, innovation ability, etc. Domestic scholars have begun to use factor analysis methods to analyze the quality structure of talents in the automotive industry, identifying industry-specific talent needs and ability requirements. Using questionnaire surveys and data analysis tools to identify key factors that affect automotive talent performance, such as professional knowledge, practical skills, and communication abilities [3-4].

This article combines the characteristics of the automotive industry with human resource management theory, targeting professional technical practitioners with certain work and practical experience, in

order to accurately measure the work ability, development potential, and adaptability to industry changes and technological progress of talents in specific positions, facilitate enterprise managers or other groups to quickly identify talent characteristics and problems, and provide targeted solutions. Aiming to build an automotive talent evaluation model, through the analysis of talent characteristics, to help enterprises select and cultivate talents more effectively. Talent cultivation not only enhances the technological innovation and market adaptability of enterprises, but also strengthens employee satisfaction and loyalty, laying a solid foundation for the high-quality development of enterprises [5-6].

## 2. PRINCIPLE OF FACTOR ANALYSIS METHOD

Factor analysis is a method of explaining the internal structure of a set of related variables through explicit variables. The basic idea is to decompose the correlation coefficient matrix of the original variables and extract some common factors to explain the interrelationships between these variables. Factor analysis can be divided into two types: Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). In talent evaluation, exploratory factor analysis is commonly used to discover potential evaluation dimensions and build evaluation models based on them.

Before data analysis, the questionnaire data was cleaned, missing and outlier values were processed, and the data was standardized. Data standardization is an important step, especially when there are significant differences in the dimensions and ranges of variables. Standardization can help eliminate these differences, making each variable equally important in the analysis. The following are the general steps for data standardization processing:

Firstly, collect the dataset that requires factor analysis. Before standardization, check the integrity of the data and handle missing and outlier values. Standardization method, Z-score Standardization: Subtract the mean from the value of each variable and then divide by the standard deviation. Confirm whether the standardized data meets expectations. The standardized formula is:

$$Y_{ij} = \frac{(X_{ij} - \bar{X}_j)}{\sqrt{\text{Var}X(j)}}, (i = 1, 2, \dots, m, j = 1, 2, \dots, n)$$

Among them,  $Y_{ij}$  is the data after standardization,  $X_{ij}$  is the data before standardization,  $\bar{X}_j$  is the mean of the  $j$ th indicator, and  $\sqrt{\text{Var}X(j)}$  is the standard deviation of the  $j$ th indicator.

The main purpose of data correlation analysis is to measure the strength and direction of the relationship between two or more variables. Different correlation analysis methods use different formulas. This article uses Pearson correlation coefficient to measure the linear relationship between two continuous variables. The formula is as follows:

$$r = \frac{\sum_{i=1}^n (X_i - \bar{X})(Y_i - \bar{Y})}{\sqrt{\sum_{i=1}^n (X_i - \bar{X})^2} \sqrt{\sum_{i=1}^n (Y_i - \bar{Y})^2}}$$

Perform factor analysis: Use standardized data for factor analysis, extract factors, and conduct subsequent analysis.

Further understanding of this formula reveals that the numerator is the covariance between two indicators, and the denominator is the product of the standard deviations of two variables. The range of this indicator is generally [-1, 1], and the larger the absolute value, the higher the correlation between the two indicators, and vice versa. If  $r=1$ , there is a perfect linear relationship between the two variables, indicating a complete positive correlation; If  $r=-1$ , there is a complete negative

correlation, and there is a perfect inverse linear relationship between the two variables; If  $r=0$ , there is no correlation, and there is no linear relationship between the two variables; If  $0 < r < 1$ , the two are positively correlated, and as one variable increases, the other variable also tends to increase; If  $-1 < r < 0$ , the two are negatively correlated, and as one variable increases, the other variable tends to decrease [7-8].

Factor analysis is a multivariate statistical analysis method aimed at identifying potential, unobserved variables (i.e. factors) by analyzing a large number of variables, simplifying data structures, reducing data dimensions, and then calculating the comprehensive scores of various automotive industry talents through the following formula:

$$F = \sum_{i=1}^a r_i \times f_i$$

Among them,  $a$  is the number of selected factors,  $r_i$  is the contribution rate of the  $i$  th factor to the total variance, and  $f_i$  is the score of the  $i$  th factor.

### **3. APPLICATION OF FACTOR ANALYSIS METHOD IN TALENT EVALUATION OF AUTOMOTIVE INDUSTRY**

In the automotive industry, talent assessment typically involves multiple dimensions and indicators, and factor analysis can integrate these indicators into a few factors to simplify the assessment process. Through factor analysis, companies can extract key talent characteristics from a large number of employee evaluation indicators. For example, in the evaluation of automotive engineers, key factors such as professional knowledge, technical ability, communication skills, and teamwork spirit can be identified through factor analysis. This helps companies clarify the focus of talent selection and development. The factors obtained through factor analysis can serve as a scientific basis for talent selection. Enterprises can develop corresponding selection criteria and scoring systems based on the needs of different positions. Factor analysis can not only be used for talent selection, but also for monitoring employee development. By regularly evaluating the changes in employees' scores on various factors, companies can understand their growth in professional knowledge, skill levels, and other aspects, and adjust training and development strategies in a timely manner to ensure the sustained growth of employees. In addition, the results of factor analysis can provide data support for the talent strategy planning of enterprises. By analyzing the distribution of different factors in different positions and departments, enterprises can identify areas of talent shortage and surplus, and thus develop more reasonable talent introduction and training plans.

Factor analysis, as an effective statistical analysis tool, has broad application prospects in talent assessment in the automotive industry. By identifying key talent characteristics, simplifying evaluation indicators, developing scientific selection criteria, monitoring talent development, and supporting talent strategic planning, factor analysis can help companies enhance the scientific and effective management of talent, thereby strengthening their core competitiveness. With the rapid development of the automotive industry, factor analysis based talent assessment methods will become increasingly important. Enterprises should actively explore and apply this method to adapt to the changes and development needs of the industry.

### **4. TALENT EVALUATION MODEL FOR THE AUTOMOTIVE INDUSTRY**

To correctly evaluate the comprehensive quality, technical ability, innovation ability, etc. of talents in the automotive industry. Design a questionnaire based on research objectives and collect data related to talent evaluation. The data for this study comes from multiple enterprises and institutions

in the Chinese automotive industry, and a large amount of data on employee personal information, work experience, professional skills, and career development was collected through questionnaire surveys. After preliminary data processing and descriptive statistics, variables including communication ability, innovation ability, teamwork, etc. were selected for factor analysis.

Perform descriptive statistics on the collected talent evaluation data to understand its basic characteristics, such as mean and standard deviation. Firstly, calculate the correlation coefficient matrix between variables, and then use principal component analysis to extract common factors. Ensure that the data is suitable for factor analysis through KMO test and Bartlett sphericity test. Finally, five common factors were identified, representing professional basic theory, professional technical skills, innovative thinking ability, project management skills, market and industry development awareness ability. According to the results of the factor loading matrix, these factors can explain most of the information of the original variables well and have a certain degree of independence from each other.

1) Professional knowledge mastery ability: Firstly, it is necessary to have a deep understanding of the professional field one is engaged in and possess a solid professional basic theory. At the same time, it is necessary to master professional basic knowledge such as automotive structure and principles.

2) Professional technical ability: require the ability to use various tools and techniques, and use advanced methods, means, and tools to solve key technical problems in their respective fields. At the same time, it is necessary to understand and track the latest technological development directions.

3) Innovative thinking ability: It requires the ability to have innovative thinking and problem-solving skills, to identify and understand problems, and then propose and implement possible solutions. This requires the ability to break out of traditional thinking frameworks and find and implement innovative solutions.

4) Project management ability: Need to manage specific engineering projects, including time, cost, quality, etc. Need to understand how to develop detailed project plans, track and adjust project progress, and manage resources to achieve optimal results.

5) Market and industry development awareness ability: With the rapid development of automotive technology, new energy, intelligent networking and other fields are becoming strategic highlands for a new round of technological and industrial revolution, and the scale of the industry will also show a continuous growth trend. Driven by the market, the development of the industry will be constantly changing. Therefore, the industry practitioners need to grasp and control the current situation and future development direction of the automotive market.

By establishing universal competency standards, a core evaluation system for the following models has been established, which enables talent evaluation in specific technical fields and cross domain comparison of talent capabilities. The talent evaluation model formulates talent scoring standards based on factor scores and weights. Different rating levels (such as excellent, good, moderate, poor) can be set to evaluate the comprehensive quality of talents. Enterprises can validate the effectiveness of the model through actual data, analyze its applicability in different positions and departments, and ensure the scientific and practical nature of the model.

## **5. MODEL CONSTRUCTION AND EMPIRICAL RESEARCH**

This article collects data through a questionnaire survey. The following table shows the specific factor analysis conducted on the received questionnaire. The data in the table are the correlation coefficients of the factors used to analyze the final correlation factors.

**Table 1.** Correlation Coefficients Analysis of Automotive Talent Evaluation Model

index	Fact or 1	Fact or 2	Fact or 3	Fact or 4	Fact or 5	Rated by n employees
Professional knowledge mastery ability	0.85					5, 4, 4, 4, 5, .....
Professional technical ability		0.88				4, 5, 3, 4, 5, .....
Innovative Thinking Ability			0.82			3, 5, 4, 5, 4, .....
Project Management Ability				0.80		4, 5, 3, 4, 5, .....
Market and Industry Development Awareness Ability					0.78	4, 4, 4, 5, 5, .....

The clear independent variables are  $f_1$ : "Professional knowledge mastery ability",  $f_2$  "Professional knowledge mastery ability",  $f_3$  "innovative thinking ability",  $f_4$  "project management ability",  $f_5$  "market and industry development awareness ability". Clearly define the dependent variable as the dimension of automotive talent evaluation and its evaluation level  $r$ . Constructing an evaluation function for identifying automotive talents:

$$F = r_1 \times f_1 + r_2 \times f_2 + r_3 \times f_3 + r_4 \times f_4 + r_5 \times f_5$$

The contribution rate of the  $r_i$  principal component to the total variance is the weight, and the total score of each factor can be obtained by weighted summation. The specific calculation formula is as follows:

$$F = 21.94\% \times f_1 + 38.4\% \times f_2 + 12.6\% \times f_3 + 11.42\% \times f_4 + 15.64\% \times f_5$$

After calculating the scores of all automotive talents, sort them according to their comprehensive scores and calculate the factor scores for each employee. Based on the results of factor analysis, develop corresponding talent selection and training plans. This process not only provides a scientific basis for talent management in enterprises, but also provides direction for subsequent training and development. By verifying the effectiveness of the model, enterprises can better optimize their talent strategy and enhance overall competitiveness.

## 6. CONCLUSION

Through factor analysis, key indicators in talent evaluation in the automotive industry can be effectively identified, and a scientific talent evaluation model can be established. The aim is to help enterprises select and cultivate talents more effectively through the analysis of talent characteristics. The research results indicate that professional basic theories, professional technical skills, innovative thinking ability, project management skills, market and industry development awareness ability are key factors affecting the evaluation of automotive talents.

This model can not only help enterprises better evaluate the comprehensive quality of employees, but also provide important basis for talent selection, cultivation, and management. With the continuous development of the automotive industry, enterprises should continuously optimize their talent evaluation system to adapt to the changes and development needs of the industry.

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