Influencing Factors and Indicator System Construction for Evaluating Science and Technology Talents in Chinese Universities: Postprint

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Abstract

[Purpose/Significance] With the rapid development of higher education, the importance of evaluating scientific and technological talents in universities has become increasingly prominent. This study aims to investigate the influencing factors and indicator system construction for the evaluation of scientific and technological talents in Chinese universities. The objective is to gain an in-depth understanding of the underlying relationships in talent evaluation and to foster the cultivation of scientific and technological talents and research innovation in universities.

[Method/Process] Based on an analysis of research progress on university scientific and technological talent evaluation both domestically and internationally, this paper systematically reviews the institutions, theories, methods, and evaluation systems of scientific and technological talent evaluation in Chinese universities, along with their associated problems. It explores the influencing factors of scientific and technological evaluation in Chinese universities and constructs an indicator system for evaluating scientific and technological talents in Chinese universities.

[Results/Conclusions] The study reveals that current scientific and technological talent evaluation in Chinese universities faces challenges including the balance between subjectivity and objectivity, the trade-off between indicator comprehensiveness and operability, issues of dynamism and timeliness, and the integration of multi-dimensional evaluation. It calls for future university scientific and technological talent evaluation systems to incorporate data-driven and intelligent evaluation, multi-dimensional assessment, behavioral and dynamic evaluation, social impact and sustainable development, and internationalization and exchange. Future research will conduct further empirical studies and indicator validation on scientific and technological talent evaluation in Chinese universities to provide references for talent development.

Full Text

Preamble

Title: Research on Influencing Factors and Indicator System Construction for the Evaluation of Scientific and Technological Talents in Chinese Universities

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Abstract:
[Purpose/Significance] With the rapid development of higher education, the importance of evaluating scientific and technological talents in universities has become increasingly prominent. This study aims to explore the influencing factors and indicator system construction for the evaluation of scientific and technological talents in Chinese universities, with the goal of understanding the relationships underlying talent evaluation and promoting talent cultivation and scientific research innovation in universities.
[Method/Process] Based on analyzing research progress on university scientific and technological talent evaluation both domestically and internationally, this paper examines the systems, theories, methods, and evaluation frameworks for Chinese university scientific and technological talent evaluation, along with related issues. It explores the influencing factors of Chinese university scientific and technological evaluation and constructs an evaluation indicator system for Chinese university scientific and technological talents.
[Results/Conclusions] The study finds that current Chinese university scientific and technological talent evaluation faces issues such as balancing subjectivity and objectivity, ensuring indicator comprehensiveness and operability, maintaining dynamism and timeliness, and achieving multi-dimensional evaluation comprehensiveness. It calls for future evaluation systems to emphasize data-driven and intelligent evaluation, multi-dimensional assessment, behavioral and dynamic evaluation, social impact and sustainable development, and internationalization and academic exchange. Future research will conduct further empirical studies and indicator validation for Chinese university scientific and technological talent evaluation to provide references for talent development.

Keywords: university scientific and technological talent evaluation; influencing factors; indicator system; evaluation research

1 Introduction

As national comprehensive strength continues to grow, talent evaluation and management have become increasingly critical. Talent represents a vital national resource that plays a crucial role in national innovation and development. Talent evaluation serves as the foundation and key to talent development and management. In recent years, China has issued numerous policy documents em-

phasizing the need to reform and innovate talent evaluation systems, establish correct talent evaluation orientation, and promote talent development through stable support for outstanding individuals and teams.

Since the founding of the People' s Republic of China, the country' s talent evaluation system has undergone five developmental stages: exploration, recovery, rapid growth, scientific development, and mechanism development. The evaluation of scientific and technological talents has evolved through four phases: work-grade assessment systems, professional qualification systems, and diversified evaluation approaches. In 2018, the Central Office issued the "Guiding Opinions on Classifying and Advancing Talent Evaluation Mechanism Reform," marking a significant institutional change aimed at building a new talent evaluation system and mechanism that meets the requirements of the new era. These policies emphasize that scientific and technological talent evaluation should be classified according to different fields and work nature, focusing on character, ability, performance, and contribution.

From the perspective of talent cultivation and academic prosperity, there is a certain relationship between ancient Chinese election systems and talent cultivation. Scholars have argued that academic debates among scholars are superior to government-led academic evaluation, and that a free academic evaluation system is conducive to academic prosperity and talent development. With the rapid development of the national economy, talent plays a vital role in national scientific and technological development. New understandings have emerged regarding fundamental theoretical issues in talent evaluation, suggesting that the cultivation of innovative abilities should focus on five aspects: imagination, insight, and other capabilities.

2 Research on University Scientific and Technological Talent Evaluation

2.1 System Research

China' s talent evaluation system has a long history, demonstrating the country' s consistent emphasis on talent evaluation and management. The evaluation system for scientific and technological talents in Chinese universities has made significant progress, but structural contradictions remain that require further improvement and refinement. The 2018 Academicians' Conference emphasized that the scientific and technological view of talent is an important guideline for talent evaluation, proposing that the essence of talent evaluation is to conduct assessments according to law.

In 1956, the State Council' s "Decision on Wage Reform" established a work-grade system for workers. Since then, China' s scientific and technological talent evaluation system has achieved historic breakthroughs and progress. With the transformation of China' s innovation paradigm, the evaluation of scientific and technological talents needs to be reformed and innovated to stimulate talent

innovation capabilities and motivation. The state has successively issued various opinions on deepening project review, optimizing research management, and improving research performance, emphasizing that scientific and technological talent evaluation should be classified and that evaluation indicators should focus on character, ability, performance, and contribution.

2.2 Theoretical Research

Research on university scientific and technological talent evaluation in China has integrated and utilized various theories, primarily focusing on performance assessment, behavioral indicators, and other evaluation types. Different types of talent evaluation play different roles, and the role of evaluation reflects the types of talent evaluation. Chinese theoretical research on talent evaluation has concentrated on talent types, drawing on foreign theories regarding output results, behavioral indicators, and other aspects.

Talent evaluation can be categorized into developmental evaluation, selective evaluation, and incentive evaluation based on different purposes. Talent evaluation plays a crucial guiding role in talent system establishment and implementation, as well as in talent cultivation and motivation. Currently, main types include enterprise talent evaluation, university talent evaluation, and others. Talent evaluation is of great significance to national scientific research innovation and technological development.

Foreign theoretical research on university scientific and technological talent evaluation has explored the redistribution of rights among multiple evaluation subjects. Studies have emphasized scientific evaluation concepts, improving evaluation methods, and perfecting evaluation systems. Some scholars have reflected on the role of papers in talent evaluation, arguing that papers should return to their essential role in improving basic scientific capabilities, recognizing characteristic indicators for different work natures, and opposing both the “paper-only” theory and the “paper-useless” theory in talent evaluation.

2.3 Methodological Research

In the 1990s, China introduced scientific and technological talent evaluation methods and established the National Center for Science and Technology Evaluation, gradually forming a more standardized talent evaluation system. University scientific and technological talent evaluation systems require scientific and objective indicators covering academic achievements, cooperative exchanges, and output applications.

Researchers have constructed diversified evaluation systems from multiple perspectives. Some have proposed talent potential value evaluation indicators based on customer relationship management theory, while others have built classified evaluation systems for scientific and technological talents. From an intelligence research perspective, some scholars have used big data collection, literature

database retrieval, and comprehensive evaluation methods to construct and empirically validate evaluation systems for high-end talents. Using the Delphi method, researchers have proposed evaluation indicator systems for overseas high-level talents based on their capability characteristics.

In terms of evaluation methods, peer review and scientometric analysis occupy mainstream positions. Peer review is widely accepted and can validate research outcomes, while scientometric methods may lead scientific and technological talents to focus on popular research topics. University scientific and technological talent evaluation is a complex task with different standards and methods across disciplines and even within different research directions in the same discipline. To play an important role in selection and stimulating national scientific and technological innovation potential, it is necessary to improve evaluation theories and methods and summarize practices to form a more scientific and objective theoretical system.

3 Analysis of Influencing Factors in University Scientific and Technological Talent Evaluation

University scientific and technological talent evaluation comprehensively assesses talents' capabilities and contributions in research, teaching, management, and other aspects, aiming to promote talent cultivation and development and drive scientific and technological innovation and social progress. Evaluation results can serve as a basis for selection, training, and development.

Existing research has analyzed influencing factors of university scientific and technological innovation capabilities using the DEMATEL method, emphasizing that human resources are key factors affecting university scientific and technological innovation capabilities. Other studies have used competency model theory and individual innovation behavior theory to construct innovation evaluation models that include factors such as innovative knowledge, motivation, and management capabilities. Research on factors influencing the growth of scientific and technological leading talents has found that family, research management mechanisms, and government policies are major influencing factors.

Based on these perspectives, influencing factors in university scientific and technological talent evaluation cover academic level, teaching level, innovation capability, teamwork and academic exchange, and social responsibility and influence. Academic level is an important indicator for research evaluation, including paper quantity and quality, impact factors, and patent applications. Teaching quality and educational capability are also important factors, involving student evaluations, teaching supervision assessments, and teaching achievements. Innovation capability is a crucial influencing factor, including research project innovation and the transformation of scientific and technological achievements. Teamwork and academic exchange reflect collaborative abilities and academic influence, including international cooperation and conference participation. Social responsibility and influence reflect the impact of scientific and technological

achievements on social problem-solving and industrial development.

4 Construction of University Scientific and Technological Talent Evaluation Indicator System

Based on comparative analysis of domestic and international research on university talent evaluation and the needs of China' s scientific and technological strength development, this study selects and constructs an evaluation indicator system for Chinese university scientific and technological talents.

4.1 Principles and Methods for Indicator Selection

The selection and weight allocation of evaluation indicators require data support, but some indicator data may be difficult to obtain or lack objectivity, affecting the accuracy of weights and evaluation results. University scientific and technological talent evaluation involves multiple dimensions and aspects, requiring consideration of complexity, diversity, and hierarchical relationships. The indicator system should be designed according to actual conditions, fully considering representativeness and breadth.

Feasibility and operability must also be considered. Some indicators may be difficult to quantify or implement, potentially causing difficulties in practical application. To ensure objectivity, representativeness, and comprehensiveness, multiple methods and strategies should be adopted, including extensive expert consultation, data analysis, and field research. The construction process requires continuous evaluation and improvement to adapt to changing evaluation needs.

A comparison of domestic and international indicator systems reveals differences. Domestic systems focus on basic scientific research, technological innovation capability, and academic influence, while international systems emphasize original research, technological achievements, and international cooperation. Domestic evaluation mainly considers paper quantity, patents, research funding, and paper quality, while international evaluation focuses more on citation counts, patent value, and research funding input. In terms of social impact, domestic evaluation emphasizes industrial application transformation and social contribution, while international evaluation stresses industry-university cooperation, technology transfer, and social innovation.

4.2 Indicator Construction and Weight Allocation

Before constructing the indicator system and allocating weights, this paper conducted a comparative analysis of domestic and international university scientific and technological talent evaluation indicator systems. The comparison covered six aspects: research focus, output indicators, social impact, honors and awards, teamwork and exchange, and social activities and services.

The comparison shows that domestic and international systems differ in research focus, honors and awards, teamwork and exchange, and social activities

and services. Domestic systems emphasize basic scientific research, technological innovation capability, and academic influence, reflecting China' s scientific and technological development characteristics and needs. International systems focus more on original research, technological achievements, and international cooperation, reflecting the importance of international scientific and technological cooperation. In terms of honors and awards, domestic evaluation emphasizes national-level awards and professional association certifications, while international evaluation values international awards and highly-cited papers. In teamwork and exchange, domestic evaluation emphasizes collaborative abilities and academic exchange, while international evaluation stresses international cooperation project scale and co-authored papers. In social activities and services, domestic evaluation focuses on science education and public service, while international evaluation emphasizes technology consulting and policy advice.

4.3 Construction of Primary, Secondary, and Tertiary Indicators and Weight Allocation

Indicator selection must reflect objectives and purposes, which determine weight allocation. The construction of China' s university scientific and technological talent evaluation indicator system is based on previous research results, analysis of influencing factors, and evaluation principles and methods. Using available data and relevant theories, statistical analysis and data mining methods assess correlations and contributions among indicators for objective quantitative analysis.

The primary indicators selected are scientific research achievements, teaching level, innovation capability, teamwork and academic exchange, social service and influence, and comprehensive quality. These reflect core abilities and comprehensive levels of scientific and technological talents in academic, teaching, and social service aspects.

In constructing secondary indicators, primary indicators are further subdivided according to specific content. For example, under scientific research achievements, secondary indicators include research papers, projects, and honors to comprehensively evaluate performance. In constructing tertiary indicators, secondary indicators are further refined to ensure specificity and measurability. For instance, under research papers, tertiary indicators include paper quantity, quality, and citation counts.

Weight allocation is based on indicator importance and actual conditions through literature review and expert consultation. Data-driven methods can be used to calculate indicator weights by obtaining actual data, standardizing it, and using statistical methods like multiple regression analysis to determine each indicator' s impact on the comprehensive evaluation result.

5 Problems and Prospects in University Scientific and Technological Talent Evaluation

5.1 Existing Problems and Challenges

Current university scientific and technological talent evaluation systems face four main problems and challenges:

First, balancing subjectivity and objectivity. Evaluation systems tend toward subjective assessment, with some indicators like academic reputation being difficult to quantify.

Second, indicator comprehensiveness and operability. Evaluation systems should comprehensively cover multiple dimensions of talent capabilities, but overly complex indicator systems increase evaluation difficulty and costs. A balance must be struck between comprehensiveness and operability.

Third, dynamism and timeliness. Rapid development in science and technology requires evaluation indicators to keep pace with emerging fields and new demands. Evaluation systems must have dynamic adjustment and updating capabilities.

Fourth, multi-dimensional evaluation comprehensiveness. Talent evaluation requires considering multiple dimensions such as research achievements, academic influence, and social contribution. Reasonable weight allocation methods and comprehensive evaluation models are needed to integrate multi-dimensional results.

5.2 Future Development Directions and Trends

Future development of university scientific and technological talent evaluation will manifest in five aspects:

First, multi-dimensional evaluation. Future evaluation will pay more attention to multiple dimensions, including not only research achievements and academic influence but also innovation capability and social impact, to better reflect comprehensive abilities and potential.

Second, data-driven and intelligent evaluation. With the rapid development of big data and artificial intelligence, future evaluation will rely more on data analysis and intelligent tools. Mining large amounts of data can provide more accurate and objective evaluation results, helping universities better understand talent characteristics and development needs.

Third, introducing behavioral and dynamic evaluation. Traditional evaluation mainly uses static indicators of research achievements. Future evaluation will pay more attention to behavioral and process evaluation, focusing on innovative thinking, problem-solving abilities, and academic exchange during the research process, as well as dynamic tracking and evaluation of long-term development.

Fourth, emphasizing social impact and sustainable development. Future evaluation will pay more attention to talents' social impact and sustainable development capabilities, considering the docking of social contributions with industrial development and the practical application and social influence of scientific and technological achievements.

Fifth, internationalization and academic exchange. With deepening global scientific and technological cooperation, future evaluation will pay more attention to internationalization and academic exchange. Evaluation systems will align with international standards, learn from international advanced experience, and promote international scientific and technological talent exchange.

6 Conclusion

Talent evaluation is a prerequisite for talent resource development, utilization, and management. In the process of constructing a university scientific and technological talent evaluation system, we must face and solve existing problems in China' s scientific and technological talent evaluation. This study has constructed a relatively complete and scientific evaluation system that can comprehensively assess scientific and technological talents' abilities and contributions, providing references for talent cultivation and management in universities.

We recognize that evaluation system construction is a dynamic process requiring continuous adjustment and improvement to adapt to changes in scientific and technological development and university needs. The establishment of evaluation systems requires comprehensive consideration of multiple factors and stakeholders, with broad participation and feedback from universities, government departments, and scientific and technological talents themselves to ensure fairness and acceptability.

Future university scientific and technological talent evaluation will develop toward multi-dimensional, data-driven, behavioral and dynamic, social impact, and internationalization directions. These trends will promote better adaptation of evaluation systems to scientific and technological development needs, providing more scientific and accurate bases for universities to cultivate and select outstanding scientific and technological talents.

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