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Applying Multi-Scale Model to Construct a Talent Introduction and Cultivation Framework for Universities: A Multi-Scale Analysis of Influencing Factors

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Abstract

With the increasing intensity of global higher education competition, talent introduction and cultivation in universities have become crucial for enhancing their core competitiveness. This paper constructs a multi-scale fusion model for university talent introduction and cultivation from a multi-scale fusion perspective, which includes three components: precision talent introduction, personalized cultivation, and scientific retention. By comprehensively considering multi-scale and multi-dimensional factors such as talent employment needs, employer demands, and external policies, this study explores the specific implementation paths of each module. The aim is to provide universities with scientific, systematic, and precise talent introduction and cultivation strategies to comprehensively improve the level and quality of the talent team, while offering references for the theoretical and practical development of university talent management.

Keywords

Multi-scale model, Talent introduction, Talent cultivation, Talent retention, University development.

1. Introduction

The report to the 20th National Congress of the Communist Party of China has designated building a talent-strong nation as one of the major strategies for achieving Chinese modernization, explicitly advocating the principle of "gathering global talents and putting them to good use" to accelerate talent-strong nation construction. As vital hubs for knowledge innovation, talent cultivation, and social service, universities' comprehensive strength and competitiveness are fundamentally shaped by the quality and calibre of their talent teams. However, current talent introduction and cultivation initiatives in higher education institutions face critical challenges: homogenized talent competition among universities has become pronounced, while traditional approaches often overlook the integrated consideration of macro-policy landscapes, meso-industry requirements, and micro-level individual differences among talents.

Multi-scale fusion theory emphasizes comprehensive analysis and problem-solving across macro, meso, and micro dimensions, systematically accounting for all factors influencing university talent management. Constructing a multi-scale fusion pathway for talent introduction and cultivation enables universities to transcend traditional intellectual constraints, formulate more scientific, precise, and effective talent strategies, enhance the quality and efficiency of talent management, and gain a competitive edge in an increasingly fierce academic landscape.

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2. Multi-Scale Fusion Model for University Talent Introduction and Cultivation

The multi-scale fusion model has been successfully applied in various fields such as radio, surveying and mapping, and intelligence [1, 2, 3, 4]. This study applies the multi-scale fusion model to the talent introduction and cultivation in universities, aiming to explore more scientific paths for university talent introduction and cultivation. The core of multi-scale fusion lies in the organic integration and collaborative analysis of factors at the macro, meso, and micro levels.

At the macro level, changes in the international political and economic landscape, adjustments in national development strategies, and reforms in education policies guide universities to strengthen the introduction and cultivation of talents in advantageous disciplines, thereby promoting the optimization of university talent structures. At the meso level, factors such as industry development trends and regional economic and social needs determine the talent demand characteristics of universities in their respective fields and regions. The differences in regional economic development levels and industrial structures also make the talent demands of universities in different regions present diversity. At the micro level, factors such as the university's own school-running orientation, disciplinary and professional characteristics, campus cultural atmosphere, as well as the individual traits and needs of talents directly affect the specific implementation of talent introduction and cultivation work.

3. Framework Design for University Talent Introduction and Cultivation

The university talent introduction and cultivation framework is composed of three closely interrelated modules: precision talent introduction, personalized cultivation, and scientific retention (see Fig. 1). Precision talent introduction lays the foundation for personalized cultivation and scientific retention, while personalized cultivation provides support for scientific retention. In turn, scientific retention offers impetus for precision introduction and personalized cultivation. These modules mutually reinforce and synergize, forming an organic whole that delivers comprehensive and systematic solutions for university talent team construction.

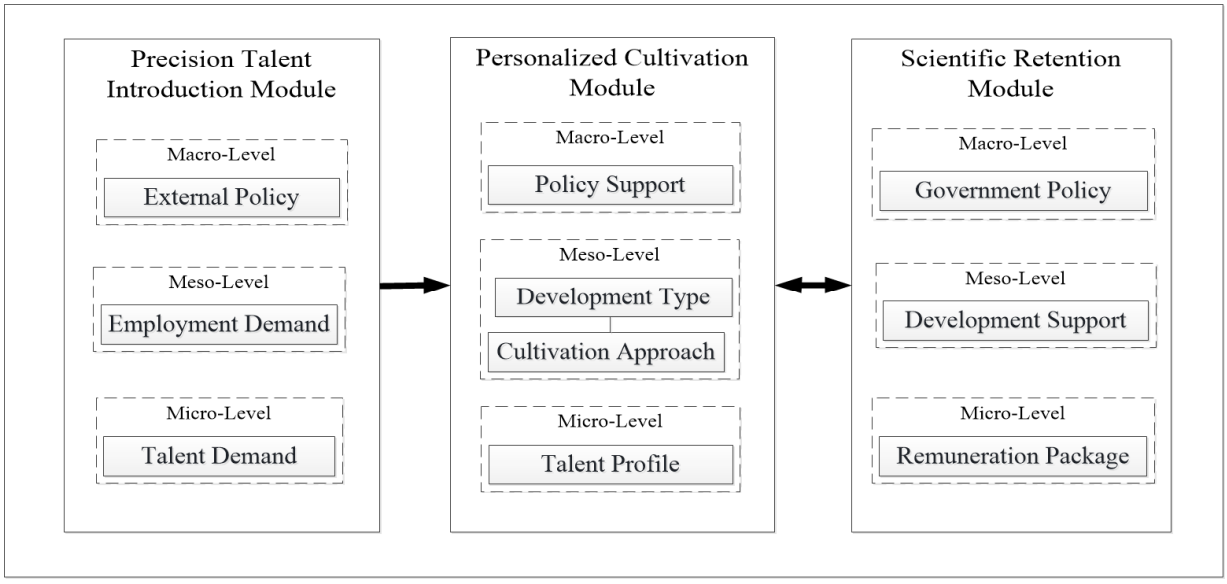

Figure 1. Framework of University Talent Introduction and Cultivation

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3.1. Precision Talent Introduction Module

The precision talent introduction involves interrelated influencing factors such as external policies, employment demands, and talent needs. In this module, external policies belong to the macro-level, employment demands to the meso-level, and talent needs to the micro-level.

3.1.1. External Policies

Among external policy factors, national development plans fall under the macro-level, government policy support under the meso-level, and university education reforms under the micro-level. National development plans specify the country's development priorities and strategic needs in different periods, providing critical guidance for university talent introduction. Government policy support serves as an important guarantee for talent introduction, with policies such as talent introduction subsidies, housing security, and preferential policies for children's education directly influencing talent mobility decisions. With globalization, international talent competition has intensified, requiring universities to actively participate in global talent recruitment and attract outstanding overseas talents to return or work in China. Changes in policies like university education reforms also indirectly affect talents' choices of universities.

3.1.2. Employment Demands

In employment demand factors, university development goals belong to the macro-level, disciplinary development plans and evaluation systems to the meso-level, and financial support & working environment to the micro-level. University development goals determine the overall direction of talent demand. Disciplinary development planning needs are the core of employment demands, requiring universities to determine appropriate talent scales based on disciplinary development plans, teaching-research tasks, and faculty-student ratios. A scientific evaluation system is crucial for attracting and retaining talents—universities should establish an evaluation system centered on innovation capability, academic contributions, and social influence, avoiding sole reliance on paper quantity or research funding. Financial support and environmental guarantees are necessary conditions for talent work: adequate research funding, advanced experimental equipment, and favorable office environments provide good working conditions and stimulate talents' innovative vitality.

3.1.3. Talent Needs

Talent needs include work location, industry distribution, organization size, institution type, compensation packages, working hours, and job satisfaction. Work location and industry distribution belong to the macro-level, organization size and institution type to the meso-level, and compensation, working hours, and job satisfaction to the micro-level. Work location is a key consideration in talent employment choices, reflecting employment distribution—first-tier cities remain popular, while second-tier (and even third-tier) cities are attracting more talents as they rise. Industry distribution is equally important, with emerging sectors like new energy, biomedicine, and big data often prioritizing first/second-tier cities. As meso-level factors, organization size and type influence employment decisions—universities or research institutions typically have strong appeal. Compensation serves as the material foundation for employment choices, while working hours and job satisfaction also play key roles. For example, universities may offer high annual salaries, research start-up funds, housing subsidies, and education benefits to attract high-level talents.

3.2. Personalized Cultivation Module

The personalized cultivation module is fundamentally anchored in an in-depth understanding of individual talents, integrating comprehensive considerations of their specific conditions to categorize different development types and combining corresponding cultivation approaches with policy support to deliver tailored growth plans. Influencing factors of this module

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encompass four interrelated dimensions: policy support, development types, cultivation approaches, and talent profiles, where policy support resides at the macro-level, development types and cultivation approaches at the meso-level, and talent profiles at the micro-level.

3.2.1. Policy Support

Within policy support, supporting policies and on-the-job training policies belong to the meso-level, while assessment and evaluation fall under the micro-level. Supporting policies such as research start-up funds and laboratory resources provide essential conditions for newly introduced talents to initiate work: adequate start-up funds enable talents to launch research projects promptly upon entry, facilitating the purchase of experimental equipment and consumables. Strengthening on-the-job training—by dispatching outstanding talents to visit top domestic and international universities—broadens their academic horizons and enhances professional literacy. A scientific talent assessment system objectively evaluates work performance and development potential through a long-term, comprehensive framework that integrates annual and term-based evaluations, offering feedback and guidance for talent cultivation.

3.2.2. Development Types

Talent hierarchy and professional technical types, categorized from distinct perspectives, both reside at the meso-level. In terms of hierarchy, leading talents exert exceptional influence in academic fields, leading teams in high-level research and driving overall disciplinary development. Disciplinary talent categories include discipline leaders—who oversee disciplinary construction and development planning—and academic backbones—who serve as critical supports in frontline teaching and research, undertaking substantial instructional and research tasks. Professional technical types are classified as teaching-oriented, research-oriented, or clinical-oriented: teaching-oriented talents focus on improving educational quality and cultivating students; research-oriented talents prioritize scientific innovation to advance academic frontiers; clinical-oriented talents play pivotal roles in medical practice and research, requiring rich clinical experience and solid medical theoretical knowledge.

3.2.3. Cultivation Approaches

Among cultivation approaches, professional title promotion belongs to the meso-level, and merit evaluation to the micro-level. Professional title promotion serves as a key incentive for talent development: universities should establish scientific evaluation systems centered on teaching-research performance, innovation capability, and social contributions, providing clear career objectives and promotion pathways. Merit evaluation activities—such as outstanding teacher or researcher awards—stimulate competitiveness and work enthusiasm, fostering a positive academic atmosphere through recognition and rewards for exceptional performance in teaching and research.

3.2.4. Talent Profiles

Within talent profiles, research types reside at the meso-level, and age at the micro-level. Age significantly influences career stages and development potential: young talents typically demonstrate strong innovation and learning capabilities, while senior talents excel in academic reputation, industry resources, and research depth. Research types (theoretical vs. applied) and key achievements reflect academic expertise and outputs: universities can provide increased academic exchange opportunities and research funding for theoretical researchers to pursue breakthroughs in basic research, while strengthening industry collaboration for applied researchers to promote the transformation of research achievements. Personal career plans reflect talents' professional development expectations, requiring universities to engage in thorough communication to align individual goals with institutional development needs.

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3.3. Scientific Retention Module

The scientific retention module constructs a comprehensive, multi-layered talent retention environment from dimensions such as government policies, development support, and compensation packages, aiming to enhance talent belongingness and loyalty while reducing brain drain. Government policies reside at the macro-level, development support at the meso-level, and compensation packages at the micro-level.

3.3.1. Government Policies

Within government policies, talent subsidy policies belong to the macro-level, while university-local cooperation and university-enterprise integration fall under the meso-level. Government-issued talent subsidy policies—such as living subsidies for high-level talents, housing allowances, and project funding—provide enhanced financial support and policy advantages. Promoting cooperation projects like university-local collaboration and university-enterprise integration expands talent development spaces, offering more practical opportunities and resource support. Through such projects, universities provide career development opportunities (e.g., corporate attachment programs) to facilitate R&D achievements transitioning from laboratories, realizing win-win outcomes for talents and enterprises. Additionally, universities should strengthen communication with government agencies to stay updated on policy dynamics, proactively secure policy support, and convert government policies into institutional advantages for talent retention.

3.3.2. Development Support

In development support, development expectations belong to the macro-level, while team building and platform construction reside at the meso-level. Providing clear development expectations is crucial: universities should formulate explicit career paths based on talents' professional plans and institutional strategies, enabling talents to visualize growth prospects. Strengthening team building—by establishing interdisciplinary research teams—promotes communication and collaboration, stimulating innovative thinking and enhancing collaborative capabilities. Constructing high-level research platforms with advanced equipment, adequate funding, and collaborative networks provides robust support for research activities, increasing the likelihood of talent retention.

3.3.3. Compensation Packages

In terms of salary and benefits, the salary performance system and performance evaluation system belong to the meso-level, while welfare benefits fall under the micro-level. Establishing a reasonable salary performance system that matches talents' income with their work performance and contributions can fully motivate their work enthusiasm. Universities should formulate differentiated salary standards based on the nature of talents' positions, work difficulty, and responsibility. Talents in front-line teaching and research, especially those undertaking important scientific research projects and high-level teaching tasks, should be offered higher salaries. Meanwhile, a scientific performance evaluation mechanism should be established to incorporate talents' performance in teaching quality, scientific research achievements, social services, etc., into the performance evaluation system, and performance bonuses should be distributed based on evaluation results. Providing competitive welfare benefits such as festival welfare subsidies can improve talents' quality of life and enhance their sense of identity and loyalty to universities.

4. Conclusion

This study constructs a comprehensive talent introduction and cultivation pathway integrating precision talent introduction, personalized cultivation, and scientific retention, based on the multi-scale fusion model. The pathway offers a novel perspective and methodology for

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university talent management, assisting institutions in transcending the limitations of traditional talent management models to introduce and cultivate talents more precisely and scientifically, optimize talent team structures, and enhance talent quality. For future research, continuous exploration and innovation of the multi-scale fusion-based talent introduction and cultivation pathway in universities are required to improve the scientificity and effectiveness of talent management, thereby continuously enhancing institutional core competitiveness.

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