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Influencing Factors of Talent Agglomeration in Information Technology Enterprises in the Lhasa Region

LAI Shiwei

Doctor of Management

Supervisors:
PhD Abdul Suleman, Professor,
ISCTE University Institute of Lisbon
PhD LIU Pu, Associate Professor,
University of Electronic Science and Technology of China

November, 2025

BUSINESS
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Marketing, Operations and General Management Department

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I declare that this thesis does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any university and that to the best of my knowledge it does not contain any material previously published or written by another person except where due reference is made in the text.

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Abstract

Against the background of innovation-driven development strategies and Western revitalization, the IT industry in Lhasa has shown rapid growth. However, due to unique geographical and economic conditions, enterprises generally face a “plateau talent vacuum effect”—difficulties in attracting and retaining talent—which has become a core bottleneck restricting regional high-quality development. This study aims to reveal the antecedent factors and impact mechanisms influencing IT talent agglomeration in Lhasa.

An indicator system covering five dimensions was constructed: high-altitude special climate conditions, regional talent policies, living security levels, IT industry development potential, and enterprise human resource management（HRM） practices. Using a questionnaire survey, employees of IT enterprises in Lhasa High-tech Zone and related parks were selected as research subjects, yielding 613 valid samples. Research hypotheses were verified through Structural Equation Modeling (SEM) and Bootstrap mediation tests using SPSS 27.0 and AMOS 28.0.

The findings indicate that: (1) high-altitude climate conditions reduce talent agglomeration by increasing plateau health risks; (2) regional talent policies enhance agglomeration by fostering local identity; (3) improvements in living security boost agglomeration by increasing local dependence; (4) industry development potential facilitates agglomeration by reducing perceived environmental uncertainty; and (5) superior enterprise HRM practices drive agglomeration by improving job satisfaction. Furthermore, the study identifies increasing salary levels as the most effective approach to offset adverse climatic factors. Based on these conclusions, targeted countermeasures are proposed to optimize the talent ecosystem in Lhasa.

Keywords: Talent agglomeration of information technology enterprises; Special climate conditions at high altitude; Regional talent policies; Living security level; Industrial development potential; Human resource management practices

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Resumo

No contexto da forte promoção da estratégia de desenvolvimento impulsionado pela inovação e do revitalização do Oeste do país, a indústria de tecnologias da informação em Lhasa registra rápido crescimento. No entanto, devido à singularidade do ambiente geográfico e da estrutura econômica, as empresas enfrentam um "vácuo de talentos de altitude" causado pela dificuldade em atrair e reter profissionais, constituindo um entrave central ao desenvolvimento de alta qualidade regional. Este estudo visa explorar e revelar os fatores antecedentes e os mecanismos que influenciam a aglomeração de talentos nas empresas de tecnologias da informação em Lhasa.

Elaborou-se um sistema de indicadores com cinco dimensões — condições climáticas de alta altitude, políticas locais de talentos, nível de garantia de vida, potencial de desenvolvimento da indústria de tecnologias da informação e práticas de gestão de recursos humanos — para a realização de uma pesquisa empírica. Utilizou-se o método de questionário, tendo como população-alvo colaboradores de empresas de tecnologias da informação na Zona de Alta Tecnologia de Lhasa e parques correlatos, obtendo-se 613 amostras válidas. Os dados foram analisados por meio dos softwares estatísticos SPSS 27.0 e AMOS 28.0, com aplicação de modelo de equações estruturais (SEM) e teste de mediação Bootstrap para validação das hipóteses.

Os principais resultados são: (1) As condições climáticas de alta altitude reduzem a aglomeração de talentos ao elevar os riscos de saúde relacionados à altitude; (2) O apoio das políticas de talentos aumenta a aglomeração por meio do fortalecimento da identificação territorial dos profissionais; (3) A melhoria do nível de garantia de vida eleva a aglomeração ao intensificar a dependência local dos talentos; (4) O potencial de desenvolvimento industrial impulsiona a aglomeração ao diminuir a percepção de incerteza dos profissionais quanto ao ambiente organizacional e externo; (5) Práticas avançadas de gestão de recursos humanos exercem efeito positivo sobre a aglomeração de talentos por meio do aumento da satisfação no trabalho. Verificou-se ainda que o aumento salarial constitui a medida mais eficaz para mitigar as desvantagens climáticas. Com base na realidade de Lhasa, são apresentadas sugestões direcionadas para a construção de um ecossistema sustentável de apoio aos talentos.

Palavras-chave: Aglomeração de talentos; Clima de alta altitude; Políticas de talentos; Segurança social; Desenvolvimento industrial; Gestão de recursos humanos
JEL: J61, L23

摘要

在国家大力推进创新驱动发展战略与西部振兴的背景下，拉萨市信息技术产业呈现快速发展态势，但由于地理环境与经济结构的特殊性，企业普遍面临“引才难、留才难”形成的高原型人才真空效应，这已成为制约区域高质量发展的核心瓶颈。本研究旨在探索并揭示影响拉萨地区信息技术企业人才集聚的前置因素及其具体的路径机制。

本文通过构建一套涵盖高海拔特殊气候条件、地区人才政策、生活保障水平、信息技术产业发展潜力和企业人力资源管理实践五个维度的指标体系，开展实证研究。研究采用问卷调查法，以拉萨高新区及相关园区的信息技术企业员工为调研对象，最终获取有效样本 613 份。此外，本文利用 SPSS 27.0 与 AMOS 28.0 统计软件，通过结构方程模型（SEM）分析与 Bootstrap 中介效应检验对研究假设进行了验证。

本文的研究结论如下：（1）拉萨高海拔气候条件会通过提升人才面临的高原健康风险，进而降低人才集聚水平；（2）人才政策支持能够通过增强人才的地方认同感，提高集聚水平；（3）生活保障水平的提升会通过增强人才的地方依赖感，提升集聚水平；（4）产业发展潜力能够通过降低人才对组织内外环境的不确定性感知，进而提升集聚水平；（5）企业高水平的人力资源管理实践通过提升员工工作满意度，对人才集聚产生正向驱动。此外，研究发现提高工资水平是对冲劣势气候因素最有效的途径。最后，本文立足拉萨实际，为构建可持续的人才支持生态提供了针对性的对策建议。

关键词：信息技术企业人才集聚；高海拔特殊气候条件；地区人才政策；生活保障水平；产业发展潜力；企业人力资源管理实践

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随着这篇博士毕业论文的逐步完善，我的学业生涯即将画上圆满的句号。我深知这不仅仅是我个人努力的成果，更是众多师长、朋友和家人无私支持与帮助的结晶。回想自己在校园中的学习和成长的时光，内心诸多感慨。在一路过来，有很多帮助和支持我的老师和朋友家人。

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Contents

Chapter 1: Introduction 1
1.1 Research background 1
1.1.1 On scientific and technological development 1
1.1.2 Talent shortage in science and technology enterprises in Lhasa 2
1.1.3 Challenges in talent agglomeration 4
1.2 Research questions 6
1.3 Research objectives and significance 8
1.4 Research methodology 9
1.4.1 Survey method 9
1.4.2 Empirical analysis method 10
Chapter 2: Literature Review 13
2.1 Connotation and related concepts of talent agglomeration 13
2.1.1 Connotation of talent agglomeration 13
2.1.2 Theories related to talent aggregation 16
2.2 Factors influencing talent agglomeration 19
2.2.1 Impact of high-altitude regions 19
2.2.2 Impact of regional talent policies 22
2.2.3 Impact of living security levels 26
2.2.4 Impact of industrial development potential 32
2.2.5 Impact of human resource management practices 40
2.3 Literature review and critique 51
Chapter 3: Research Hypotheses and Research Model 55
3.1 High-altitude special climate conditions on talent agglomeration 55
3.1.1 Direct impact effects 55
3.1.2 Mediating role of plateau health risks 56
3.2 Regional talent policy support on talent concentration 57
3.2.1 Direct impact effects 57
3.2.2 Mediating role of place identity 58
3.3 Living security levels on talent agglomeration 59
3.3.1 Direct impact effect 59

3.3.2 Mediating role of place dependence 60
3.4 Information technology industry development potential on talent agglomeration 61
3.4.1 Direct impact effect 61
3.4.2 Mediating role of perceived organizational environmental uncertainty 61
3.5 Human resource management practices on talent agglomeration 63
3.5.1 Direct impact effect 63
3.5.2 Mediating role of job satisfaction 64
3.6 Regression model 65
Chapter 4: Research Design and Data Processing 69
4.1 Questionnaire design 69
4.2 Definition and measurement of variables 73
4.2.1 Measurement of independent variables 73
4.2.2 Measurement of mediating variables 76
4.2.3 Measurement of dependent variables 77
4.3 Data collection and analytical procedures 78
4.3.1 Data collection 78
4.3.2 Data processing and analysis procedures 78
Chapter 5: Data Analysis and Empirical Testing 81
5.1 Sample distribution statistics 81
5.2 Empirical analysis of core explanatory variables 82
5.2.1. Special climatic conditions of high altitude 82
5.3 Descriptive statistics and correlation analysis of key variables 90
5.3.1 Descriptive statistical analysis 90
5.3.2 Correlation analysis 93
5.4 Reliability and validity analysis 94
5.4.1 Reliability analysis 94
5.4.2 Validity analysis 97
5.5 Common method bias test 101
5.6 Hypothesis testing 102
5.6.1 Main effect testing 102
5.6.2 Mediation effect testing 107
5.7 Discussion on the mitigation pathways of adverse climatic impacts 113
Chapter 6: Research Conclusions and Policy Recommendations 119
6.1 Conclusions 119
6.2 Policy recommendations 120

6.3 Discussion 122
6.4 Limitations and future research 123
Bibliography 125
Annex 133

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List of Tables

Table 4.1 Index design for the influencing factors of talent agglomeration in information technology enterprises in Lhasa 70
Table 5.1 Descriptive statistics of survey sample (N = 613) 81
Table 5.2 Descriptive statistics and correlation coefficient analysis (N = 613) 91
Table 5.3 Reliability test results of scales for independent variables 94
Table 5.4 Reliability test results of scales for mediating variables 95
Table 5.5 Reliability test results of the dependent variable (talent agglomeration) 95
Table 5.6 Summary of questionnaire reliability test results (N = 613) 96
Table 5.7 KMO and bartlett's test of sphericity results for variables 97
Table 5.8 Confirmatory factor analysis of measurement model 98
Table 5.9 Comparative results of CFA for competing models 100
Table 5.10 Results of common method bias test (N = 613) 101
Table 5.11 Main effect regression results 103
Table 5.12 Results of mediation test: plateau health risks 107
Table 5.13 Mediation test results: place identity 108
Table 5.14 Mediation test results: place dependence 109
Table 5.15 Mediation test results: perceived environmental uncertainty 110
Table 5.16 Mediation test results of job satisfaction 112
Table 5.17 Bootstrap mediation test results 113
Table 5.18 Survey on mitigation pathways for climatic disadvantages in Lhasa 114

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List of Figures

Figure 1.1 Research framework diagram 11
Figure 3.1 Research model diagram..... 67
Figure 5.1 Survey data distribution chart on the special high-altitude climatic conditions in Lhasa 82
Figure 5.2 Distribution of survey data on talent policies in the Lhasa region 84
Figure 5.3 Survey data distribution chart on talent security level..... 86
Figure 5.4 Survey data distribution chart of industrial development potential 87
Figure 5.5 Distribution of survey data on Human Resource Management Practices (HRMP) in enterprises..... 89
Figure 5.6 Distribution chart 1 of mitigation pathways for adverse climatic factors..... 115
Figure 5.7 Distribution chart 2 of mitigation pathways for adverse climatic factors..... 115

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Chapter 1: Introduction

1.1 Research background

1.1.1 On scientific and technological development

Science and technology serve as the core driving forces for a nation's economic and social advancement. The level of technological development has become a key indicator for measuring a country's comprehensive national strength and international competitiveness. Historical experience has shown that major breakthroughs in scientific and technological innovation often trigger profound adjustments in industrial structures and fundamental transformations in economic paradigms. Globally, a new wave of technological revolution and industrial transformation—represented by information technology, biotechnology, and new energy—is accelerating, exerting far-reaching influence on the political, economic, social, and cultural systems of countries worldwide.

The Chinese government has consistently attached great importance to scientific and technological innovation, regarding it as a strategic cornerstone of national development. It has explicitly stated that "innovation is the primary driving force leading development". Both the National Medium- and Long-Term Science and Technology Development Plan (2006–2020) and the 14th Five-Year Plan for National Science and Technology Innovation identify the enhancement of indigenous innovation capacity as a core objective. These plans emphasize the need to establish a technology innovation system that is enterprise-led, market-oriented, and deeply integrated with academia and research institutions. Particularly noteworthy is the increasing policy support targeted toward western and ethnic minority regions, aimed at promoting balanced regional development and achieving common prosperity through technological empowerment.

Under the overall framework of national strategy, the Tibet Autonomous Region has also accelerated the construction of its science and technology innovation system, actively responding to the national "innovation-driven development" strategy. In 2017, the Party Committee and Government of the Autonomous Region issued the Opinions on Accelerating the Implementation of the Innovation-Driven Development Strategy, which explicitly proposed leveraging technological innovation to drive entrepreneurship, industrial upgrading,

employment growth, and regional development. The policy stipulates cash rewards of RMB 100,000 to 200,000 for enterprises obtaining national intellectual property certifications, and investment subsidies—up to 30% of total costs, with a ceiling of RMB 1 million—for enterprises undertaking national key laboratory and engineering center construction projects. It also encourages municipalities, industrial parks, and high-tech zones to establish special support funds and provide financial subsidies to newly registered tech enterprises.

These policy initiatives have yielded tangible results. According to statistics from the Tibet Department of Science and Technology, in 2020 alone the region supported 40 scientific research and development projects, with over RMB 30 million in government R&D funding, which in turn stimulated nearly RMB 60 million in enterprise R&D investment. The total R&D investment of high-tech enterprises exceeded RMB 1.1 billion, reflecting a notable improvement in both innovation willingness and capacity. Meanwhile, the region has introduced additional incentive measures such as technology innovation voucher subsidies and tax deductions for R&D expenses. It has also encouraged local enterprises to participate in events such as the China Hi-Tech Fair and international technology expos, continuously expanding their external cooperation channels and capabilities for commercializing research outcomes. Since 2016, over 270 high-quality technology projects have been recommended for collaboration with enterprises outside the region, resulting in cooperation agreements worth more than RMB 300 million, effectively promoting two-way flows of talent and technology.

Overall, Tibet's science and technology policy framework has formed a multi-dimensional support system combining financial subsidies, institutional incentives, and platform cultivation. A region-specific innovation mechanism has gradually taken shape, providing institutional guarantees and practical opportunities for the development of local science and technology enterprises, particularly in the field of information technology. Against this backdrop, a systematic study on the talent agglomeration in science and technology enterprises in Tibet—especially in Lhasa—holds significant practical relevance for regional development and aligns with the national strategies of building a strong country through science and technology and revitalizing the western region.

1.1.2 Talent shortage in science and technology enterprises in Lhasa

Driven by national and regional policies, science and technology enterprises in Tibet — particularly in Lhasa— have experienced rapid development in recent years. For instance, as of 2023, the number of high-tech enterprises in the Lhasa High-Tech Industrial Development Zone reached 61, accounting for 47.29% of all high-tech enterprises in the entire Tibet Autonomous

Region, underscoring its central role within the region's science and technology system. Despite this overall positive development trend, operational bottlenecks have increasingly emerged, among which the shortage of high-level innovative talent has become a critical barrier to sustainable development.

According to the author's long-term field research and interviews with multiple information technology enterprises in Lhasa, many companies have repeatedly emphasized difficulties in attracting and retaining talent. Against the backdrop of high labor mobility nationwide, Lhasa —as a frontier city— has yet to establish a science and technology talent ecosystem comparable to those in more developed eastern and central cities, resulting in a relatively weak willingness among high-quality talent to relocate to the region. This phenomenon can be primarily attributed to the following three structural factors.

First, weak macroeconomic attractiveness. A substantial body of research has demonstrated a positive correlation between regional economic development and talent agglomeration: the more developed the economy, the greater the employment opportunities and the more competitive the compensation, the stronger the region's ability to attract talent (Biondo et al., 2012; Lien & Wang, 2005). In 2020, the GDP of the Tibet Autonomous Region was RMB 190.274 billion, only 8.6% that of Beijing, and the region's per capita disposable income lagged significantly behind that of coastal cities. Constrained by its limited economic scale, industrial structure, and urban infrastructure, Lhasa lags behind in terms of salary levels, career development prospects, and urban amenities—factors that drive tech talent to gravitate toward Tier-1 cities such as Beijing, Shanghai, Guangzhou, and Shenzhen, as well as to the innovation hubs of the Yangtze River and Pearl River Deltas.

Second, the industrial support system remains underdeveloped. Lhasa's economy is currently dominated by the tertiary sector and some resource-based industries, and it has yet to form a sufficiently scaled and layered information technology industry cluster. This not only limits the degree of professional alignment for tech talent but also restricts long-term career development pathways. Compared with leading digital economy cities such as Shenzhen and Hangzhou, Lhasa remains at an early stage in terms of industrial chains, innovation ecosystems, capital access, and research platforms. As a result, it is unable to provide the talent absorption and cultivation capabilities found in innovation-driven platform enterprises such as Huawei, Alibaba, and Tencent. Consequently, the lack of competitive job offerings and innovation resources constitutes a form of structural exclusion for potential talent.

Third, geographical and environmental barriers related to high-altitude living and cost of living. Lhasa is located in the heart of the Qinghai-Tibet Plateau at an altitude of 3,650 meters,

where oxygen levels are only about 60% of those at sea level. The natural environment is harsh, with a dry climate and intense ultraviolet radiation. Existing studies indicate that high-altitude environments pose considerable physiological challenges for long-term residents, especially first-time migrants, including symptoms such as altitude sickness, sleep disorders, and increased cardiopulmonary strain—all of which occur at significantly higher rates than the national average. Additionally, due to Lhasa's remote location, its public transportation, medical services, educational resources, and consumer amenities are still under development and fall short when compared with those of eastern cities. Taken together, these factors reduce the migration willingness of potential talent, especially among young professionals and family-oriented technical personnel.

In summary, while the development trajectory of Lhasa's science and technology sector remains positive, the city still faces structural disadvantages in attracting, deploying, and retaining high-level technical talent. The talent bottleneck currently faced by Lhasa's information technology enterprises is essentially the result of the combined influence of macroeconomic constraints, regional industrial structure, and environmental suitability. Against this backdrop, establishing an attractive innovation-driven talent ecosystem has become a central challenge that must be addressed to ensure the sustainable development of science and technology enterprises in Lhasa.

1.1.3 Challenges in talent agglomeration

Against the backdrop of technological innovation driving regional economic development, talent —often regarded as the foremost strategic resource— plays an irreplaceable role in industrial upgrading and enterprise growth. However, for science and technology enterprises in Tibet, especially those in Lhasa, the dual challenges of "difficult talent acquisition" and "low retention" have become significant constraints on business development. Although certain enterprises have been able to attract a limited number of highly educated and professionally matched technical talents through recent policy support, the overall turnover rate of high-quality personnel remains elevated, resulting in a severe deficiency in sustained talent agglomeration.

Based on the author's questionnaire survey and in-depth interviews with multiple information technology enterprises in Lhasa, the current turnover rate of technical personnel in the region's science and technology companies is generally higher than that of similar firms in eastern and central China. This trend is especially pronounced in research and development (R&D) and project management positions. One study shows that the annual turnover rate of mid- to senior-level technical staff in some companies exceeds 15%, significantly above the

national average. In regions where talent supply and demand are significantly mismatched, this phenomenon is referred to as the "plateau-type talent vacuum effect," characterized by the paradox of "talent can be attracted but not retained, and enterprises can afford talent but fail to anchor it".

First, high turnover imposes multiple negative impacts on business operations. Recruiting high-quality talent often requires substantial investment in time, financial resources, and human capital for recruitment, relocation, and subsequent training. However, excessive talent mobility not only prevents return on these upfront investments but also directly hampers the accumulation of technical expertise and institutional knowledge within the enterprise. This is particularly critical in science and technology firms, where R&D positions require long-term collaboration, mutual adjustment, and experience accumulation. Frequent turnover among core R&D staff may lead to project discontinuation, technological gaps, and delays, thereby weakening the firm's overall innovation capacity and market competitiveness.

Second, high mobility disrupts organizational stability and management efficiency. For instance, when key technical personnel or project managers resign, companies must rebuild teams and trust networks, which often results in low morale, structural imbalances, and what is known as "talent-dependence bottlenecks". This issue is especially acute in small and micro-sized technology enterprises that lack risk resilience. These firms are particularly vulnerable to falling into a vicious cycle of "project–personnel–project," where continuity is frequently broken.

Third, the high attrition of technical talent severely impedes long-term technological accumulation and intellectual property (IP) planning. The growth of IT enterprises often depends on continuous R&D efforts and consistent patent output. However, frequent personnel changes not only disrupt R&D progress but also break the chain of technological inheritance, making it difficult for companies to achieve breakthroughs in core technologies—from "zero to one". As one company executive stated in an interview, "If our technical personnel cannot stay long-term, all our R&D planning remains theoretical—it can never be translated into tangible products or results."

Finally, issues related to environmental adaptability further complicate talent retention. Many interviewees noted that the plateau climate presents persistent challenges to physical health and family life. Families with young children or elderly members are especially inclined to settle in cities with milder climates and better public services. Such concerns about "living sustainability" have become increasingly important variables influencing long-term talent inflows. Thus, even with policy incentives and salary subsidies, the structural contradiction of

"talent comes and quickly goes" remains difficult to resolve.

In conclusion, the primary challenge currently facing science and technology enterprises in Lhasa is not only how to attract talent but also how to develop an effective talent retention mechanism that supports the formation of a sustainable talent ecosystem. This issue provides both a practical entry point and a theoretical lens for further investigation into the factors influencing talent agglomeration in Lhasa's science and technology sector.

1.2 Research questions

Against the backdrop of an increasingly complex global economic environment and intensifying regional development competition, how to enhance the talent attraction and aggregation capacity of local technology enterprises has become a key issue in both regional economic research and human resource management practice. This issue is particularly prominent in western frontier regions of China, where geographical constraints and relatively weak economic foundations exacerbate the talent bottleneck in technological enterprises, thereby imposing substantial limitations on industrial upgrading and high-quality development.

Taking Lhasa as an example, although its information technology industry has shown rapid development in recent years — with growing policy support and a steady increase in the number of enterprises — the recruitment and retention of high-quality talent remain significantly challenging. Preliminary field investigations conducted by the author revealed that many enterprises face a common dilemma of "inability to attract, difficulty in retaining" talent, with a talent aggregation pattern characterized by "high inflow but low retention, with evident outflow." This phenomenon not only restricts the improvement of enterprises' R&D capabilities and innovation levels but also hinders the sustainable development of the regional IT industry.

The formation mechanism of talent aggregation is characterized by its multidimensionality and systemic nature. It is influenced not only by macro-level environmental factors — such as natural climate and living conditions — but also by meso- and micro-level factors including policy incentives, industrial foundations, and corporate management practices. Based on a thorough review of existing literature and findings from field research, and in conjunction with the practical development of the IT industry in Lhasa, this study proposes the following five core research questions to explore the key factors influencing talent aggregation in Lhasa's IT enterprises:

(1) Does the plateau climate environment have a negative impact on talent aggregation?

Located on the Qinghai-Tibet Plateau, Lhasa is characterized by high altitude and harsh climate conditions. Long-term residence in such an environment may pose significant physiological adaptation challenges, including altitude sickness and strong ultraviolet radiation, which may reduce the willingness of potential talent to relocate, thus becoming a major external barrier to talent inflow. Therefore, it is necessary to examine whether the plateau's natural environment significantly affects the level of talent aggregation in Lhasa's IT enterprises.

(2) Do local talent policies have a positive impact on talent aggregation?

In recent years, the Tibet Autonomous Region has introduced a series of talent support policies targeting technology-based enterprises, covering areas such as talent recruitment, financial subsidies, and housing security. However, the actual effectiveness of these policies and whether they have truly enhanced enterprises' attractiveness to talent remain to be empirically tested. This study aims to assess the intensity and mechanism through which local government policies influence talent aggregation in IT enterprises.

(3) Do quality of life and social welfare significantly influence talent aggregation?

Urban quality of life factors — such as medical services, education, transportation, housing, and child-rearing conditions — directly affect individuals' willingness to settle and make long-term residential decisions. The soundness of the social welfare system and its capacity to provide sustained life security serve as important indicators of a region's talent ecosystem. This study will examine the extent to which quality of life and social welfare in Lhasa are associated with talent aggregation levels.

(4) Does the development level of the IT industry influence talent aggregation?

There exists a high degree of coupling between regional industrial development and talent aggregation. The more developed the IT industry, the better the job opportunities and clearer the career paths it can offer, thereby attracting and retaining high-level talent. As the core region for Tibet's IT industry, whether Lhasa's industrial scale, innovation platforms, and development potential exhibit a notable "magnetic effect" warrants in-depth analysis.

(5) Do enterprises' human resource management practices enhance talent aggregation capacity?

At the micro level, internal HRM practices — such as scientific recruitment processes, fair compensation systems, comprehensive training and promotion mechanisms, and healthy organizational culture — play a direct role in attracting and retaining talent. This study seeks to explore whether the level of HRM practices at the enterprise level has a significant positive effect on talent aggregation, and further, to propose management improvement strategies accordingly.

1.3 Research objectives and significance

In this context, this study takes information technology enterprises in Lhasa as the primary research object, systematically exploring the influencing mechanisms of talent aggregation and proposing corresponding management strategies and policy optimization directions. The objectives and significance of this research can be elaborated from the following three perspectives:

(1) Theoretical Significance: Enriching the theoretical research on talent aggregation mechanisms and expanding the regional understanding of talent management in IT enterprises

Although numerous scholars have examined the influencing factors of talent aggregation from multiple angles—such as economic attractiveness, social networks, and institutional environments — most existing studies focus on developed coastal regions in eastern China. There remains a significant gap in research concerning talent aggregation in high-altitude regions and frontier cities, particularly Lhasa.

This study integrates the unique natural environment of the plateau with macro-level regional institutional factors to construct an analytical framework comprising five dimensions: natural environment, policy support, social welfare, industrial potential, and internal human resource management practices. The aim is to fill the research gap in the intersecting fields of "frontier regions – high-tech enterprises – talent aggregation," and to promote the contextualized development of relevant theories in peripheral regions.

(2) Practical Significance: Providing managerial and policy-based insights to enhance talent aggregation in Lhasa's IT enterprises

Talent aggregation is a key variable driving regional innovation and industrial upgrading. By empirically identifying the major obstacles and driving forces that influence talent aggregation in Lhasa's IT sector, this study helps enterprises clarify directions for improving their human resource management — such as optimizing recruitment processes, enhancing incentive mechanisms, and improving organizational culture — to increase their attractiveness and retention capacity for high-level talent.

Furthermore, by pinpointing the key factors affecting talent retention, enterprises can better allocate resources, improve job-person matching efficiency, and achieve deeper integration between human capital and organizational strategy. This will enhance overall competitiveness and innovation capability. Especially in the innovation-driven IT industry, talent aggregation produces notable marginal spillover effects, playing a strategic role in shaping the broader industrial ecosystem.

(3) Policy Significance: Offering empirical references for optimizing regional talent policies and promoting balanced regional development strategies

As a representative frontier city in China's economic geography, Lhasa faces inherent disadvantages in attracting and retaining high-end talent. Through a combination of quantitative and qualitative methods, this study evaluates the effectiveness of existing local talent policies, identifies weak points in policy implementation and institutional bottlenecks, and proposes differentiated and targeted policy recommendations.

The findings of this study can provide theoretical support for the Lhasa municipal government to develop more practical policy tools, enhance the systematization, feasibility, and adaptability of talent-related policies, and offer decision-making references for regional development and talent strategies in other frontier areas across Tibet and the broader western region. This contributes to the national strategic goals of "coordinated regional development" and "high-quality development."

1.4 Research methodology

1.4.1 Survey method

This study adopts questionnaire surveys as the main method for data collection, supplemented by field interviews, to systematically investigate the phenomena of talent attraction and turnover among high-quality personnel in Lhasa's technology enterprises. The survey process is divided into three phases:

(1) Preliminary interview and sampling preparation phase

By reviewing official documents from Lhasa's science and technology management departments and industrial park platforms, a list of local IT enterprises was compiled, along with basic information such as enterprise size, industry attributes, and geographic distribution. Based on this, preliminary interviews were conducted to understand the practical challenges of talent management faced by Lhasa-based tech companies, providing first-hand insights for questionnaire design.

(2) Pilot survey phase

Drawing on the literature review and interview findings, a draft questionnaire was developed, covering five core dimensions: plateau environmental factors, policy support, social welfare, industrial potential, and human resource management practices. A pilot group was formed to conduct a small-scale survey among selected IT employees to assess the

questionnaire's content validity, structural reliability, and item clarity. Based on feedback, the questionnaire was revised and refined to ensure its scientific rigor and contextual adaptability.

(3) Formal survey phase

Upon finalizing the questionnaire, a full-scale survey was conducted with broader coverage and a larger sample size, including Lhasa High-Tech Zone, IT industrial parks, and representative private and state-owned IT enterprises. The data collected during this phase serves as the empirical foundation for subsequent hypothesis testing.

1.4.2 Empirical analysis method

To ensure the statistical significance and explanatory power of the research results, multiple econometric techniques will be employed to systematically analyze the survey data:

Descriptive Statistical Analysis: Used to present basic trends of sample characteristics and key variables.

Reliability Test: Cronbach's alpha coefficient will be used to assess internal consistency of the measurement scales.

Validity Test: Kaiser-Meyer-Olkin (KMO) and Bartlett's test of sphericity will be used to determine the suitability for factor analysis.

Regression and Structural Equation Modeling (SEM): Multiple regression analysis and SEM will be employed to test the path relationships among variables and to verify the proposed research hypotheses.

The structural diagram of this dissertation is shown in Figure 1.1.

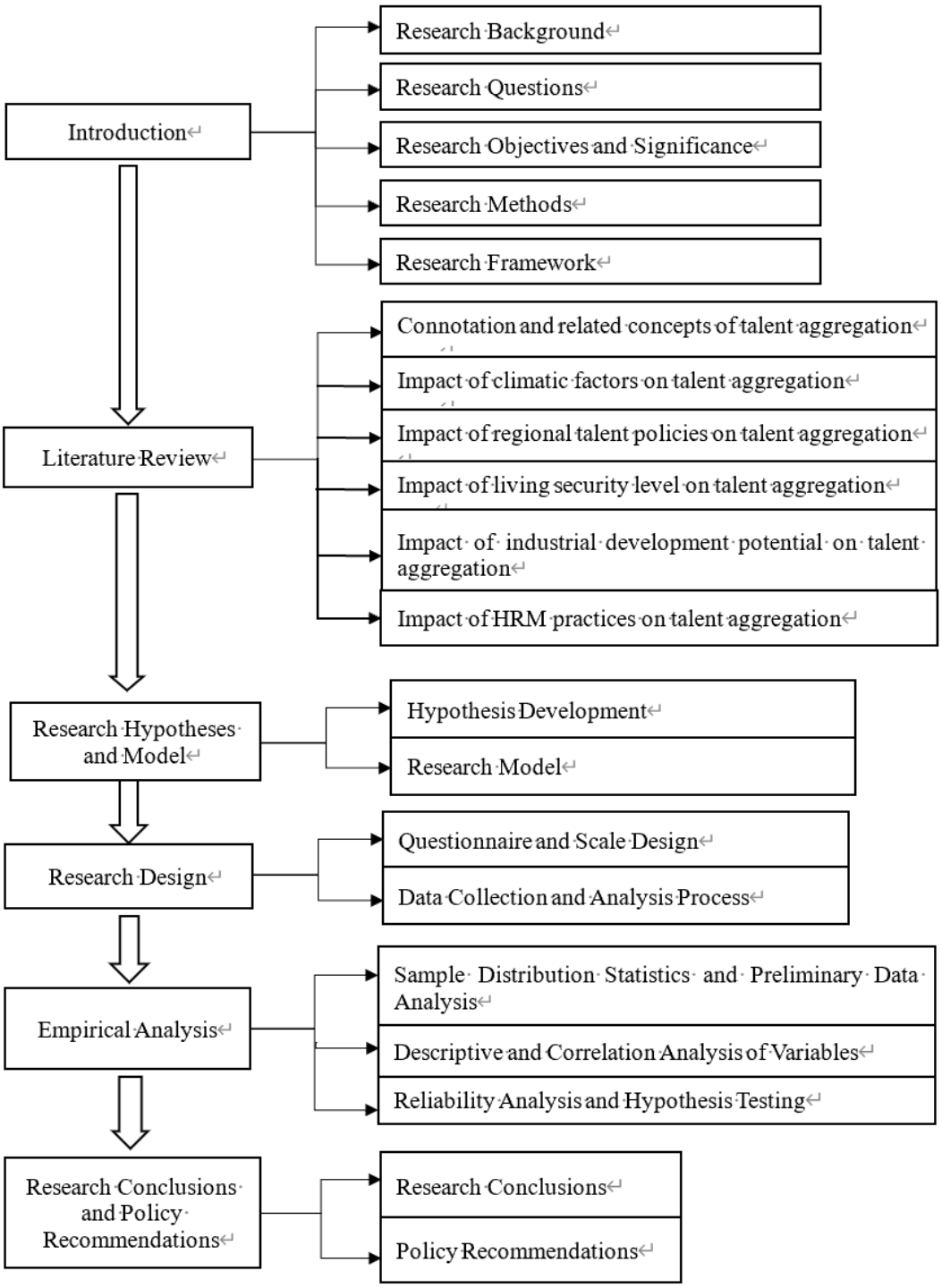


Figure 1.1 Research framework diagram

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Chapter 2: Literature Review

2.1 Connotation and related concepts of talent agglomeration

2.1.1 Connotation of talent agglomeration

In the era of the knowledge economy, talent — serving as the core carrier of knowledge creation, technological breakthroughs, and industrial upgrading — has become a critical factor in assessing the development potential of a region through its spatial distribution patterns and agglomeration effects. This issue has garnered increasing attention across sectors. In essence, regional competition in the 21st century is a contest over the capacity to allocate talent resources. From a practical standpoint, talent is not only the initiator of technological innovation and the disseminator of knowledge, but also the most dynamic core element within regional innovation systems. Through interdisciplinary collaboration, talent helps break down technological barriers and catalyze the emergence of new industrial models. This process is directly linked to a firm's market competitiveness, the upgrading of industrial value chains, and the sustainable growth of regional economies. Therefore, a thorough explanation of the fundamental connotation of talent agglomeration and a systematic clarification of its interaction with variables such as industrial foundation, spatial carriers, and policy environments is not only a logical starting point for constructing a theoretical framework of talent development, but also a practical necessity for formulating differentiated talent strategies, optimizing regional resource allocation, and achieving breakthrough development amid intense competition.

Talent agglomeration has long been a topic of academic and practical concern. Since Lucas (1988) posed the classic question — "Why do people pay such high rents to live in Manhattan or Chicago?" — the phenomenon of spatial talent concentration has increasingly attracted scholarly attention. Lucas argued that the continuous attractiveness of cities to talent is not a coincidence but is primarily driven by the "knowledge externalities" and "interactive learning" mechanisms generated through high-density talent clustering. Specifically, when a large number of talented individuals gather within a particular geographic area, knowledge exchange among individuals more readily transcends traditional boundaries. Tacit experiences and explicit information are rapidly diffused through everyday interactions. This "proximity effect" not only accelerates the value enhancement of human capital but also generates significant

positive spillovers in terms of urban productivity and innovation capacity. Numerous real-world cases — from the tech elites of Silicon Valley to the financial experts of Wall Street — have vividly illustrated this pattern. The "intellectual magnetic field" formed by talent agglomeration enables individuals to upgrade their skills through interaction, while simultaneously empowering cities to achieve sustainable growth via knowledge spillovers. This reflects the deep logic underlying the phenomenon of talent agglomeration and lays a crucial theoretical foundation for subsequent research on talent mobility and urban development.

Simon (1998) defined talent agglomeration as "a process in which socioeconomic motivations related to employment drive the dense spatial distribution of human capital." This definition highlights the geographic and social dimensions underpinning talent flows and emphasizes the phenomenon's characteristics of spatial concentration, actor interaction, and institutional embeddedness. Building on this theoretical foundation, Giannetti (2001) further argued that the structural combination of workers with different skill levels within a given space, through mechanisms of specialized division of labor and collaborative synergy, can generate significant economies of scale and effectively enhance innovation efficiency. This "skill complementarity" mechanism, rooted in skill differentiation, forms the micro-foundation of the talent agglomeration process. It not only offers critical insight into how stable and efficient relational networks are formed among talent in space, but also reveals the intrinsic, self-organizing driving forces behind agglomeration patterns. It is precisely the complementary coordination of individual skills at the micro level that shapes the vitality and sustainability of talent agglomeration at the macro level.

In the context of globalization and the knowledge economy, the strategic value of talent agglomeration has risen to become a central priority in regional development and a core driver of regional competitiveness (Rogerson & Tremblay, 2008). The ability of cities and enterprises to achieve sustainable development increasingly depends on their capacity to attract and retain key talent. Nankervis (2013), focusing on the Chinese context, further revealed that amid the complex backdrop of rapid economic growth and deep transformations in labor structures, China's human resource management faces a formidable "dual challenge": On the one hand, it must continuously enhance its appeal to external high-end and scarce talent in order to fill critical skill gaps and inject innovative vitality; on the other hand, it must strengthen internal retention and motivation mechanisms to fully unleash the potential of existing talent and prevent the loss of core human capital. These two intertwined challenges together form the key leverage points for improving talent management effectiveness at the current stage of development.

From the perspective of regional economics, Krugman (1991), in his theory of New Economic Geography, emphasizes that talent, as a critical factor of production akin to physical capital, is not randomly distributed in space. Instead, its spatial allocation is significantly influenced by factors such as increasing returns to scale, market potential, and transportation costs, resulting in a pronounced tendency toward agglomeration. His classical Core–Periphery Model illustrates the dynamic process of spatial talent accumulation: in the early stages of industrial spatial evolution, the centripetal forces generated by agglomeration economies lead to the accelerated convergence of talent and various resources into the "core region." Conversely, peripheral areas are often caught in a dual dilemma of "talent drain" and "industrial hollowing-out," thus revealing and potentially reinforcing regional development disparities. This model provides a powerful micro-level analytical framework for understanding the root causes of regional imbalances and offers significant theoretical insights for formulating policies aimed at promoting balanced talent development across regions.

Talent agglomeration and industrial agglomeration exhibit a mutually constitutive and symbiotic relationship, with the former often regarded as both a derivative outcome and a strategic prerequisite of the latter. On the one hand, talent agglomeration is frequently seen as the natural extension and core product of industrial clustering. The formation of mature industrial chains offers abundant job opportunities, efficient collaboration platforms, and continuous learning and development spaces for professionals in specific fields, thereby strongly attracting related talent to gather in particular regions. This convergence is not merely an accumulation of individuals but leads to the emergence of tightly knit "talent networks" through sustained collaboration and interaction, which in turn accelerates knowledge diffusion and generates significant "technology spillover effects." These processes form the core of regional innovation vitality (Van Hemert et al., 2013).

On the other hand, talent agglomeration also serves as a critical strategic foundation for driving continuous industrial upgrading and deep development. As early as in the industry life cycle theory, Taylor and Taylor (1977) emphasized that high-level, specialized talent clusters can effectively feed back into industrial development by providing intellectual support, stimulating entrepreneurial dynamics, and optimizing the regional entrepreneurial ecosystem. This significantly enhances the efficiency with which technological innovations are translated into real productivity. In the context of China's pursuit of high-quality development, this deep coupling and positive feedback mechanism between talent and industry is particularly essential. Talent networks nourish industrial innovation, while industrial upgrading in turn creates broader value realization platforms for talent, ultimately fostering a virtuous cycle of "industry

attracting talent, and talent advancing industry," which serves as a foundational pillar for enhancing regional and national competitiveness.

Furthermore, the formation of talent agglomeration is not solely driven by market forces but is also profoundly influenced by a combination of institutional arrangements, cultural contexts, social welfare systems, and living environments. Empirical studies have confirmed that key factors such as quality of life, housing affordability, access to high-quality education and healthcare, and urban inclusiveness significantly affect individuals' willingness to migrate. In recent years, the analytical perspective has deepened, placing increasing emphasis on the central role of "soft environmental factors" in attracting and retaining talent. These factors go beyond traditional physical infrastructure and encompass intangible aspects such as urban cultural atmosphere, community sense of belonging, and environmental comfort. This is particularly critical for regions with relatively harsh natural conditions or remote geographical locations, such as plateau cities and border areas. For such regions, the construction of an appealing soft environment — through fostering an open and inclusive social climate, providing efficient and accessible government services, ensuring a high-quality ecological environment, and enhancing livability — often becomes a strategic breakthrough and a core competitive advantage to offset inherent disadvantages and improve talent attraction and retention. In many cases, the importance of these soft factors may even rival that of economic incentives.

2.1.2 Theories related to talent aggregation

Talent agglomeration is a complex process involving the interaction of multi-level factors, including macro-environmental attraction and repulsion forces, individual cognitive and affective evaluations, as well as reciprocal exchanges between organizations and individuals. In order to systematically reveal the influencing factors and mechanisms of talent agglomeration in information technology enterprises in Lhasa, this study adopts Push–Pull Theory, Cognitive-Affective Theory, and Social Exchange Theory as the core theoretical foundations. An analytical framework is constructed from three levels: macro-level driving forces, individual psychological mechanisms, and organizational interaction relationships.

(1) Push–Pull Theory

Push–Pull Theory was first proposed by Ravenstein (1885) in his study of population migration patterns and was subsequently systematized and further developed by Lee (1966), becoming a classical theoretical framework for explaining population mobility and talent migration. The theory posits that spatial mobility is jointly driven by two categories of forces: push factors and pull factors. Push factors refer to negative conditions in the place of origin that

motivate individuals to leave, such as harsh natural environments, limited development opportunities, and lower quality of life. Pull factors refer to positive conditions in the destination that attract talent inflows, including favorable policy support, promising industrial prospects, and competitive compensation (Lee, 1966).

Building upon this foundation, Castles and Miller (2009) extended Push–Pull Theory to the study of international labor mobility under globalization, emphasizing the moderating role of institutional environments and social networks in migration decision-making. In this study, Push–Pull Theory provides a macro-level analytical framework for understanding how high-altitude climatic conditions in Lhasa (push factors), regional talent policies and industrial development potential (pull factors), and living security levels (with both push and pull attributes) influence talent agglomeration.

Specifically, the health risks associated with the plateau climate constitute significant push forces that may discourage talent retention, whereas preferential talent policies, favorable industrial development prospects, and well-developed living security systems function as pull forces attracting talent inflows. The relative strength and interaction between these push and pull forces directly determine the level of talent agglomeration in Lhasa.

(2) Cognitive-Affective Theory

Cognitive-Affective Theory originates from psychology and emphasizes the central role of cognitive appraisal and emotional response in behavioral decision-making. Lazarus (1991) argues that individual behavioral responses to external environments are not directly determined by objective stimuli but are mediated through subjective cognitive appraisal processes. Individuals first cognitively process environmental information and evaluate its relevance to their well-being, subsequently generating emotional experiences that ultimately drive behavioral decisions.

Building upon this perspective, Mischel and Shoda (1995) proposed the Cognitive-Affective Personality System (CAPS), highlighting the dynamic interaction between cognition and affect in shaping individual behavioral patterns. In organizational behavior research, this theoretical perspective has been widely used to explain how employees' subjective evaluations of their work environment influence their attitudes and behaviors. Events in the work environment trigger affective reactions, which subsequently shape employees' work attitudes and behavioral outcomes.

In this study, Cognitive-Affective Theory provides the theoretical basis for understanding the mediating mechanisms of key psychological variables. Talents' perceptions and evaluations of various environmental factors in Lhasa, including perceived high-altitude health risks, place

identity, place dependence, perceived environmental uncertainty, and job satisfaction, are essentially outcomes of cognitive appraisal and emotional responses. These subjective psychological states play a critical mediating role between objective environmental factors and talent agglomeration behaviors.

(3) Social Exchange Theory

Social Exchange Theory was initially proposed by Homans (1958) and further developed by Blau (1964) and Emerson (1976), becoming a foundational theory for explaining social interaction and organizational behavior. The core assumption of the theory is that social interaction is fundamentally a process of resource exchange. Individuals evaluate the ratio between contributions and returns in social relationships. When perceived returns exceed contributions, individuals are inclined to maintain and strengthen the relationship; otherwise, they may choose to withdraw (Blau, 1964).

In organizational contexts, Cropanzano and Mitchell (2005) argue that a reciprocal exchange relationship exists between employees and organizations. Organizations provide resources such as compensation and benefits, career development opportunities, work support, and fair treatment in exchange for employees' loyalty, commitment, and performance contributions. When employees perceive that organizational support meets their expectations, organizational commitment and retention intention are enhanced. Conversely, when the exchange relationship is perceived as inequitable, turnover intention increases significantly.

Furthermore, Eisenberger et al. (1986) proposed Perceived Organizational Support Theory, emphasizing that employees' perceptions of whether the organization values their contributions and cares about their well-being constitute a key determinant of work attitudes and behaviors. In this study, Social Exchange Theory provides the theoretical foundation for explaining how human resource management practices influence talent agglomeration in information technology enterprises in Lhasa. Through scientific compensation systems, comprehensive training and development mechanisms, and fair performance evaluation systems, enterprises establish positive exchange relationships with employees, enhance job satisfaction and organizational commitment, and thereby promote talent agglomeration.

At the regional level, this theory also facilitates understanding of the exchange relationship between talents and the locality. Local governments and communities provide policy support and living security resources in exchange for talents' long-term settlement and contributions to regional development.

2.2 Factors influencing talent agglomeration

2.2.1 Impact of high-altitude regions

High-altitude regions exhibit a distinctive influence mechanism on the process of talent agglomeration, differing notably from low- and mid-altitude areas. Compared with these regions, the harsh climatic conditions of hypoxia and cold, relatively weak infrastructure, and unique geo-economic structures in high-altitude zones jointly shape special patterns of talent mobility and concentration. Existing research primarily focuses on three dimensions — physiological adaptability, economic and infrastructure conditions, and policy adjustment mechanisms—to explore the restrictive factors of the plateau environment on talent agglomeration and to propose adaptive optimization strategies accordingly.

(1) Impact of physiological adaptability

The physiological effects of high-altitude environments on talent agglomeration exhibit a distinct dual character. The unique features of low oxygen and low air pressure function through physiological adaptability pathways to create both rigid barriers and dynamic adjustment potential. This dual mechanism of inhibition and promotion fundamentally shapes the internal logic of talent attraction and retention in plateau regions.

The hypobaric and hypoxic conditions in high-altitude areas act as physiological constraints, forming barriers to talent agglomeration. As altitude increases, atmospheric pressure decreases, resulting in reduced partial pressure of oxygen in the air. Since the human brain is highly dependent on oxygen, the low-oxygen environment of the plateau poses a significant challenge to neurological function (Burtscher et al., 2024). It is also documented through clinical trials that prolonged exposure to hypoxic conditions at high altitudes may lead to chronic high-altitude responses, such as dyspnea, sleep disturbances, and cognitive decline. All of these effects may impair labor productivity and the sustainability of human capital. These effects are particularly pronounced for knowledge workers in brain-intensive industries, as hypoxic states may impair decision-making, creativity, and learning abilities. The negative impacts tend to worsen over time and, once prolonged exposure surpasses a certain threshold, may even result in irreversible structural changes in the brain (Qaid et al., 2017). In addition to direct physiological effects, hypoxia at high altitudes may also contribute to psychological health issues. Research shows that, compared with populations living at low altitudes, residents of high-altitude regions experience higher rates of anxiety, depression, suicidal behavior, and cognitive disorders. This discrepancy may be linked to the long-term impacts of low oxygen

levels on brain function (Burtscher et al., 2024).

However, systematic high-altitude training can activate compensatory physiological mechanisms, transforming rigid constraints into manageable adaptive challenges. Research has shown that certain individuals, after undergoing structured acclimatization training, are capable of adapting to hypoxic environments to a significant extent, demonstrating considerable environmental adaptability. This finding suggests that although harsh high-altitude conditions pose physiological barriers, they do not function as absolute exclusionary mechanisms; rather, there exists a window of adaptation. During this period, with continuous training and bodily self-regulation, individuals may gradually achieve new physiological equilibrium. This has important implications for policy-making—specifically, for establishing "transitional support mechanisms" to assist in high-altitude development, workforce deployment, and tourism planning. Policies based on human physiological adaptation can help formulate rational transition strategies, supported by appropriate infrastructure and monitoring systems, thereby providing a sound basis for the development and utilization of high-altitude regions.

(2) Impact of economic and infrastructure conditions

The relative underdevelopment of the economic base in high-altitude regions exerts a suppressive effect on human capital accumulation. Due to geographic isolation and high construction costs, these regions often face systemic developmental constraints, including sparse transportation networks, inadequate access to healthcare and education, and structural deficiencies in comprehensive urban services. These limitations weaken a region's "livability" and "career development potential", thereby restricting its capacity to attract and retain talent. Moreover, the limited market scale and incomplete industrial chains constrain job diversity and diminish the predictability of career advancement opportunities.

At the same time, numerous scholars have categorized regional environmental characteristics that attract talent into two broad types: soft factors and hard factors. Soft factors include elements such as urban culture, social inclusiveness, population diversity, and openness, while hard factors primarily refer to investment availability, employment opportunities, and cost of living (Bereitschaft & Cammack, 2015). Esmaeilpoorarabi et al. (2018) further analyzed the distinct roles these two types of factors play in talent attraction. His research found that, at both urban and regional scales, soft factors typically rely on the foundation provided by hard infrastructure to attract clusters of knowledge workers. The interplay between soft and hard factors thus creates a synergistic effect that continuously cultivates and strengthens regional talent capacity.

Despite the natural challenges posed by high-altitude environments, their unique climatic

conditions have opened up new pathways for talent agglomeration. From the perspective of industrial economics, high-altitude regions, by leveraging their extreme climates and unique ecological resources, have developed irreplaceable competitive advantages through differentiated growth in specialized industries such as eco-tourism, alpine agriculture and animal husbandry, clean energy, and traditional Tibetan medicine. These specialized industries not only align with the region's resource endowments but also generate a strong talent "magnet effect" in niche sectors. Although plateau regions face objective limitations in terms of urban infrastructure and market scale, their precise industrial positioning and alignment with professional development demands can disrupt conventional patterns of talent concentration, fostering a highly localized "point-based talent agglomeration effect." This form of agglomeration focuses on specific domains and centers around key industries. By extending and refining the associated industrial ecosystem, it gradually builds an exclusive development space for talent, thereby exploring an innovative, targeted path for regional human capital accumulation.

(3) Impact of policy adjustment mechanisms

Policy interventions play a critical role in mitigating the locational disadvantages of plateau regions and in promoting talent agglomeration. It is widely acknowledged that policy levers can significantly compensate for inherent geographic disadvantages. Measures such as establishing dedicated talent subsidies, offering tax incentives, and redirecting research programs toward high-altitude regions have not only effectively reduced the overall cost of living and working in these areas but also provided key platforms for professionals to realize their value and potential. Comparative analysis of case studies in Tibet, China and the Andean regions of Latin America has further revealed the instrumental role of "public interest-oriented talent guidance mechanisms" in essential fields such as healthcare, education, and public services. These findings offer actionable models for local government policymaking. For example, China's "Three Regions and Three Prefectures" Talent Support Program and the "Highland Talent Program" launched by the Tibet Autonomous Region have successfully guided core talent inflows into high-altitude areas by creating a comprehensive support model of "living subsidies + professional platforms + housing guarantees," thereby initially alleviating structural talent shortages in key sectors.

The effectiveness of well-designed policy interventions lies not only in their short-term ability to attract talent inflows. More importantly, through sustained resource investment, they work to improve the working environment, career development prospects, and overall quality of life in high-altitude regions, gradually establishing a virtuous cycle in which talent can be

"attracted, retained, and effectively utilized." From a long-term perspective, the deep implementation of such talent policies continues to infuse high-altitude regions with dynamic innovative capacity and significantly expands the scale of urban human capital. Davis and Dingel (2019) pointed out that this agglomeration effect leads to ongoing optimization of the human capital structure in cities, moving toward higher levels of specialization and sophistication. Therefore, policy intervention is not merely an emergency response to talent shortages in plateau regions—it constitutes a long-term strategic support mechanism that injects sustained momentum into regional economic and social development and lays a solid foundation for talent-driven growth.

2.2.2 Impact of regional talent policies

As a key variable influencing talent agglomeration, regional talent policy has attracted increasing attention in recent years. Against the backdrop of intensifying interregional competition, local governments across various regions have actively formulated and implemented differentiated talent policies to attract and retain skilled individuals. These policies play a significant role in the allocation of talent resources and the advancement of regional innovation. This section reviews relevant literature from two dimensions: the theoretical logic and institutional framework of talent policies, and the mechanisms of diverse policy tools, in order to explore the impact pathways of regional talent policies on talent agglomeration.

(1) Theoretical logic and institutional framework of talent policy

In the context of the knowledge-driven economy becoming the dominant force in global development, the strategic value of talent as a core innovation factor has been elevated to an unprecedented level. Regional talent policies formulated and implemented by local governments have therefore become critical institutional variables for shaping regional talent ecosystems, guiding efficient talent flows, and optimizing the spatial configuration of talent resources. Particularly in China, where provincial-level competition is increasingly fierce, talent policy has evolved beyond a conventional public administration tool. It has become a key vehicle for articulating local strategic priorities and gaining first-mover advantages in future development. Existing studies generally agree that systematic, differentiated, and targeted talent policies significantly enhance a region's attractiveness and retention capacity for high-level professionals (Shen, 2020).

Rodrik (1995), in his discussion of policy tools in developing countries, pointed out that under imperfect market conditions, effective government intervention—through industrial and

talent policies—can help correct market failures, optimize resource allocation, and promote comprehensive socioeconomic development. This theoretical perspective provides a critical foundation for understanding the institutional logic behind Chinese local governments' implementation of "talent-powered city" strategies.

As China faces a declining demographic dividend due to population aging and a falling birth rate (Z. Wang et al., 2024), fully leveraging the talent dividend has become both an objective necessity and an inevitable path to achieving innovation-driven, high-quality economic development (King et al., 2021). In 2010, China issued the National Medium- and Long-Term Talent Development Plan Outline (2010–2020), marking a critical step in using talent dividends to facilitate economic transformation. In 2012, the General Office of the CPC Central Committee released the Opinions on Further Strengthening the Party's Leadership over Talent Work, emphasizing that "the Party's leadership over talent" is a fundamental principle. Since then, local governments have gradually improved their mechanisms for talent introduction and management, including enhancing post-recruitment performance evaluations and incentive systems. Given the scarcity of high-level talent and the enormous demand posed by high-tech industries, local governments have engaged in active competition to attract skilled professionals. The 19th National Congress of the Communist Party of China in 2017 reaffirmed that national development and rejuvenation depend on talent. In response to national strategies and urban development needs, local governments have become increasingly proactive in talent acquisition, forming systematic talent introduction frameworks.

Typically, local talent attraction policies consist of two major components. The first is talent classification, which categorizes individuals based on academic qualifications, professional credentials, or job titles. Definitions of high-level talent vary by region, depending on the local stage of development, economic conditions, and policy objectives. Classification is generally based on three dimensions: educational background, professional rank or role significance, and economic value. Different talent categories receive differentiated benefits and preferential policy treatment. The second component specifies the welfare entitlements available to recruited talent. To incentivize high-level professionals, local governments often provide direct financial support, such as monetary subsidies and housing allowances. Additionally, major supporting measures typically include streamlined household registration procedures, access to quality education for dependents, and comprehensive social security services for family members.

(2) Mechanisms of diverse talent policy instruments

In the Chinese context, many cities have launched intense "talent wars" by implementing

preferential settlement policies, living subsidies, housing assistance, and other incentives to attract high-end groups such as postdoctoral researchers, senior engineers, and overseas returnees. Cities like Shenzhen, Hangzhou, and Chengdu have introduced new talent policies characterized by high policy density and rapid implementation, fostering a competitive environment (Shen, 2020). These measures help shape a strong regional sense of talent identity and exert a pronounced absorptive effect, particularly on emerging industries and technology enterprises.

Economic incentives in talent introduction policies serve as crucial institutional tools that continuously and significantly guide the optimization of regional human capital structures. From the intrinsic drivers of population mobility, China's interregional labor migration is primarily influenced by disparities in regional economic development levels, with wage income—an economic factor—being the fundamental consideration in migration decisions (Y. Liu & Shen, 2014). This economically driven mobility characteristic clearly indicates that local governments, through diversified monetized incentives such as housing subsidies, research startup funds, performance bonuses, and tax reductions, can substantially enhance the attractiveness and competitiveness of targeted regions for specific skilled talents. These measures effectively regulate the spatial allocation of talent resources, guiding highly skilled and specialized individuals to concentrate in policy-favored areas, thereby systematically reshaping the skill density, professional structure, and innovation capacity of regional human capital. This process injects core momentum into regional industrial upgrading and high-quality economic development.

Beyond providing economic subsidies, constructing psychological and cultural adaptation mechanisms between talent and regions should also be regarded as a key consideration in policy design. Rogerson and Tremblay (2008), through their study of Place Rating Almanacs (PRA) and talent migration behavior, revealed an important insight: if local governments incorporate social identity shaping, a sense of belonging cultivation, and career development support—soft dimensions—into their talent strategies, they can form a unique "talent preference pathway." This pathway transcends purely material incentives and profoundly influences talent choices and work initiative, significantly enhancing the relative attractiveness of a region in the fiercely competitive human capital market (Sim et al., 2025). This finding suggests that local governments urgently need to move beyond the sole focus on salary subsidies and instead systematically invest in fostering deep connections between talent and regional environments in terms of psychological compatibility, cultural affinity, and value recognition. By cultivating a more inclusive, supportive, and growth-oriented soft environment, regions can not only attract

talent inflows but also effectively promote their long-term rooting and value creation—achieving a strategic shift from short-term "blood transfusion" to long-term "hematopoiesis" in talent introduction.

Talent policies often interact with local resource endowments. From a talent ecosystem perspective, Cadorin et al. (2021) emphasize the critical role of local governments in building "industry park—universities—enterprises" collaborative mechanisms. They point out that successful talent agglomeration policies typically rely on innovation platforms and university resources to facilitate knowledge flow between enterprises and academic institutions, promoting talent concentration and retention within industrial parks. Local policies act not only as incentive tools but also as intermediary systems for resource integration and factor coordination. Governments need to use policy as a linkage to connect the knowledge transfer chain by establishing industry-academia-research cooperation platforms and improving technology commercialization mechanisms, enabling talent to realize value resonance within a compatible resource environment. This policy design goes beyond mere subsidy incentives, forming a virtuous cycle of "policy guidance — resource aggregation — talent attraction" that achieves deep coupling between talent agglomeration and regional developmental endowments.

Policy interventions not only directly influence individual talent decisions but also indirectly construct talent magnets by optimizing the enterprise development ecosystem. Lach (2002), in his study of Israeli firms, found that government-provided R&D subsidies significantly increased firms' willingness to invest in research and development, which not only boosted short-term R&D intensity but also effectively optimized the firms' long-term human capital structures, attracting more high-skilled talent (Walker, 2015), in his research on Southeast Asian agricultural enterprises, revealed that, under stable political conditions, government subsidies more efficiently translate into productivity improvements. Both studies point to a profound reality: the effectiveness of any policy incentive is not isolated but deeply embedded and constrained by specific industry characteristics, complex macro-environmental contexts, and the implementation capabilities of policy actors. The practical outcomes of these incentives must be released through dynamic adaptation to realize the compound effects of talent attraction and agglomeration.

Chinese scholars have further empirically validated the effects of talent policies on regional innovation and talent agglomeration using panel data. Zhong (2020), based on panel data from 30 provinces between 2005 and 2014, found that the construction of talent platforms—such as talent apartments, entrepreneurship carriers, and research funds—plays a core role in enhancing regional talent competitiveness. Moreover, the promotion effect of talent policies on innovation

output (measured by patent applications) was most pronounced in the subsequent year, indicating that the mechanism design of talent policies exhibits lagged and cumulative characteristics.

W. Chen et al. (2022) applied a multi-period difference-in-differences model to empirically examine the impact of talent policies on urban innovation across 277 prefecture-level cities in China from 2010 to 2019. The study revealed that the so-called "talent wars" policy generated positive effects on urban innovation. Specifically, among the subsidy methods under the talent wars policy, employment and entrepreneurship subsidies had the strongest incentive effect on urban innovation, followed by housing subsidies for talent. Furthermore, the talent wars policy positively influenced urban innovation by enhancing cities' innovation willingness and talent agglomeration levels.

At the micro-level, Xue et al. (2025), using new energy vehicle enterprises as a research sample, pointed out that targeted talent policies optimize firms' human capital structure by increasing the proportion of highly educated and technical employees in the total workforce, thereby improving technological innovation, patent output, production quality, and efficiency.

X. Shi et al. (2022), analyzing a sample of 1,536 A-share listed companies from 2010 to 2020, employed signaling theory and agency theory to investigate how talent policies affect corporate green technological innovation through executive incentive strategies. Their findings show that talent policies not only promote green technological innovation but also enhance such innovation by increasing executive compensation incentives. This impact pathway is more significant in high-tech enterprises and firms with weaker debt-paying abilities.

H. Wang et al. (2023), studying Chinese manufacturing firms in 2017, found that government subsidies act as a signaling mechanism to attract talent. The signaling effect released by government subsidies helps firms attract more talent, thereby achieving innovation more efficiently. Compared with state-owned enterprises, government subsidies are more effective at attracting talent to private manufacturing enterprises.

2.2.3 Impact of living security levels

Living security, as an important "soft environment variable" affecting talent inflow and stability, has attracted considerable attention in recent talent mechanism studies. High-quality transportation, housing supply, education, and healthcare not only constitute the core support system for talents' daily lives but also profoundly influence their career decisions and migration intentions (Lepawsky et al., 2010). In the new era of intensified talent competition, living security relates not only to talent's quality of life but also serves as a critical indicator for

measuring a city's talent competitiveness. It acts as the "phoenix tree" that attracts talents to a city, playing an irreplaceable strategic role in optimizing talent ecology and enhancing urban development resilience. For plateau cities with complex natural environments and relatively peripheral locations, such as Lhasa, improving living security systems is a key pathway to solving the difficulties of "talent attraction" and, even more so, "talent retention." Based on this, this section will review research on how living security levels influence talent agglomeration from three aspects: transportation, housing, and education & healthcare.

(1) Impact of transportation development level

Transportation infrastructure, as a critical physical carrier of regional economic development, is not only the rigid support for the efficient operation of various economic activities but also an indispensable fundamental guarantee for talents' daily commuting, social interactions, and access to public services. It profoundly affects residents' quality of life and regional competitiveness. As early as the 1930s, with the rise of Keynesianism, large-scale infrastructure investment was regarded as one of the core governmental economic intervention tools to stimulate effective demand. Its core logic lies in the significant "multiplier effect" — initial investments drive expansions in related industries and job creation, accelerating social capital accumulation and forming a virtuous cycle of economic growth (Farhadi, 2015).

In the context of profound changes in the global economic landscape and demands for high-quality development, the strategic importance of transportation infrastructure has become increasingly prominent. Its planning and construction have transcended pure economic stimulus functions to become systematic projects aimed at optimizing spatial structure, promoting efficient factor flows, achieving regional coordinated development, and improving overall social welfare. Transportation infrastructure shoulders the responsibility of promoting economic transformation and upgrading, thereby enhancing national comprehensive competitiveness.

Y. Huang (2008) pointed out that a well-developed transportation network is not only a key driver for enhancing a city's "economic centripetal force" but also helps effectively optimize the allocation structure of talent resources, thereby significantly enhancing the city's agglomeration effect and its connectivity with multi-centered regions. This core viewpoint has been empirically supported by Ahlfeldt and Feddersen (2018), who found a significant positive correlation between transportation investments (such as expressways, rail transit, and air accessibility) and talent agglomeration, establishing transportation as an important engine for enhancing urban comprehensive attractiveness.

Notably, the prominent role of high-speed transportation in promoting talent mobility and

regional coordinated development has been widely confirmed and extensively explored in multiple studies. C. Huang et al. (2025) found that the expansion of high-speed rail networks significantly promotes cross-regional mobility of highly skilled talents, creating favorable conditions for knowledge spillover and innovation activities. Dong et al. (2020), through comparative analysis, further revealed that in location preference, people are more inclined to migrate to second-tier cities directly connected to metropolitan areas via high-speed rail lines, as opposed to those without such connections. This underscores the critical influence of high-speed rail in reshaping urban hierarchies and talent distribution patterns. Furthermore, Q. Cheng and Yang (2024), through in-depth micro-level enterprise analysis, pointed out that the construction of high-speed rail effectively reduces spatial barriers to labor mobility, alleviating internal labor resource misallocation and improving human resource allocation efficiency. Thus, modern transportation systems represented by high-speed rail are increasingly becoming core foundational conditions for optimizing regional talent structures, stimulating economic vitality, and promoting high-quality development.

Within the regional development context, B. Hu et al. (2020) proposed that "quality of life" is a key factor influencing talent migration decisions, with transportation convenience being a critical and explicit indicator of quality of life. The level of transportation convenience not only affects talents' daily commuting efficiency and life comfort but also more deeply impacts their family's long-term settlement willingness and sense of belonging and loyalty to the city. Especially for remote cities facing urgent talent bottlenecks and seeking high-quality development, comprehensively improving quality of life is the strategic core for achieving regional balanced development. In this process, vigorously enhancing both external urban traffic connectivity (e.g., integration into regional backbone transport networks) and internal transport accessibility (e.g., improving intra-city public transport systems) should be regarded as key pathways and fundamental measures. This is not only essential for breaking geographic spatial barriers and enhancing a city's "accessibility" for talents but also serves as an important foundation and prerequisite for strengthening a city's "carrying capacity."

(2) Impact of housing security level

The issue of housing extends far beyond the mere provision of living space—it profoundly affects individuals' sense of belonging to a city and the stability of their career development. Esmaeilpoorarabi et al. (2016) pointed out that knowledge-based talents are highly sensitive to quality of life and the spatial image of cities when choosing their place of residence. As both a core carrier of life quality and a critical component of urban spatial systems, housing—specifically its scarcity and affordability—constitutes a key determinant in the decision-making

process of talents. When housing costs are prohibitively high or when individuals cannot access a living environment that meets their expectations, their satisfaction with the city may decline significantly. This not only undermines their emotional attachment to the location but also threatens their confidence in long-term development, potentially leading to reduced migration intentions or even outflow among those who have already settled, thereby affecting the stability and competitiveness of the city's talent ecosystem.

There has been substantial research on the pivotal role of housing costs in talent mobility and the complex mechanisms by which they operate. Reiner et al. (2017), in a comparative study of major metropolitan areas in Central Europe, found that for international academic talent, the affordability of housing and the availability of socially inclusive environments often outweigh career development opportunities as determining factors for location choice. King et al. (2021), in an empirical study, further demonstrated that high housing costs significantly compress talents' spending capacity in non-housing domains such as culture, education, and health, thereby reducing their overall well-being and ultimately discouraging both innovation output and migration willingness.

W. Li et al. (2023) refined this suppression effect by confirming that rising housing prices have a significant "crowding-out effect" on labor mobility, with the strength of this effect following an inverted U-shaped curve relative to the housing price-to-income ratio. Notably, this crowding-out effect is significantly more pronounced for tertiary industry workers than for those in the primary sector. Moreover, the impact of housing costs exhibits a distinct nonlinear pattern: Akosa and Osei (2025) identified a threshold effect of local housing prices on employment, indicating that at low price levels, rising housing prices may positively correlate with labor inflow, but once prices exceed a certain threshold, further increases significantly inhibit labor migration.

As competition among Chinese city clusters intensifies, many local governments have introduced targeted policies such as talent apartments and housing subsidies to ease the housing burden for talents and enhance urban attractiveness. This policy approach offers meaningful practical guidance for high-altitude cities like Lhasa. Given the city's unique plateau environment and relatively limited public service resources, Lhasa may draw on these experiences to develop more precise and differentiated housing support mechanisms aimed at attracting young professionals and family-oriented talents.

For example, the government could provide fully equipped, socially vibrant transitional apartments for young talents and offer more generous housing subsidies or access to high-quality school district resources for talents with families. By implementing policies tailored to

the core needs of different demographic groups, cities can effectively lower the migration threshold, enhance talents' willingness to settle, and build confidence in their long-term development in high-altitude urban areas. This represents a strategic breakthrough in overcoming bottlenecks in talent recruitment.

(3) Impact of education and healthcare services

The rational allocation and service quality of educational and healthcare resources form the foundational pillars for sustaining long-term talent development and enhancing urban attractiveness. These two categories of public services directly influence the quality of life and future expectations of talents. Particularly for core middle-aged and young professionals who bear family responsibilities, access to high-quality and equitable education opportunities—from primary to higher education—for their children, along with the ability for all family members to obtain convenient, reliable, and comprehensive healthcare services, have become primary considerations when evaluating potential cities for settlement and making migration decisions (Zhang & Liu, 2011).Therefore, systematically optimizing resource allocation efficiency and improving service levels in these two critical sectors is undoubtedly a key strategic focus for enhancing a city's talent appeal and overall competitiveness. It is fundamental to ensuring the health and sustainable development of the local talent ecosystem.

At present, the regional imbalance in education resource distribution and the persistent rise in education costs have become major factors contributing to educational anxiety, talent instability, and even talent migration across regions (Athamneh, 2020). In practice, China's more developed eastern regions tend to enjoy significant advantages in terms of educational funding, teaching resources, the density of elite schools, and research infrastructure, forming a noticeable gap compared to the central and western regions (Fan & Li, 2020; J. Liu, 2015). This objective disparity exerts a powerful "pull effect" in attracting talent to the eastern region. Simultaneously, the ever-increasing costs associated with the entire educational pipeline—from preschool to higher education—have imposed a considerable economic burden on many families. This financial pressure has even prompted some employees to resign and relocate to areas with either better opportunities or lower living costs to support their children's education. From a macro perspective, deficiencies in the quality of higher education and research capacity within certain countries or regions further weaken their ability to retain local talent. For example, Padmanabha (2018), in analyzing the large-scale outflow of Indian students to the United States, highlighted that deficiencies in the domestic higher education system—particularly in academic quality and cutting-edge research capacity—were core driving forces behind talent emigration. Similarly, Mlambo (2020), in their assessment of Southern Africa, noted that long-term

underinvestment in higher education, low levels of internationalization, and weak research environments have severely constrained the development and retention of high-level domestic talent, contributing significantly to talent outflow to developed countries. This composite trend of talent mobility—shaped by uneven education resource distribution, high education costs, and quality disparities—is profoundly reshaping regional development potential and competitive dynamics.

By contrast, countries and regions that have successfully attracted and retained talent are often supported by high-quality and accessible education and healthcare systems, which constitute a core component of their competitive advantage. High-income countries such as Canada and Germany offer consistently high standards in basic education, well-developed higher education systems, and efficient, comprehensive public healthcare services, providing strong life guarantees and development platforms for technical professionals and their families. These elements have become a fundamental force in attracting global talent (Lepawsky et al., 2010). Park et al. (2016), in assessing national talent migration risk levels, also emphasized that the soundness of a country's education system and its overall living standards are the two most decisive factors influencing talent retention. The core strength of such a high-quality living environment lies in its ability to eliminate worries about personal and family well-being, offering stable and predictable conditions for long-term development. High-quality educational resources ensure that talents' children have access to equitable and excellent starting points for development, while accessible and reliable healthcare services safeguard the most basic sense of security for the family. This sense of security and predictability—beyond material income—is a deep-seated reason behind decisions to remain long-term in a particular location.

Moreover, the quality of healthcare provision itself should not be underestimated. Botezat and Ramos (2020), in their study on the mobility of medical professionals, found that the modernization level of medical infrastructure, competitive compensation systems for doctors, and the availability of universal health coverage are key variables influencing the inflow or outflow of healthcare professionals. This underscores the reality that a robust healthcare delivery system not only serves the general population but also forms the backbone of regional talent ecosystem stability. A well-functioning medical system not only attracts high-end medical talents directly but also indirectly supports the vitality and sustainability of the overall regional human capital by ensuring the health and well-being of all residents—including talents in other fields and their families—thus reducing the risk of talent loss caused by health-related uncertainties.

Therefore, establishing a well-planned, high-quality, and widely accessible network of

educational and healthcare resources is an essential and long-term strategy for enhancing a city's or region's talent competitiveness and creating a livable and development-friendly environment. This necessitates that policymakers move beyond the traditional view of education and healthcare as mere public services and instead regard them as core infrastructure underpinning regional innovation capacity and competitiveness. Forward-looking, systematic planning and sustained investment are required. Only by solidifying these two fundamental pillars of public welfare—critical to talent retention—can regions effectively enhance their magnetic appeal to talent and build a strong defense against the risks of talent outflow.

2.2.4 Impact of industrial development potential

The potential for industrial development in a region, as a key indicator of the optimization level of its economic structure and its future development capacity, directly determines its ability to accommodate and attract talent. A sound industrial ecosystem not only offers high-quality employment opportunities but also provides platforms for technical advancement, career progression, and long-term professional security, serving as a fundamental basis for forming a "structural talent magnetism" (Barro, 2002). In recent years, an increasing number of scholars have examined the interactive mechanisms between industrial development and talent agglomeration from the perspectives of regional economic development, industrial structure evolution, and innovation ecosystem construction.

(1) Regional economic environment and industrial support capacity

The economic foundation of a city is the prerequisite for building its capacity to attract talent. The higher the level of economic development, the more diverse and abundant the job opportunities it can generate and offer, with more competitive and appealing compensation systems. Moreover, it creates broader and more inclusive opportunities and platforms for innovation and entrepreneurship. This comprehensive economic advantage significantly enhances the marginal benefits and expected future returns of talent development in the city, thus effectively strengthening individuals' willingness to relocate and establish long-term careers there.

On the one hand, sustained economic growth expands employment capacity on a large scale, continuously improves job specialization and quality, and greatly broadens the channels for talent inflow—effectively lowering barriers to labor market entry and improving the "accessibility" of the city. On the other hand, continuous optimization and upgrading of the industrial structure—especially shifts toward knowledge-intensive and innovation-driven sectors—can stimulate vibrant waves of technological innovation and facilitate the efficient

circulation and integration of knowledge and information, thereby creating a more dynamic and growth-oriented industrial ecosystem. This virtuous evolution of the industrial structure acts as a powerful magnet, significantly enhancing the appeal and long-term “stickiness” of the industrial system to highly skilled and specialized talent, ultimately achieving deep coupling and mutual reinforcement between urban and talent development.

According to the classical "push-pull" theoretical framework, population or talent migration decisions are shaped by a dynamic process involving a complex set of influencing factors. Specifically, each geographical region or sector possesses a unique combination of advantages and disadvantages. Among them, positive and favorable conditions constitute key “pull” factors that attract external individuals to the region. These typically include favorable living environments, promising development opportunities, abundant resource endowments, or robust institutional support. In contrast, negative or adverse conditions function as “push” factors—stemming from constraints or difficulties in the individual’s place of origin—which propel individuals to seek opportunities elsewhere (Cronbach, 1975).

This theory clearly explains the general trend of talent flow: talent tends to gravitate toward economically developed and dynamic regions. These regions, by virtue of their stronger overall competitiveness, more favorable business environments and institutional systems, broader career development platforms, and better infrastructure and public services, exert strong “pull” forces that can effectively offset or mitigate potential “push” factors (Meyers et al., 2020; J. L. Shi & Lai, 2023). This push-pull analytical perspective offers deep insights into the intrinsic motivation mechanisms underlying regional talent migration and the formation of spatial distribution patterns.

The key consideration in talent migration decisions is increasingly shifting toward the overall quality of regional economic development. From this perspective, Lopez et al. (2008) points out that evaluating a region’s economic potential should not rely solely on GDP growth rates but must also take into account multiple dimensions such as poverty reduction, structural equity, sustainability, and the return on social investment. This insight significantly expands the conventional understanding of how industrial development potential drives talent attraction. It highlights that highly qualified professionals are now shifting their preferences from quantitative expansion to qualitative improvement—that is, they increasingly favor regions that offer “quality development,” characterized by both economic efficiency and social equity, short-term growth and long-term sustainability, rather than pursuing mere increases in total output.

There is often a disconnect between traditional economic development indicators and

individuals' subjective satisfaction. Kusago (2007) points out that subjective well-being at the individual level is not solely determined by objective measures of economic development. This is especially true in remote regions, where the primary concerns of talent tend to focus more on long-term development prospects, the industrial structure, and the degree of alignment between local industries and their own professional capacities. From this perspective, S. Chen and Song (2014), through an in-depth analysis of data from nine provinces in western China, revealed a significant imbalance in talent attraction across the region. Structural constraints—such as a weak foundation for technological innovation, a lack of high-quality entrepreneurial platforms, and fragmented industrial chains—have become key bottlenecks hindering the introduction and retention of high-level talent.

This phenomenon highlights the urgent need for governments at all levels to move beyond a narrow reliance on conventional economic indicators when formulating talent attraction policies. Instead, efforts must be made to optimize such policies from multiple dimensions, including industrial ecosystem development and the provision of long-term growth opportunities. Only by more precisely addressing the core needs of talent can regions effectively tackle the challenges of talent imbalance and foster sustainable human capital accumulation.

(2) Industrial upgrading and occupational opportunity matching

The more advanced and comprehensive a modern industrial system is, the more accurately it can accommodate talent's specialized capabilities, offering them broader space for professional growth. In their study on talent shortages in Scotland, Houston et al. (2008) emphasized that isolated "talent attraction" policies are insufficient to sustainably appeal to high-level professionals. Only through strategic, systemic planning—by cultivating a dynamic economic ecosystem and offering ample, high-quality "economic opportunities"—can regions lay a solid foundation for a sustainable talent ecosystem. This insight carries particular significance for cities like Lhasa, which are still in the early stages of industrial upgrading. It underscores the necessity of closely aligning talent strategies with industrial development goals, building long-term mechanisms that enable industries to attract, cultivate, and retain talent—thus fostering a virtuous cycle of co-development.

Meng (2019), in an evaluation of major Chinese cities' talent attraction capacities, further revealed that the key drivers behind talent mobility decisions lie not only in existing industrial foundations but also in the prospects for future industrial development, the degree of industrial diversification, and the concentration of high-end platform resources. These factors strongly influence migration decisions. Strategic emerging industries—such as information technology, advanced manufacturing, and fintech—are particularly attractive to high-level professionals, as

they provide clear career advancement paths, high value-added positions, and knowledge-intensive innovation environments. These industries have become prime targets for talent competition and serve as core drivers of urban innovation.

Moreover, the creation of job opportunities through industrial upgrading is not abstract; it requires effective spatial carriers. Cadorin et al. (2021) argue that industrial parks, as spatialized industrial systems, act as key hubs for linking university-based knowledge sources, enterprise-level application demands, and institutional R&D capacities. The vitality of these parks—their density of innovation elements, and the flexibility, openness, and inclusiveness of their institutional environment—directly determines their ability to attract high-end talent. Thus, building modern industrial parks with highly integrated industrial functions, dense innovation resources, and adaptive, efficient institutional environments is a critical strategy for cities like Lhasa. It offers a practical pathway for breaking through resource bottlenecks, enhancing regional competitiveness, and effectively attracting and concentrating outstanding talent.

(3) Implications in the context of Lhasa

As a typical highland city, Lhasa has, in recent years, made initial strides in cultivating emerging industries such as information technology, supported by targeted policies and resource investments. These developments have infused the city with new dynamism. However, when viewed from the broader perspective of its industrial structure, Lhasa's development remains imbalanced. The tertiary sector dominates, while the secondary sector remains underdeveloped. This structure results in a fragile industrial system and gives rise to deeper structural issues—such as short industrial chains, weak platform capabilities, and insufficient capital activity.

Such an underdeveloped industrial ecosystem falls short of providing high-level professionals with a comprehensive development environment that includes cutting-edge technological platforms, modern organizational management systems, and regionally competitive compensation packages. As a result, newly attracted talent often faces practical challenges such as limited career growth prospects and insufficient overall incentives. This leads to a structural contradiction where talent can be brought in, but cannot be retained—an increasingly prominent bottleneck hampering Lhasa's pursuit of higher-quality development and enhanced competitiveness.

Industrial agglomeration, as a core feature of the spatial distribution of regional economic activity, reflects not only the efficiency of spatial resource allocation but also directly shapes talent's career decisions and development trajectories. It plays a decisive role in determining their geographic mobility patterns and spatial clustering dynamics.

Looking back to classical location theories—such as those from the German school of economic geography and Weber's theory of industrial location—the central mechanism emphasized is that enterprises, in pursuit of cost minimization and profit maximization, tend to cluster in locations with comparative advantages. The aggregation of these micro-level rational decisions generates powerful industrial agglomeration effects at the macro level (Ciccone & Hall, 1996). This fundamental dynamic of "agglomeration and diffusion" has long served as a vital explanatory framework for interpreting the evolution of regional economic structures and talent clustering phenomena. It remains an indispensable theoretical foundation for understanding regional vitality and competitiveness.

(4) Industrial clusters and the "industry–talent symbiosis model"

Industrial clusters, through their powerful agglomeration effects, form what can be described as an "industry–talent symbiosis model." The core value of industrial clustering goes far beyond the mere geographic concentration of enterprises. In essence, clusters systematically create a unique ecosystem that efficiently attracts, matches, and cultivates specialized talent. The foundation of this ecosystem is understood to rest on several key pillars: a highly specialized and interdependent division of labor that significantly reduces production and coordination costs; a vibrant and efficient knowledge spillover mechanism that facilitates the rapid flow of information, technology, and market insights across firms; and closely-knit knowledge exchange networks that foster the dissemination of tacit knowledge and enable collective learning.

Such an environment dramatically lowers the "transaction costs" associated with talent finding appropriate positions and enterprises locating suitable professionals. More importantly, the cluster itself acts as a powerful magnetic field—through its clear industrial positioning and vigorous growth momentum, it is able to attract highly specialized professionals closely aligned with its core industries, thus creating a strong "magnetic effect."

This gives rise to and reinforces a distinct "industry–talent symbiosis model": the industrial cluster offers abundant job opportunities, specialized development platforms, and a fertile ground for knowledge spillovers; while the dense concentration of specialized talent significantly enhances the human capital stock within the region. This in turn injects ongoing innovative vitality into the cluster, stimulating collective intelligence, driving technological upgrading and business model innovation, and feeding back into the competitiveness and attractiveness of the cluster itself—thus forming a powerful positive feedback loop.

The universality and efficacy of this symbiotic model have been widely validated beyond theoretical discussions. It has been demonstrated in high-tech parks, cultural and creative

districts, and biopharmaceutical clusters around the world—particularly in knowledge-intensive industrial agglomerations—where it has become a key engine of regional economic growth. Moreover, Chan et al. (2020) argue that modern talent increasingly values industrial alignment, social integration, and lifestyle incentives in their locational decisions. Therefore, industrial clusters should not merely be understood as enterprise concentrations, but as "platform-based spatial structures" that offer professionals collective identity, collaborative innovation mechanisms, and long-term development pathways.

(5) Evolving logic of talent mobility: from salary-driven to ecosystem-oriented decisions

Talent mobility decisions are becoming increasingly diversified, with industrial and professional ecosystems now serving as critical determinants. The traditional "rational economic man" model—where income was the primary driver of relocation—is no longer sufficient to explain modern talent flows. Instead, decision-making has become more nuanced and multifaceted. In an empirical study of talent mobility in Spain, Sánchez-Moral et al. (2018) found that professionals increasingly gravitate toward urban areas characterized by high industrial concentration, robust professional networks, and ample growth opportunities. Particularly attractive are those industrial clusters that support socially interactive and collaborative work environments.

This trend highlights a crucial shift: talent decisions are influenced not only by tangible economic rewards (e.g., salary) but also by a series of non-monetary "soft environment" factors that affect long-term career development and self-actualization. These factors include access to rich collective learning opportunities that facilitate continuous skill and cognitive development; the openness and vibrancy of the local industrial network, which determines resource accessibility and social connectivity; and the availability of strong institutional or platform support that underpins career advancement and entrepreneurial ventures.

Talent today is not merely choosing a job, but rather selecting an ecosystem—one that fosters professional growth, expands career boundaries, and fulfills social engagement needs. This growing emphasis on career ecosystems and developmental environments signals a fundamental transformation in the underlying logic of talent mobility. At the macro level, industrial agglomeration and economic growth exhibit a high degree of synergy.

From a regional economic development perspective, the relationship between industrial agglomeration and economic growth is far from a simple one-way linear correlation. Instead, it is characterized by a highly coordinated and mutually reinforcing dynamic coupling mechanism. Englmann and Walz (1995) and Baldwin and Forslid (2000) point out that industrial agglomeration exerts a significant "multiplier effect" on economic growth. This driving force

stems from three main aspects:

First, agglomeration accelerates technology diffusion. Knowledge and technologies spread, are imitated, and are reinvented more easily among geographically proximate firms, generating a "standing on the shoulders of giants" effect.

Second, agglomeration enhances innovation capacity. The high density and diversity of firms, talent, and institutions create more opportunities for idea exchange, reduce innovation risks, improve efficiency, and foster the emergence of breakthrough technologies and products.

Third, it facilitates the incubation of emerging industries. Agglomeration provides fertile ground for nurturing new technologies and business models through trial and error and scaling up, thus acting as an incubator for industrial upgrading and structural transformation.

In return, robust economic growth injects vitality into a region, significantly improves its capital accumulation capacity, market size, and attractiveness to talent and investment, thereby further consolidating the foundation of agglomeration and triggering the migration of more related firms and skilled workers. This forms a virtuous cycle in which "agglomeration promotes growth, and growth reinforces agglomeration." Building upon this, Ottaviano et al. (2002) further elaborates on the critical role of talent mobility within this cycle. From the perspective of labor division, they model the free flow of skilled labor across industrial clusters as a core mechanism for forming and transferring technological gradients across regions and redistributing industries. As talent flows to more dynamic clusters, they bring knowledge, skills, and innovative capacity, accelerating technology diffusion and industrial upgrading, while also potentially prompting existing industries to adjust spatially based on comparative advantages. At the intra-industry level, the dissemination of knowledge and technology plays a central role.

Krugman and Venables (1995) argues that knowledge and technology are "non-rival intermediate goods" that can be rapidly disseminated through "ordered decomposition and reconstruction" among firms. This mechanism fundamentally drives the continuous evolution and innovation of organizational structures and business models, enhancing firms' adaptability and competitiveness. Notably, such dynamics create diverse "career pathways" within industries. In this context, talent is no longer confined to vertical promotion within a single firm but can accumulate varied experiences and achieve cross-sector skill upgrades and career growth by flowing within dynamic networks and projects.

Additionally, Storper and Venables (2004) notes the prevalence of "informal exchange mechanisms" within industrial clusters—such as expert networks and cross-firm project collaborations—that transcend formal contracts and organizational boundaries. These mechanisms constitute a complex and efficient "soft-institutional learning environment."

Although not rigidly enforced, their highly self-organizing and frequent nature gives them an institutionalized effect. The direct benefit is a significantly higher "rate of knowledge acquisition" for individuals in such environments compared to those in non-agglomerated areas. These abundant knowledge flows and social interaction networks naturally translate into more diverse and higher-quality "career development opportunities." This "soft institutional environment" is a crucial source of a cluster's core competitiveness, accelerating knowledge circulation and the enhancement of talent value.

Strategic logic of urban talent attractiveness: from job provision to ecosystem empowerment.

From a strategic perspective on talent development, a city's ability to attract talent is not merely about offering "jobs" but lies in whether it can provide a clear "career pathway" and a sustainable "development ecosystem." Malerba et al. (2007) find that high-tech industrial clusters form strong talent magnets because they combine high salaries, high growth potential, and high knowledge density—factors that jointly form a strong pull for high-skilled talent. At the same time, active governmental intervention—such as building industrial parks, providing policy support, and offering R&D subsidies—further amplifies the agglomeration effect, forming a positive feedback loop of "industrial policy → cluster effects → talent concentration." This insight reveals that enhancing a city's talent attractiveness has shifted from simple "job provision" to "ecosystem construction," which involves coordinated industrial layout, policy synergy, and institutional innovation. Specifically, cities must act across multiple dimensions to build a sustainable talent development ecosystem:

Attract and cultivate leading enterprises with core competitiveness to enhance the refinement and resilience of industrial chains, drive collaboration among upstream and downstream enterprises, and stabilize employment.

Establish efficient innovation and entrepreneurship platforms to reduce trial-and-error costs and stimulate innovative vitality. Establish robust mechanisms that encourage knowledge exploration and the transformation of innovation outcomes, thus offering a fertile technological environment for talent to grow (Asongu, 2024; H. Cheng et al., 2020; S. Li & Zhu, 2023).

Only through such systematic ecosystem cultivation can a virtuous cycle of "attracting, cultivating, employing, and retaining talent" be formed—providing talent with a clear, stable, and sustainable career outlook, and ultimately transforming the city into a highland for talent realization and professional advancement.

From short-term absorption to long-term symbiosis: the deeper logic of building a "talent magnet."

The ultimate goal of a city's talent strategy is not the short-term absorption of talent but the establishment of a symbiotic relationship in which talent and the city grow together. Traditional talent competition often focuses on immediate incentives such as salaries and subsidies. However, sustainable attractiveness lies in whether the city can offer long-term value growth opportunities. Studies show that high-skilled professionals, when choosing a city, are increasingly concerned not just with current job offers but with long-term growth potential—such as access to frontier technologies, cross-disciplinary collaboration networks, and opportunities for personal development (Chan et al., 2020; Malerba et al., 2007).

This implies that cities must move beyond the primitive competition of "policy incentives" and shift toward strategic ecosystem construction, including industrial upgrading, optimization of innovation environments, and improvement of social services. Governments play a crucial role in this process. On one hand, they must guide the development of key sectors through targeted industrial policies—for example, fostering strategic emerging industries with tax incentives and R&D funding, thus creating "track dividends" for career growth. On the other hand, cities must strengthen their soft power, including high-quality education and healthcare, an open innovation culture, and an inclusive social environment, thereby reducing the overall cost of long-term talent settlement (H. Cheng et al., 2020; S. Li & Zhu, 2023).

Especially in the digital economy era, spatial and temporal constraints on talent mobility are further weakened. Inter-city competition has shifted from "locational advantage" to "ecological advantage." The cities that will become future talent hubs are those that can integrate industrial dynamism, innovative vitality, and quality of life. They offer more than just job opportunities—they become platforms for lifelong talent development and ultimately form a self-reinforcing "talent magnet" effect.

2.2.5 Impact of human resource management practices

(1) Research on talent development programs

Employee promotion mechanisms are crucial factors for enterprises to enhance attractiveness and reduce turnover rates. Generally, the more reasonable the promotion mechanism within an organization, the stronger its talent attraction and the lower employees' willingness to leave. Tumi et al. (2022) found a significant correlation between promotion mechanisms and employee motivation. Their study suggests that companies should provide vocational training to improve knowledge and skills, and offer employees ample and diversified job opportunities to boost their engagement.

Russen et al. (2021) studied hotel managers' perceptions of employee promotion processes

based on the gender of promoted employees, perceived organizational justice, and perceived gender discrimination against women. The findings indicate that if organizations provide more opportunities to women, the promotion process is perceived as fairer, which fosters a stronger organizational culture and higher financial performance.

Rouhanizadeh and Kermanshachi (2021) examined factors influencing promotions and found that women are promoted to senior positions less frequently than men, mainly due to lower educational levels, age, and years of service. W. Chen et al. (2022) explored the relationship between individual promotion focus and job crafting through the mediating role of psychological empowerment. Their research showed that promotion focus relates to job crafting and is partially mediated by psychological empowerment.

Rahaman and Uddin (2022) emphasized that the success of small and medium-sized enterprises (SMEs) depends on employee job satisfaction, as satisfied employees can improve work efficiency and actively enhance business performance. Their study analyzed the impact of job training (JT) and promotion (PRO) opportunities on employee job satisfaction, finding that both have positive effects in SMEs.

Su and Xiao (2022) investigated the influence of supervisors' positive feedback on employees' in-role and extra-role performance, with promotion focus as a mediator. Results indicated a positive correlation between supervisors' positive feedback and promotion focus, and between promotion focus and both types of employee performance. Furthermore, promotion focus mediated the relationship between supervisor feedback and employee performance.

Providing career development opportunities can also address talent attraction challenges. Organizations that actively plan and invest in employee career growth can effectively establish themselves as preferred employers, significantly enhancing their ability to attract new talent. In short, offering attractive career opportunities requires not only a strong emphasis on learning and development activities but also the establishment of a systematic and sustainable approach to support employee career pathways (Becker, 2011).

Constantine (2016), based on strategic human resource management and organizational development systems principles, further validated an integrated model of talent attraction and retention. The study highlights that a high-performance organizational culture is the core driver of talent attraction and retention, with its impact deeply moderated by employee satisfaction and organizational commitment.

Bibi (2018) confirmed this in Pakistani healthcare institutions, finding that while optimizing recruitment and selection processes attracts talent, retaining talent depends heavily

on ongoing employee training and development investments.

Lesenyeho et al. (2018) studied high-quality early-career academics in South African public higher education institutions, exploring relationships among antecedents such as talent attraction and management support, and outcomes like organizational commitment. Results clearly showed that effective management support, systematic talent development programs, competitive compensation and recognition mechanisms, higher satisfaction, and sound institutional practices collectively enhance organizational commitment among early-career academics and significantly reduce their turnover intentions.

These studies consistently demonstrate that placing career development at the core of talent management strategies—through systematic learning and development systems and strong organizational culture support—not only directly improves internal talent engagement and retention but also serves as the foundation for building a strong employer brand and gaining a competitive advantage in the talent market. Therefore, investing in employee career growth is far from a mere cost; it is a strategic investment critical to future talent reserves and sustainable organizational competitiveness.

Other studies use multiple regression models to analyze the relationship between talent management variables and employee retention, demonstrating the contribution of talent management practices to retention. Employees are more willing to stay in organizations that provide career development and growth opportunities, and compensation plans also play a significant role in attracting and retaining staff (Kumar, 2022).

Osipova et al. (2018) studied talent attraction and selection practices based on talent categories and industry types (knowledge economy versus traditional industries). They discussed three types of talent selection systems: talent-specific selection systems, differentiated talent selection systems, and position-based selection systems. Their findings show that differentiated talent selection systems characterize knowledge economy firms.

Mohammed et al. (2019) examined talent management processes in Australian higher education (AHE) and developed a quantitative measurement method for talent management processes (TMP) within the higher education (HE) sector. Their study focused on three dimensions: talent attraction, talent development, and talent retention. They found that effective talent development promotes both attraction and retention.

(2) Talent incentive mechanisms

Employee compensation level is the cornerstone and decisive factor in building a company’s talent attractiveness. It is widely agreed that companies offering more competitive pay often hold a significant advantage in the talent war. However, the mechanism through

which salary incentives attract talent is not uniform but shows high contextual dependence and complexity. Damiani et al. (2019) pointed out that wage incentives play distinctly different roles in enhancing the competitiveness of family and non-family businesses, with systematic differences in effectiveness. Meanwhile, Fang (2019) argued that status competition affects executive compensation in focal firms, especially when non-executive directors serve as stakeholders' executives. This executive identity often triggers status competition with the core firm's executives, leading non-executive directors to suppress core executives' pay to safeguard and expand their position. However, since ordinary employees do not threaten non-executive directors, their salaries tend to increase. Corporate strategic orientation also deeply shapes internal compensation patterns. Gómez-Bezares et al. (2019) empirically showed that firms with strong commitments to sustainable development strategies often exhibit significantly widened pay gaps between CEOs and ordinary employees, demonstrating a clear positive correlation.

In summary, designing effective compensation strategies is far from a simple numbers game; it must comprehensively consider company nature, governance structure, strategic positioning, and underlying social comparison psychology to achieve a sustainable balance between talent competition and firm performance.

Compensation satisfaction, as a key driver of organizational effectiveness, is gaining increased attention. Athamneh (2020) surveyed pay satisfaction in Jordan's public sector, revealing generally low satisfaction levels regarding pay, benefits, raise mechanisms, and salary structure, which undoubtedly challenge organizational productivity. Meanwhile, compensation structure also exerts profound and broad influence. Chan et al. (2020) focused on CEO-to-non-executive employee pay gaps and their effects on corporate R&D efficiency. On a broader commercial scale, Kim and Jang (2020) empirically demonstrated that increased employee compensation investments effectively boost revenues in enterprises such as restaurants. Additionally, X. Shi et al. (2022) emphasized that employee pay satisfaction, as a critical component of pay management, is indispensable to consolidating a firm's competitive advantage and vital for sustainable development. Thus, establishing a scientific, equitable, and competitive pay management system is a core strategy for attracting and retaining key talent, thereby enhancing market competitiveness.

High salary levels remain a crucial factor in attracting talent. The three main work motivation factors include: providing a comfortable and supportive work environment; granting employees sufficient autonomy and creative space to participate in decision-making; and effectively balancing work and life. These incentives relate not only to employees' current work

motivation but also closely to long-term retention (Ahmić & Čizmić, 2021).Furthermore, Schlechter et al. (2014) stressed that to effectively attract knowledge workers and build competitive advantage in the knowledge economy, organizations must deeply understand how different types and levels of economic rewards function at various levels. High-level salary structures, generous benefits, and attractive variable pay plans are widely regarded as critical attraction elements in reward programs. Therefore, organizations should emphasize these aspects when formulating talent attraction strategies, as they significantly appeal to knowledge workers. Similarly, Aziz et al. (2019) studied Islamic Bank Institutions (IBI) in Malaysia and found through structured interviews that competitive base salaries, comprehensive employee benefits, and flexible work schedules play important roles in talent attraction. In other words, economic incentives combined with non-material work experiences jointly constitute key pillars for attracting and retaining talent.

Employee benefits, as a core element of corporate attractiveness and talent retention, have become increasingly important in today's fiercely competitive job market. Generally, companies offering better benefits enjoy a significant advantage in talent competition. Boudreaux (2021) deeply explored how employee benefits affect startup firm performance. Focusing further on benefit changes, Quinby and Wettstein (2021) utilized the natural experiment of the 2005 reform of the Rhode Island Employees' Retirement System (ERSRI) to analyze the effects of deferred benefit reductions on employee turnover. This reform only reduced benefits for pre-2005 non-retired members, without affecting long-term members and municipal employees. Using a rigorous triple-difference design, they revealed that the labor supply elasticity concerning deferred benefits for firm-specific labor is 0.28. Notably, while government employees showed greater sensitivity to benefit cuts than teachers, the overall low elasticity values for both groups strongly evidence the relatively limited labor market competition among government workers.

From a corporate governance perspective, Mia (2022) conducted an empirical test on a sample of 2,964 microfinance institutions worldwide, examining the relationship between the proportion of female board members and employee welfare levels. The study found that a higher proportion of female directors significantly and positively drives improvements in employee benefits, providing new insights into the multidimensional drivers of welfare policies.

Improving welfare facilities helps retain and attract talent as part of overall employee compensation (Zhao, 2021). Vinerean et al. (2013) argued that in today's economic environment, firms must work harder than ever to attract, retain, and motivate talented employees to improve employee satisfaction. Their study applied structural equation modeling

to analyze how ten multinational companies use corporate social responsibility initiatives to attract and retain excellent employees.

Chand (2019) noted that African immigrants are among the highest educated immigrant groups in the US. Their migration motivations include pull factors such as wages, living conditions, and career opportunities, and push factors like low-quality institutions, lack of infrastructure, corruption, and nepotism in home countries. Leveraging their skills, resources, and networks, African immigrants can help provide urgently needed human, social, and financial capital to their countries of origin. This study used talent loss and talent circulation theories to analyze these dynamics in the recent context of African immigration to the US.

Shahabadi et al. (2020) pointed out that in their studied countries, welfare gaps and real wage gaps are significantly positively correlated and insignificantly positively correlated, respectively, with talent loss. The study suggests that policymakers and managers in Islamic countries should pay more attention to competitiveness indicators to reduce talent loss.

(3) Impact of corporate culture environment

Some scholars have explored the relationship between other micro-level organizational characteristics and corporate attractiveness. As established in the literature, corporate reputation, as a key external signal, significantly influences job seekers' expectations of organizational attractiveness. Focusing on specific industries, King et al. (2021) studied the unique challenges and opportunities faced by the hotel industry, exploring how the sector effectively attracts and retains managerial talent. They argued that employees' sense of organizational identification is the core motivational factor influencing their employment decisions and emphasized the necessity of adopting a multi-level perspective to understand the formation process of this identification.

Furthermore, in the context of global talent competition, Bose (2011) highlighted that internal entrepreneurship has become a critical talent management strategy. Internal entrepreneurship refers to entrepreneurial activities by employees within an organization, which has been rapidly emerging in India. Numerous studies confirm that most leading large companies actively cultivate this culture, regarding it as a key approach to achieving multiple strategic objectives—not only enhancing innovation capacity and market competitiveness but also attracting and retaining top talent (Shahabadi et al., 2020; Simon, 1998).

In today's fiercely competitive business environment, corporate brand strategy's importance in attracting and retaining top talent has become increasingly prominent, serving as a core element for building sustainable competitive advantage. By systematically creating multi-dimensional value for individuals, organizations, and society at large, strong corporate

brands establish enduring identification-based bonds with potential and existing employees. This undoubtedly acts as a key driver for efficient talent attraction and long-term retention (Deepa & Baral, 2017).

Although talent management shows a strong positive correlation with an organization's financial and non-financial performance, it must be recognized that this complex relationship is profoundly influenced and constrained by many other key variables embedded within the organizational ecosystem. These variables include overall strategic orientation, internal structural design, HR policy directions, core leadership styles and value systems, as well as other potentially deeper and broader factors explaining performance relationships (Muriithi & Makau, 2017).

To better grasp the intrinsic mechanisms of talent attraction, Ronda et al. (2018) innovatively proposed an employee-centered research framework, which deeply reveals the foundational roles of unique corporate attributes, actual employee benefits received, and employees' subjective perceived value in corporate brand studies. This framework provides solid theoretical support for organizations to formulate more forward-looking and effective talent attraction strategies.

Focusing further on practice, González-Masip et al. (2019) conducted empirical research based on technology park enterprises, investigating the specific effects of corporate social responsibility (CSR) practices on employee attractiveness. Their findings clearly indicate that active CSR implementation plays a significant positive moderating role, effectively strengthening the positive linkage between tech park enterprises and their talent attraction, becoming an important lever to enhance employer brand appeal.

Corporate brand building is key to attracting and retaining talent. Talent is attracted by a brand's commercial success and driven by goal-oriented branding. Companies can leverage corporate branding, internal branding, and employer branding to effectively compete for scarce talent essential for organizational success (Wolfswinkel & Enslin, 2020). Monteiro et al. (2020) developed a corporate branding model specifically suitable for SMEs, aimed at precisely increasing and improving talent attraction and retention. Their study used a quantitative exploratory approach to build the model, mainly integrating and optimizing two major reference corporate branding models and frameworks.

Ogbeibu et al. (2022) further pointed out that through effective talent management, organizations can not only retain talent but also significantly promote organizational sustainability. Their study examined the predictive effects of green soft and hard talent management, leadership management capabilities, and the interdependence of digital tasks on

turnover intention.

Nager et al. (2019) found that some companies adopt short-term orientations, focusing on profit maximization through simple cost reductions, while others pursue long-term strategies emphasizing quality improvement to attract talent and enhance corporate image. Such long-term strategies focused on talent attraction and corporate image not only effectively reduce the turnover rates of key talents but also build strong organizational resilience and sustainable competitive advantage in complex environments. Consequently, these companies tend to achieve more robust and enduring development, realize a win-win between economic benefits and social value, optimize long-term resource allocation, and enhance overall competitiveness.

Corporate branding plays a central strategic role in today's fierce talent competition, and its construction and maintenance are profoundly influenced by multiple critical factors. These factors include accurately understanding the core needs of target talent groups, designing and implementing a competitive and differentiated Employee Value Proposition (EVP), formulating HR strategies highly aligned with brand image, ensuring consistency of brand messaging across internal and external communications, and the coordinated efforts between corporate-level management and HR departments in brand building (Botha et al., 2011).

Jauhari and Singh (2013) deeply explored the mechanisms through which the organizational internal environment affects employee loyalty. Their findings indicate that employees' positive perceptions of organizational diversity climate significantly enhance their loyalty via the key psychological mechanism of perceived organizational support. This effect remains robust even after controlling for demographic variables such as age, gender, and education level, highlighting the core bridging role of organizational support in linking diversity management to employee attitudes. The study offers important implications for organizational managers: building employee loyalty systematically requires more than superficial diversity policy advocacy; it necessitates strategic management actions that truly integrate diversity values into organizational culture, allowing employees to genuinely feel support and recognition from the organization. Such loyalty-building based on psychological contracts fundamentally addresses talent attraction and retention challenges in competitive environments.

Barrena et al. (2015) shifted the research focus to a key talent market segment—university graduates. Their empirical study found that Corporate Social Responsibility (CSR) practices have surpassed traditional compensation and benefits factors to become a core consideration influencing high-quality graduates' career decisions. Enterprises with comprehensive CSR systems not only demonstrate significant advantages at the talent attraction stage but more importantly build emotional bonds with employees through shared values, thereby achieving

long-term retention. This research redefines CSR as an essential part of internal organizational capability development rather than merely an external image-building exercise.

Building on this, Magbool et al. (2016) expanded the conceptual boundaries, finding that sustainable development practices have become a differentiating competitive factor in contemporary corporate talent strategies. Data shows that job seekers, especially high-skilled talent groups, exhibit unprecedented attention to corporate performance in environmental responsibility, social contribution, and corporate governance (ESG). Over 83% of respondents explicitly stated a stronger willingness to join organizations excelling in sustainability efforts. This trend is prompting more companies to elevate sustainable business practices from marginal compliance requirements to core strategic priorities.

From a strategic management perspective, Mohan and Rao (2019) synthesized these insights, systematically demonstrating the central position of corporate brand building in modern talent management. They argue that in the knowledge economy era, corporate brands have evolved into multidimensional complexes embodying organizational values, cultural identity, and development vision, directly influencing talent market competition dynamics. This has driven leading enterprises to deeply embed brand management into strategic planning processes, building sustainable talent competitive advantages through systematic employer branding, value dissemination, and cultural shaping.

Notably, these studies collectively reveal a significant trend: contemporary talent strategies have shifted from traditional material incentive-driven models toward integrated competitive approaches centered on value alignment, psychological contracts, and organizational culture. To win the talent war, organizations must optimize not only compensation systems and work environments but also establish deep value resonance and emotional connections with employees through diversity management, social responsibility practices, and sustainability initiatives, thereby creating inimitable talent competitive advantages. This shift calls for executive leadership to position talent strategy at the core of organizational development, achieving deep synergy among human resource management, brand building, and corporate strategy.

Beyond explicit factors such as brand reputation and corporate social responsibility, the deeper cultural environment has increasingly become a core consideration in talent decision-making. As a vital driver of the global economy, micro, small, and medium enterprises (MSMEs) play an irreplaceable role in promoting employment, driving innovation, and maintaining economic resilience. However, compared to large enterprises, MSMEs often face unique challenges such as limited resources, insufficient managerial experience, and non-standardized

human resource practices (Sindhwani et al., 2023). These constraints place MSMEs at a disadvantage in attracting, cultivating, and retaining talent, thereby affecting their long-term competitiveness and sustainable development.

Particularly regarding gender equality, the proportion of female employees in this sector remains relatively low, despite evidence indicating that women play a crucial role in fostering innovation, creating employment opportunities, and achieving sustainable growth (Virmani et al., 2022). Therefore, creating a more inclusive work environment for women—including flexible work arrangements, equal promotion opportunities, and targeted career development support—not only meets social equity demands but also represents a strategic initiative for MSMEs to achieve long-term growth (Çoban, 2022; Greer et al., 2016).

In this context, the value of remote work practices—such as virtual team collaboration, flexible working hours, adaptive compensation schemes, and temporary or project-based positions—has become increasingly prominent. With the rapid development of the digital economy, societal acceptance of digital working methods continues to rise, and employees' adaptability to remote work improves accordingly. Studies show that satisfaction with remote work correlates positively with proactive work behaviors such as higher engagement, stronger organizational commitment, and reduced turnover intention (Blahopoulou et al., 2022). The temporal and spatial flexibility provided by remote work not only enhances employee productivity but also enables enterprises to access a broader global talent pool, no longer constrained by geographical boundaries.

This trend is especially evident in the IT/ITES (Information Technology and IT Enabled Services) sector, where remote work has become the new norm. Practices in this industry demonstrate that remote work models effectively promote work-life balance, reduce commuting stress, and improve overall productivity (Manroop & Petrovski, 2023). Additionally, during extreme events—such as pandemics, natural disasters, or economic turmoil—remote work functions as a contingency mechanism to ensure business continuity and reduce operational disruption risks. This flexibility is particularly critical for resource-constrained MSMEs, which typically lack the risk resilience of larger enterprises.

However, the widespread adoption of remote work also presents challenges, including team collaboration efficiency, employee sense of belonging, fairness in performance evaluation, and data security concerns. Therefore, MSMEs need to tailor their remote work policies according to their characteristics, establishing clear communication protocols, effective performance management systems, and necessary technical support to ensure that remote work truly empowers the enterprise rather than becoming a managerial burden.

Given the growing heterogeneity in employees' preferences for working modes, MSMEs urgently need to revise their human resource policies and strategies to enhance responsiveness and adaptability. Nevertheless, the impact of flexible work arrangements like remote work on female employees is particularly complex. Due to prevalent gender inequalities within organizations, practitioners often worry about potential negative effects on women's career development paths (Raišienė et al., 2020). Coupled with women's generally lower financial and social capital compared to men, this concern can exacerbate stress, resource depletion, and declines in well-being. Therefore, implementing sound and gender-sensitive human resource practices in MSMEs is crucial to effectively enhance female employees' well-being and thereby increase the attractiveness of this sector to female talent.

The deeper driving force of corporate cultural environment on talent aggregation lies in the value congruence it fosters and the psychological safety constructed through daily interactions. When an organization's core value propositions closely align with the intrinsic value systems of both potential and existing talents, a significant person-organization fit effect emerges. The degree of this fit greatly influences employees' sense of belonging and work efficiency. Individual-level micro perceptions of work can significantly aggregate into macro-level overall outcomes. This effect has been widely confirmed as a key antecedent variable predicting employee job satisfaction, enhancing organizational commitment, and reducing turnover intention (Kristof-Brown et al., 2005).

Such deep resonance at the value level is particularly critical in knowledge-intensive fields: a culture that champions open exploration, embraces trial and error, and encourages knowledge sharing demonstrates strong attraction to high-end talent pursuing frontier breakthroughs and self-actualization. Psychological safety—an increasingly important dimension in recent talent research—has shown growing influence (Newman et al., 2017). In cultures characterized by high trust, candid communication, and respect for diverse viewpoints, employees feel more empowered to voice opinions and assume responsibilities. This not only directly drives higher innovation effectiveness but also deeply strengthens their organizational belonging and long-term retention intentions. In stark contrast, environments lacking trust or pervaded by "accountability cultures" severely undermine employees' psychological safety and professional dignity, becoming a major driver of core talent attrition—even when generous material rewards are offered.

2.3 Literature review and critique

To date, scholarly research on the information technology (IT) industry—recognized as a core engine of the knowledge economy—has increasingly focused on its lifeline: talent, particularly the mechanisms of talent aggregation, attraction, and retention. Specifically, existing studies primarily delve into the critical issue of how to effectively gather high-quality talent, while keenly acknowledging that this process is not an isolated corporate activity but rather is profoundly shaped by the dual influences of a complex and dynamic external environment and finely tuned internal organizational factors.

In the dimension of talent attraction, the academic community has made relatively systematic theoretical constructions and empirical explorations. Not only has the core concept of "talent attraction" been analyzed and defined from multiple and in-depth perspectives, clarifying its strategic value as a sustainable source of competitive advantage for enterprises, but also the current state of research on the "talent aggregation" phenomenon has been comprehensively reviewed. This includes explorations of the economic, social, and innovation mechanisms underlying agglomeration effects, thereby providing a solid theoretical foundation and rich practical references for understanding how IT enterprises formulate and implement various talent attraction strategies and measures.

On the other hand, talent turnover issues have also received targeted attention in existing literature. Scholars have investigated turnover motivations, influencing factors, and coping strategies from multiple angles. These studies have significantly deepened our understanding of the systemic challenges, structural dilemmas, and latent risks that IT enterprises face in fiercely competitive talent markets to maintain core human resources. They reveal the complexity and urgency of talent retention work and collectively form the cornerstone of our cognition regarding talent mobility issues in the IT sector.

However, current research seldom addresses the unique contextual characteristics of high-altitude regions such as Lhasa, leaving questions about the particularity of challenges in such areas and whether there is any generalizability consistent with other regions. This gap calls for further exploration and discussion.

At the macro level, regional environmental factors play a decisive role in shaping the overall attractiveness and long-term competitiveness of IT enterprises. Regional talent policies—such as residency facilitation, targeted subsidies, tax incentives, and the extent of scientific research funding—directly create a "policy pull" effect for specific locales. Regional living standards, encompassing housing costs, education and healthcare resources,

transportation convenience, cultural and recreational facilities, natural environmental quality, and social inclusiveness, form the "livability considerations" that influence talent's settlement decisions. Meanwhile, regional industrial development potential—particularly the maturity of IT industry clusters, the completeness of industrial chains, the vibrancy of innovation ecosystems, and prospects for future market growth—provides critical "career development expectations." These macro factors intertwine to construct the broad "environment" of talent mobility, deeply influencing the willingness of external talents to migrate in and the propensity of incumbent talents to exit. Their impact mechanisms are complex and profound, warranting more detailed deconstruction and analysis.

Simultaneously, micro-level internal company factors—such as management practices and organizational climate—form an "intrinsic magnetic field" that attracts and stabilizes talent. Scientifically sound talent development plans map clear career growth paths and skill enhancement channels for employees; diverse and effective talent incentive mechanisms meet multi-level value demands; while a positive, healthy, open, inclusive, and innovation-encouraging corporate culture enhances employees' sense of belonging, job satisfaction, and loyalty as an intangible but powerful bond. These internal factors are deeply rooted in the enterprise's human resource policy system, and their design and implementation efficacy significantly and directly affect the attractiveness to internal staff and reduce the turnover rate of key talents.

A thorough exploration of the interaction between these internal and external factors, and their specific impact pathways on talent aggregation effects, holds critical theoretical and practical significance. It can guide regions at different development stages to optimize talent policy environments tailored to local conditions and help IT enterprises precisely formulate and implement more attractive talent incentive systems and more effective retention strategies.

While macro-level policies have significant impacts, high-altitude regions exhibit unique local policies and characteristics. Understanding how these exogenous variables influence talent mobility represents a valuable complement to existing research conclusions.

By comprehensively reviewing the aforementioned research trajectories and findings, this research contends that the current academic discourse on talent aggregation in information technology enterprises has formed a relatively clear framework. Rich knowledge has been accumulated regarding the connotation and definition of talent attraction, identification of influencing factors, analysis of the motivations behind talent mobility, and recognition of the intrinsic value of agglomeration effects. Through a systematic review, critical summary, and integrative reflection on existing literature, we can clearly delineate the common challenges

faced by IT enterprises in the globalized, digitized wave of talent competition, as well as the embedded development opportunities. These insights undoubtedly lay a solid foundation for subsequent research.

However, there remains a scarcity of dedicated, systematic, and in-depth studies focused specifically on the talent aggregation issues confronting IT enterprises in Lhasa—a region characterized by unique geographical location, socio-economic development stage, cultural background, and policy environment. The development of the IT industry in Lhasa started relatively late, and factors such as its high-altitude geography, relatively weak infrastructure, distinctive socio-cultural environment, particular regional industrial characteristics, and the current status of talent reserves collectively constitute a unique contextual factor set that impacts the talent aggregation effect of local IT enterprises. This notable regional research gap impedes an accurate understanding of the profound and specific barriers Lhasa's IT enterprises encounter in attracting, cultivating, motivating, and retaining key talent, thereby limiting the precision and effectiveness of related support policies and corporate talent strategies.

Based on the above considerations, this study will focus on the specific and highly research-worthy regional context of Lhasa, thoroughly exploring the current status, characteristics, and core influencing factors of talent aggregation in its IT enterprises. This research aims to transcend the limitations of existing literature, which predominantly adopts a universal perspective or draws mainly from developed regions' experiences. It will closely integrate the actual regional conditions of Lhasa, employing rigorous scientific methods to systematically identify and analyze the key bottlenecks hindering effective talent convergence and stabilization in local IT enterprises. Through empirical investigation and in-depth analysis of these localized and contextual factors, this study seeks to fill the theoretical gap in applying existing knowledge to special regional contexts and to propose a series of solutions and policy recommendations grounded in Lhasa's realities, supported by theory and practically feasible.

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Chapter 3: Research Hypotheses and Research Model

3.1 High-altitude special climate conditions on talent agglomeration

3.1.1 Direct impact effects

This study posits that the high-altitude special climate conditions in the Lhasa region negatively affect talent agglomeration levels in information technology enterprises. The main reasons are as follows.

First, high-altitude special climate conditions may adversely affect physiological health. Lhasa is located on the Qinghai-Tibet Plateau at an altitude of approximately 3,650 meters, where the air is thin and oxygen content is low. This high-altitude, low-oxygen environment poses challenges to human physiological functions. For instance, individuals new to high-altitude regions often experience altitude sickness, manifesting as headaches, insomnia, fatigue, and breathing difficulties. For information technology professionals entering high-altitude regions for the first time, altitude sickness may severely impact their work and quality of life, potentially leading them to leave due to inability to adapt.

Second, the high-altitude special climate conditions in the Lhasa region somewhat restrict the work and living environments for information technology enterprise talents. Lhasa experiences long, cold winters and brief summers with significant temperature variations between day and night. Additionally, the plateau region is characterized by volatile weather patterns, including sudden temperature drops, strong winds, and sandstorms. These extreme climate conditions may affect transportation, daily life, and the convenience of outdoor activities, thereby increasing the difficulty of work and living for local residents and migrant workers. Both residents and incoming talents must develop capabilities to respond to sudden weather changes.

Due to the aforementioned physiological health challenges and restrictions in work and living environments, the Lhasa region may face a higher risk of talent outflow. Even successfully recruited talents might choose to leave if they cannot adapt to the high-altitude environment. Based on this, this study contends that compared to inland cities, the Lhasa region may lack attractiveness in terms of climate environment. For talents pursuing comfortable living environments and career development opportunities, the high-altitude special climate

may constitute a significant barrier. Thus, the following hypothesis is proposed:

Hypothesis H1a: The high-altitude special climate conditions in the Lhasa region reduce talent agglomeration levels in information technology enterprises.

3.1.2 Mediating role of plateau health risks

This study proposes that the high-altitude special climate conditions in the Lhasa region reduce talent agglomeration levels in local information technology enterprises by increasing plateau health risks.

On one hand, the high-altitude special climate conditions in the Lhasa region elevate plateau health risks. First, Lhasa's thin air and low oxygen content cause newcomers to experience various symptoms of altitude sickness, such as headaches, dizziness, insomnia, fatigue, nausea, vomiting, and breathing difficulties. Severe altitude sickness may progress to high-altitude pulmonary edema, characterized by coughing, chest tightness, worsening breathing difficulties, and even pink, foamy sputum. Second, populations living in high-altitude regions for extended periods may develop chronic altitude sickness, manifested as abnormal increases in red blood cells and hemoglobin, resulting in increased blood viscosity. This elevates the risk of thrombosis, consequently increasing the risk of cardiovascular and cerebrovascular diseases. Third, the special climate conditions in the Lhasa region more readily induce respiratory and ocular diseases, among others. For example, the dry air in Lhasa may irritate respiratory mucous membranes, leading to coughing and sputum production, thereby increasing the risk of respiratory infections. Ultraviolet radiation may increase the risk of ocular diseases such as cataracts and snow blindness. Finally, high-altitude climate characteristics pose more severe plateau health risks to special populations (pregnant women and those with chronic illnesses). For instance, high-altitude regions may cause fetal hypoxia, affecting fetal development and increasing the risk of premature birth and miscarriage, while patients with cardiovascular and respiratory diseases may experience exacerbated conditions in high-altitude environments.

On the other hand, plateau health risks arising from high-altitude climate characteristics reduce talent agglomeration levels in information technology enterprises in the Lhasa region. First, plateau health risks stemming from special climate conditions such as high altitude directly diminish the region's attractiveness to talents. Plateau health risks associated with high-altitude and other special climate conditions, such as altitude sickness, respiratory diseases, and skin problems, directly affect talents' physical health and quality of life. These physiological discomforts and disease risks reduce the attractiveness of regions like Lhasa to talents, causing

many potential talents to hesitate. Second, long-term exposure to plateau health risks may lead to psychological issues such as anxiety and depression among talents, further weakening the Lhasa region's attractiveness to information technology professionals. Moreover, mental health issues not only affect work efficiency and quality of life but may also increase the risk of talent outflow, reducing talent agglomeration levels in the Lhasa region. Finally, existing talents facing continuous plateau health risks may choose to leave out of concern for their health, especially for those with chronic diseases or weak constitutions, for whom plateau health risks may become a significant reason for resignation.

Based on this, this study proposes the following hypothesis:

Hypothesis H1b: Plateau health risks play a mediating role in the negative impact of high-altitude special climate conditions in the Lhasa region on talent agglomeration levels. That is, the high-altitude special climate conditions in the Lhasa region reduce talent agglomeration levels in local information technology enterprises by increasing plateau health risks faced by talents.

3.2 Regional talent policy support on talent concentration

3.2.1 Direct impact effects

As a measure for the government to guide resource allocation, policy can compensate for market failures. Regional talent policies, as a type of policy, are one of the common methods used by cities to attract and retain talent. Regional talent policy support related to information technology enterprises typically covers various aspects such as talent introduction, cultivation, and services, providing the most direct attraction to talent. This research argues that in the Lhasa region, talent policy support can significantly enhance talent agglomeration.

Firstly, implementing proactive talent introduction policies in the Lhasa region can enhance the level of talent agglomeration in information technology enterprises. Talent introduction policies usually include financial subsidies for talent, improved job allowances and position benefits, improved professional title evaluation and appointment, and various talent introduction activities. The greater the support for these talent introduction policies, the better the future career prospects for talent, and the stronger the attraction of the region to talent.

Secondly, implementing high-quality talent cultivation policies in the Lhasa region can enhance the level of talent agglomeration in information technology enterprises. Talent in information technology enterprises is more concerned about whether their future development

can be guaranteed, which determines whether they will join enterprises in the city. Regional talent cultivation plans usually include the construction of good talent exchange and development platforms, strengthening special support for talent, carrying out knowledge update projects for technical talent, and providing relevant vocational skills training. These talent cultivation activities can provide support in various aspects such as job design, interpersonal relationship handling, and achievement transformation recognition, thereby increasing the attractiveness of information technology enterprises in the Lhasa region to both existing and external talent, thus enhancing talent agglomeration.

Lastly, the talent service policies in the Lhasa region can enhance the level of talent agglomeration in information technology enterprises. Talent service policies mainly include providing better services for information technology talent cardholders, optimizing talent services with digital governance empowerment, and enriching related policy promotion activities. To better attract and retain relevant talent, it is also essential to consider the various needs of talent comprehensively and establish a good talent service environment. The more thoughtful the service for talent cardholders, the more confident the talent will be in their future development, thereby making the region's related enterprises more attractive to both existing and external talent. Digital governance empowerment of talent services means that the use of digital technologies is already embedded in the operations of enterprises in the region. This helps enterprises strengthen data screening and comparison, accurately match the needs of software and information service enterprises and individuals, improve the accuracy and relevance of talent services, optimize talent services, and thereby enhance talent agglomeration. Therefore, talent policy support will have the most direct positive impact on talent agglomeration. Based on this, this study proposes the following hypotheses:

Hypothesis H2a: Policy support for information technology enterprise talent in the Lhasa region can enhance the level of talent agglomeration in these enterprises.

3.2.2 Mediating role of place identity

Place identity refers to a psychological attachment, an emotional relationship between individuals and a place, formed through personal perceptions, preferences, evaluations, and behavioral tendencies related to the place. Place identity is a concentrated expression of personal identity, and as a form of personal identity, it is derived from the characteristics of the region and the nature of human-place interactions. This study posits that regional talent policy support can enhance talent agglomeration by strengthening the place identity of talent.

In cognitive-affective theory, the reason why people have different emotions toward

environments is that they have different cognitions of those environments, which is usually used to explain that cognition is a prerequisite for individuals to generate emotions and make behavioral responses. On one hand, regional talent policy support can enhance talent's place identity. A city's talent policies reflect the city's emphasis on talent and sincerity in building an emotional connection with talent. The greater the support for talent policies in the Lhasa region, the stronger the atmosphere of valuing and supporting talent within the society. This can make talent more clearly perceive that their value is recognized and affirmed in the region, thereby generating a stronger sense of place identity. On the other hand, the stronger the talent's place identity with the Lhasa region, the more likely they are to stay in the area and recommend it to others, which means that the level of talent agglomeration in the information technology enterprises in the Lhasa region will correspondingly increase. Based on this, this study proposes the following hypothesis:

Hypothesis H2b: Place identity plays a mediating role in the effect of regional talent policy support on talent agglomeration, that is, regional talent policy support can enhance talent agglomeration by improving talent's place identity.

3.3 Living security levels on talent agglomeration

3.3.1 Direct impact effect

Regional living security levels mainly include transportation development, education and medical standards, and housing security. This study posits that the higher the level of living security in a region, the higher the level of talent agglomeration. This will be explained through three aspects of regional living security levels.

Firstly, Lee's push-pull theory suggests that when making migration decisions, labor considers not only the factors of the origin and destination but also the degree of natural barriers between the two. Good transportation infrastructure indicates a high level of transportation development, which can reduce obstacles to labor mobility, increase regional accessibility, break down labor market segmentation caused by natural and geographical factors, attract industries, and bring significant relative population growth and improved human capital levels to the regions along the route. Empirical research on the opening of high-speed rail shows that good transportation development can promote the inflow of human capital and enhance the level of talent agglomeration in a region.

Secondly, higher education and medical standards can provide better living security for

regional talent, ensuring good education and medical care for themselves and their offspring. This can enhance the attractiveness of the region to existing and potential talent, thereby improving the level of talent agglomeration.

Lastly, good housing security policies can address a series of issues related to the migration of accompanying family members, such as employment and education, thus ensuring the basic living conditions of workers and attracting relevant talent, thereby enhancing talent agglomeration. Housing security policies typically include various housing benefits for introduced talent, such as priority in purchasing commercial housing, talent housing, housing subsidies, rental housing for talent, and rental subsidies. This housing security can provide talent with a comfortable, convenient, and orderly material living foundation, attracting talent to move in and settle, thus enhancing talent agglomeration.

Based on this, the following hypothesis is proposed:

Hypothesis H3a: The higher the level of living security in the Lhasa region, the higher the level of talent agglomeration in local information technology enterprises.

3.3.2 Mediating role of place dependence

Place dependence refers to a person's functional attachment to a place, a relationship based on the facilities, resources, and environment provided by the place. This research posits that the investment in living security facilities and resources for talent in the Lhasa region can enhance their place dependence, thereby retaining existing talent and attracting external talent, thus enhancing talent agglomeration.

On one hand, an improvement in living security levels means that transportation, education, medical facilities, and housing resources are all highly secured. These elements constitute the living environment and personal experience perceived by individuals, providing a relatively stable perceptual space. This orderly perceptual environment or content enables people to achieve a stable and continuous perceptual state, and individuals in such an environment will gradually develop deeper place dependence on the region providing this perception.

On the other hand, the higher the degree of personal place dependence, the higher their level of embeddedness in the locality, reducing the likelihood of talent outflow. Additionally, individuals are more likely to promote the Lhasa region to external members, attracting other external members to move in and enhancing talent agglomeration. Based on this, the following hypothesis is proposed:

Hypothesis H3b: Place dependence plays a mediating role in the relationship between living security levels and talent agglomeration in information technology enterprises in

the Lhasa region. That is, an improvement in living security levels will enhance talent agglomeration by increasing talent's place dependence.

3.4 Information technology industry development potential on talent agglomeration

3.4.1 Direct impact effect

This study posits that the development potential of the information technology industry in the Lhasa region enhances talent agglomeration in related enterprises. The greater the development potential of the information technology industry in Lhasa, the better its industrial agglomeration level and prospects. Industrial agglomeration is one of the most crucial factors influencing talent agglomeration. Marshall's "Principles of Economics" was the first to propose the phenomenon of industrial agglomeration and its relationship with labor mobility in the analysis of economic factors. Following Marshall, industrial agglomeration theory has significantly developed, with contributions from Weber's location theory, Schumpeter's innovation cluster theory, Hoover's optimal scale of industrial agglomeration, and Porter's "industrial clusters." Industrial agglomeration inevitably includes the aggregation of both physical capital and human capital. Talent resources, aggregated using organizations as platforms, can produce a synergistic effect where the whole system's effectiveness is greater than the sum of its parts. The formation of industrial clusters brings numerous advantages, such as closer inter-firm connections, enhanced specialization and cooperation, reduced talent search costs, and improved human capital levels. These advantages can trigger talent mobility and agglomeration, enhancing the level of talent agglomeration in the region. Due to the external economic effects and knowledge spillover effects of industrial clusters, the benefits for talent increase during the agglomeration process, significantly improving the level and quality of specific human capital and fully leveraging the intensity of specialized human capital within the cluster, thereby achieving talent agglomeration.

Based on this, the following hypothesis is proposed:

Hypothesis H4a: The greater the development potential of the information technology industry in the Lhasa region, the higher the level of talent agglomeration.

3.4.2 Mediating role of perceived organizational environmental uncertainty

Uncertainty is typically defined as "the inability of an individual to accurately predict something". This is caused by a lack of information or by ambiguous and contradictory

information. Organizational environmental uncertainty generally refers to members' inability to precisely judge future changes inside and outside the organization and to predict the outcomes of certain events. Based on previous literature, this study divides organizational environmental uncertainty into internal organizational uncertainty and external organizational uncertainty. The former refers to job insecurity, while the latter refers to perceived environmental uncertainty. This research posits that the development potential of the industry can influence talent agglomeration by reducing employees' job insecurity and perceived environmental uncertainty.

On one hand, the development potential of the information technology industry in the Lhasa region can reduce members' perceptions of organizational internal and external environmental uncertainty. In terms of job insecurity, the greater the industry's development potential, the better the prospects for industrial agglomeration. Therefore, the information technology industry can provide relevant talent with better research platforms and work carriers, better job positions, higher salaries, and better working environments, enhancing the job security of both existing and potential incoming talent. In terms of perceived environmental uncertainty, the greater the development potential of the information technology industry in the Lhasa region, the higher the members' expectations for the local industry's prospects. Developing in the region allows them to gain more information and knowledge related to their industry, sector, and position, thereby reducing their perceived external environmental uncertainty.

On the other hand, reducing perceived organizational environmental uncertainty will increase the retention willingness of internal employees and the entry willingness of potential job seekers, thereby enhancing talent agglomeration. In terms of job insecurity, job insecurity is rated as a hindrance stressor, defined as excessive demands related to work that impede personal work achievement. One emotional coping strategy for this stress is behavioral withdrawal from the situation, such as leaving the current enterprise or region. When job insecurity decreases, the likelihood of talent turnover decreases. In terms of external environmental uncertainty, if talent perceives high external environmental uncertainty, their psychological state will become unstable, leading to anxiety, stress, and self-doubt regarding their responsibilities and tasks. If these negative emotions are not well managed, the coping strategy is withdrawal. For talent not yet entering enterprises in the Lhasa region, if they perceive high external environmental uncertainty, their likelihood of moving into the region will also decrease.

Therefore, this study posits that regional industry development potential can reduce talent's perceived organizational internal and external environmental uncertainty, thereby enhancing

talent agglomeration. Based on this, the following hypothesis is proposed:

Hypothesis H4b: Perceived organizational internal and external environmental uncertainty plays a mediating role in the relationship between the development potential of the information technology industry and talent agglomeration, that is, industry development potential can enhance talent agglomeration by reducing talent's perceived organizational internal and external environmental uncertainty.

3.5 Human resource management practices on talent agglomeration

3.5.1 Direct impact effect

Human Resource Management Practices (HRMP) refer to the specific practices designed and implemented by enterprises to manage employees. These practices aim to align with employees' knowledge, abilities, and motivations to achieve strategic goals, involving activities that acquire, allocate, and utilize human resources to enhance their value and utility. Daily management activities, such as professional and scientific recruitment, targeted training, reasonable compensation systems, promotion systems, and organizational culture, all reflect HRMP. This research posits that high-level HRMP can enhance the level of talent agglomeration in information technology enterprises in the Lhasa region.

According to social exchange theory, individuals engage in and maintain exchange relationships with others with the expectation of receiving returns. This "transaction" or "exchange" is characterized by mutual benefit and reciprocity throughout the process. In information technology enterprises in the Lhasa region, this exchange relationship is most directly reflected in the HRMP implemented by the organization and whether employees are willing to stay, as well as the attraction of potential employees who have not yet joined the organization.

On one hand, for internal employees, the organization's proactive investment in training employees' knowledge and skills, planning their career development, and providing reasonable compensation and benefits can be seen as the enterprise's investment cost in human capital. As a return, employees are willing to stay and contribute to the enterprise. Based on the "principle of reciprocity" in social exchange, effective HRMP means the organization provides various work incentives. When employees perceive these incentives as matching their value, and they can contribute equally based on their abilities to ensure the enterprise's sustainable development, the "organization-individual" exchange relationship is maintained, leading to a higher

likelihood of employees staying.

On the other hand, for potential employees who have not yet joined the enterprise, high-level HRMP can attract them significantly. Job seekers often focus on their personal development prospects when choosing enterprises and positions, and high-level HRMP can help them achieve these personal goals. Therefore, implementing high-level HRMP in information technology enterprises in the Lhasa region can enhance current employees' retention willingness and potential job seekers' application probability, thereby improving talent agglomeration.

Based on this, the following hypothesis is proposed:

Hypothesis H5a: The better the HRMP in information technology enterprises in the Lhasa region, the higher the level of talent agglomeration.

3.5.2 Mediating role of job satisfaction

Job satisfaction refers to employees' feelings or emotional responses to their roles within an organization, which can be externally expressed as their attitude toward work. Existing research has confirmed a positive correlation between HRMP and job satisfaction. Sound human resource management practices indicate that enterprises are attentive to employees' personal growth and individualized development needs. Such organizations are willing to design comprehensive career development paths and training programs for employees' long-term development, helping them enhance their skills and knowledge, providing promotion opportunities, and enabling employees to envision their future within the enterprise. For example, offering employees continuous learning opportunities through internal training, external further education, and professional certifications enhances employees' professional qualities and innovative capabilities. Simultaneously, these practices allow for the formulation of reasonable training plans and content tailored to employees' specific circumstances and needs, fulfilling their individualized development requirements. Furthermore, exemplary human resource management practices encompass equitable promotion systems, fair compensation and benefits policies, transparent performance evaluation mechanisms, and a positive corporate culture atmosphere. All in all, high-level HRMP can enhance employees' job satisfaction and, in turn, their willingness to stay, positively impacting talent agglomeration.

This assumption can be explained from the following two aspects.

Firstly, HRMP essentially represents the organization's recognition of employees' work performance and abilities and serves as a means to realize self-concept and value and gain recognition from others. Any issue in HRMP, such as lack of training, unreasonable

compensation systems, lack of promotion, or poor cultural atmosphere, can significantly impact employees' internal and external motivations. This can lead to negative emotions and reduce employees' job satisfaction. In other words, high-level HRMP means employees feel well-treated and fairly treated, perceiving the organization's concern and recognition for their value and contributions. This can lead to a positive work attitude, enhancing job satisfaction.

Secondly, increased job satisfaction can significantly enhance employees' willingness to stay. Additionally, employees will contribute to the enterprise's development, such as promoting their company in various situations, which can attract potential job seekers and increase their likelihood of joining, thereby improving talent agglomeration. Employees with high satisfaction typically demonstrate a strong sense of belonging and loyalty to their organization. They are more inclined to remain with the organization long-term and contribute to its development. Additionally, when employees feel satisfied with their work environment, team collaboration, leadership, and career development opportunities, they are more likely to envision their future within the organization and thus be more inclined to stay. Furthermore, employees with higher job satisfaction tend to maintain better psychological states at work, enabling them to more effectively cope with work-related pressure and challenges, thereby enhancing their personal willingness to remain with the organization.

Based on this, the following hypothesis is proposed:

Hypothesis H5b: Job satisfaction mediates the relationship between HRMP and talent agglomeration in information technology enterprises in the Lhasa region, i.e., higher-level HRMP can enhance members' job satisfaction, thereby improving talent agglomeration.

3.6 Regression model

Based on the literature review and theoretical analysis, this study proposes that high-altitude special climate conditions, regional talent policy support, regional quality-of-life assurance, regional industry development potential, and enterprise human resource management practices are all antecedent factors affecting talent agglomeration levels in information technology enterprises in the Lhasa region. However, they influence talent agglomeration levels through different pathways. Specifically, this is manifested in the following five points:

First, high-altitude special climate conditions may bring higher plateau health risks. The physiological discomfort and disease risks caused by special climate conditions reduce the attractiveness of the Lhasa region to talents and may also trigger the outflow of existing talents, thereby reducing the agglomeration level of talents in information technology enterprises.

Second, the stronger the talent policy support in the Lhasa region, the more clearly talents can perceive that their individual value is affirmed and recognized in the region, thereby generating a stronger sense of local identity among talents toward the Lhasa region. On the other hand, talents' strong sense of identity with the Lhasa region enhances their willingness to stay locally, and the possibility of recommending the Lhasa region to others also increases accordingly, thereby enhancing talent agglomeration levels in information technology enterprises in the Lhasa region.

Third, the Lhasa region's facilities and resource investments in quality-of-life assurance for talents can enhance their sense of place dependence, thereby retaining existing talents and attracting external talents, improving talent agglomeration levels.

Fourth, the development potential of the information technology industry in the Lhasa region can reduce members' perception of environmental uncertainty within and outside the organization. Furthermore, the reduction in perceived organizational environmental uncertainty enhances the retention willingness of internal employees and the entry willingness of other potential job seekers, thereby improving talent agglomeration levels.

Fifth, high-level human resource management practices can make employees feel that the organization cares about and recognizes their value and contributions. This helps improve employee job satisfaction, and the enhancement of employee job satisfaction can significantly increase employees' willingness to stay. Meanwhile, employees within the enterprise will also make corresponding reciprocal behaviors for the development of the enterprise, such as promoting their enterprise externally, thereby enhancing talent agglomeration levels in information technology enterprises in the Lhasa region.

To summarize, the research model of this study is illustrated in Figure 3.1 below:

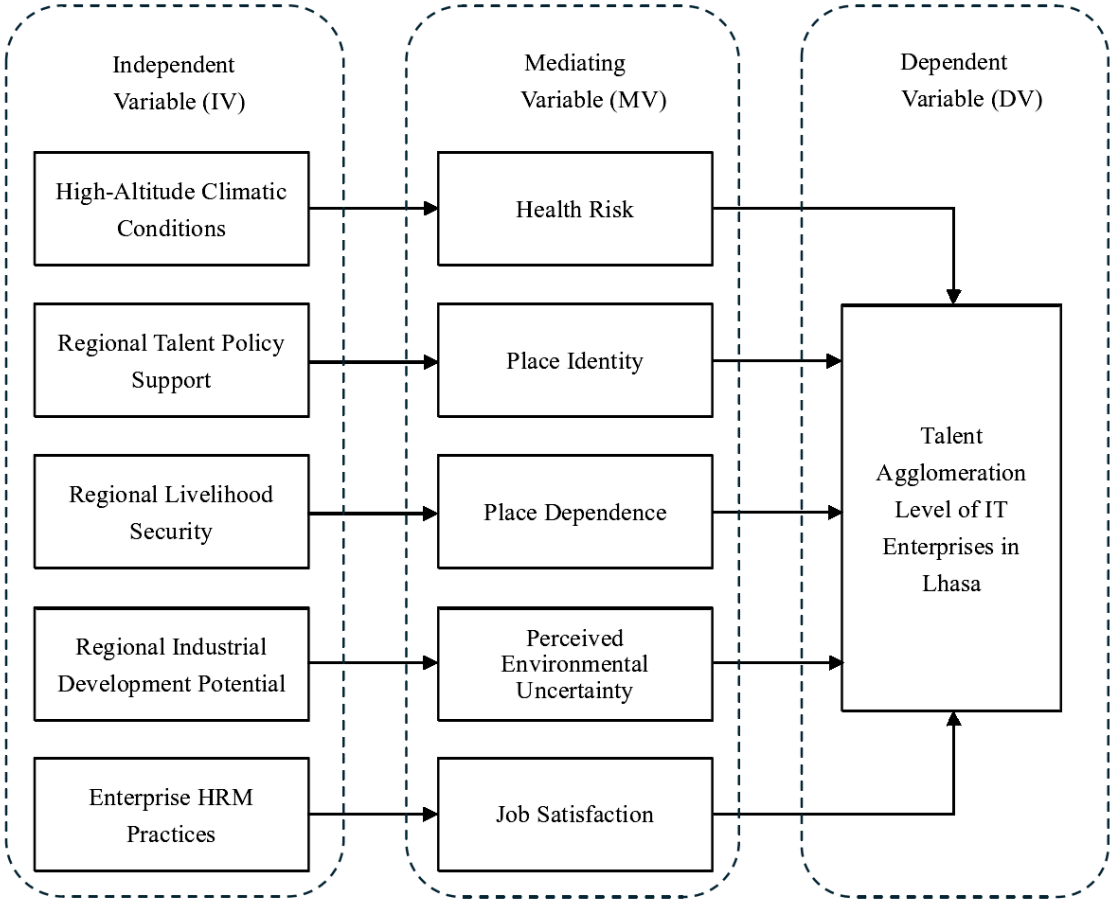


Figure 3.1 Research model diagram

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Chapter 4: Research Design and Data Processing

4.1 Questionnaire design

This study employs a standardized questionnaire survey method to collect empirical data. To ensure the validity and reliability of the research, the questionnaire was designed in strict accordance with psychometric principles.

Firstly, in terms of item construction, a dual-verification mechanism was adopted:

(1) Expert consultation was conducted to ensure that all measurement items were unambiguous and that each construct was operationally defined;

(2) Cognitive interview techniques were employed to anticipate respondents' potential misinterpretations, and any expressions likely to cause confusion were iteratively refined.

Secondly, regarding ethical safeguards:

(1) Anonymization protocols were applied, and no personally identifiable information was collected through the questionnaire;

(2) An informed consent section was included to clearly communicate the purpose of the study and the confidentiality commitments;

(3) Data desensitization was performed via third-party platforms to ensure compliance with data protection regulations such as the General Data Protection Regulation (GDPR).

Thirdly, for quality control:

(1) Attention check items were embedded (e.g., "Please select 'Strongly Agree' for this item");

(2) A minimum completion time threshold of 100 seconds was established, and responses submitted below this threshold were considered invalid;

(3) Reverse-coded items were incorporated into the Likert scale to balance acquiescence bias and enhance response accuracy.

Finally, in the selection of measurement instruments:

(1) Priority was given to well-established scales with more than 100 citations;

(2) Cross-cultural adaptation procedures were conducted to ensure the cultural and contextual validity of the scales in the local setting;

(3) A pilot test (N=30) was conducted, and only those scales with a Cronbach's alpha

coefficient greater than 0.7 were included in the formal study.

The present study focuses on the key factors influencing talent agglomeration in information technology enterprises in Lhasa. Five core dimensions were identified:

(1) High-altitude climatic conditions;

(2) Regional talent policy support;

(3) Quality of life security;

(4) Potential for IT industry development; and

(5) Human Resource Management Practices (HRMP).

Each primary factor consists of several secondary indicators, which are further broken down into tertiary items to enable a more nuanced and comprehensive assessment. The detailed index system is presented in Table 4.1.

Table 4.1 Index design for the influencing factors of talent agglomeration in information technology enterprises in Lhasa

Primary Indicator	Secondary Indicator	Tertiary Indicator
High-Altitude Climatic Conditions	Plateau Reactions	Oxygen Concentration in the Air
		Ultraviolet Radiation
	Temperature and Humidity	Diurnal Temperature Variation
		Dryness of the Climate
Regional Talent Policy	Talent Introduction	Intensity of Talent Introduction Subsidies
		Diversity of Talent Attraction Activities
		Maturity of Market-Oriented Talent Recruitment (e.g., headhunting)
	Talent Development	Talent Exchange and Development Platforms
		Special Talent Programs
		Knowledge Renewal Initiatives for Talent
		Professional Skills Enhancement Training
	Talent Services	Quality of Services for Talent Card Holders
		Digital Empowerment in Talent Services
		Policy Communication and Publicity Activities
Living Security Level	Transportation Infrastructure	Convenience of Communication with Inland Regions
		Convenience of Daily Commuting
	Education and Healthcare	Employment and Education Security for Spouses and Children
		Opportunities for Personal Learning and Development
		Accessibility of Medical Services
		Medical Service Environment

Development Potential of the IT Industry	Housing Security	Coverage of Talent-Oriented Housing
		Convenience of Rental Housing
		Housing Affordability Pressure
	Market Development & Infrastructure	Market Demand and Share
		Development of IT Infrastructure
	Industrial Ecosystem & Innovation Cooperation	Industrial Ecosystem and Collaborative Environment
		Level of R&D and Innovation
Human Resource Management Practices	Talent Development and Incentive Mechanisms	Vocational Skill Training and Career Development Planning
		Promotion Mechanisms for Talent
		Compensation and Benefits Systems
		Performance Evaluation Systems
	Organizational Culture	Material Culture of the Enterprise
		Institutional (Systematic) Culture of the Enterprise
		Spiritual and Ideological Culture of the Enterprise

This research adopts a structured questionnaire format, with content designed according to rigorous standards of social science methodology. The questionnaire is composed of the following sections:

(1) Questionnaire Introduction Section

Statement of Research Purpose: This study aims to elucidate the academic value and practical significance of investigating the factors influencing talent agglomeration in the information technology sector.

Data Confidentiality Protocol: A three-level protection mechanism is employed to ensure the confidentiality of respondents' data, including anonymous responses, encrypted data storage, and restricted data usage within the research scope only.

Ethical Statement: This research complies with the ethical principles outlined in the Declaration of Helsinki for research involving human subjects (World Medical Association, 2013).

Instructions for Completion: Standardized response examples are provided to guide participants in accurately completing the questionnaire.

(2) Demographic Variables Module:

Individual-Level Variables:

Biosocial characteristics: gender, age (measured by category ranges);

Human capital attributes: highest educational qualification (classified according to ISCED), academic discipline;

Career trajectory characteristics: years of service in current organization (measured to the

nearest year), current job level (identified with the aid of organizational charts).

Organizational-Level Variables:

Economic capital indicator: pre-tax annual income (divided into quintiles based on regional income medians);

Organizational type indicator: industry classification (in accordance with GB/T 4754);

Organizational size: number of employees (log-transformed for normalization purposes).

Quality Control Items:

Attention-check questions (randomly inserted on page 3);

Consistency checks across similar items placed in different modules to detect response irregularities.

(3) Perception Survey on High-Altitude Climate, Talent Policies, Quality of Life, Industry Development Potential, and HRMP:

This section is designed to gather respondents' perceptions regarding the unique climatic conditions in Lhasa and assess how local governments and enterprises implement relevant policies to facilitate talent agglomeration.

(4) Perception Survey on Health Risk, Place Identity, Environmental Uncertainty, Risk Tolerance, and Job Satisfaction:

This module focuses on individual perceptions of plateau health risks associated with residing in Lhasa, place attachment, perceived uncertainty in internal and external organizational environments, personal risk-taking tendencies, and job satisfaction. The purpose is to evaluate the overall subjective experience and assessment of local working and living conditions by IT professionals in Lhasa.

This study adopts a cross-sectional study design, conducting a one-time questionnaire survey among employees of information technology enterprises in the Lhasa region at a specific point in time to obtain cross-sectional data on the influencing factors of talent agglomeration. This design is appropriate for exploring relationships between variables but does not address the temporal evolution required for causal inference.

The research strictly adheres to the World Medical Association Declaration of Helsinki (World Medical Association, 2013), particularly the provisions concerning informed consent, privacy protection, and the principle of non-maleficence. Although the study participants are enterprise employees rather than medical patients, voluntary participation, anonymous responses, and data confidentiality were ensured throughout the questionnaire design and data collection processes.

4.2 Definition and measurement of variables

The research model comprises a total of eleven variables, comprising five independent variables, five mediating variables, and one dependent variable. The independent variables include High-Altitude Climatic Conditions (X1), Regional Talent Policy Support (X2), Level of Public Service Provision (X3), Development Potential of the Local Information Technology Industry (X4), and Human Resource Management Practices (X5). The mediating variables are Perceived Health Risk (M1), Place Identity (M2), Place Dependence (M3), Perceived Organizational Environmental Uncertainty (M4), and Job Satisfaction (M5). The dependent variable is the Talent Agglomeration Level in Information Technology Enterprises (Y).

Among them, the measurements of Human Resource Management Practices, Place Identity, Place Dependence, Perceived Organizational Environmental Uncertainty, and Job Satisfaction are based on well-established scales widely adopted by Chinese and international scholars. These instruments were adapted to fit the specific research context of this study. Meanwhile, the scales used for High-Altitude Climatic Conditions, Talent Policy Support, Public Service Provision, Industrial Development Potential, and Talent Agglomeration were developed with reference to prior research and were refined through expert review and pilot testing.

All variables were measured using a 5-point Likert scale, where “1” represents “strongly disagree”, “2” indicates “disagree”, “3” represents “neutral”, “4” indicates “agree”, and “5” represents “strongly agree”. A higher score reflects greater alignment between the respondent’s actual experience and the content of the item.

4.2.1 Measurement of independent variables

4.2.1.1 High-altitude climatic conditions in Lhasa

Located on the Qinghai-Tibet Plateau at an average altitude of approximately 3,650 meters, Lhasa is characterized by distinctive high-altitude climatic conditions that have a significant impact on both the natural environment and human activities. In this study, the special climatic features of Lhasa are operationalized through two dimensions: altitude-induced physiological reactions and temperature-humidity characteristics. The measurement items were developed to capture respondents’ perceived experiences with these environmental features. The specific question items are as follows: Q1. Due to Lhasa’s high altitude, you experienced symptoms such as headache, chest tightness, and insomnia upon arrival, with some cases requiring medical attention, which affected your ability to work and live normally; Q2. Ultraviolet radiation is

particularly intense in Lhasa; Q3. Lhasa experiences significant temperature fluctuations between day and night, requiring frequent changes in clothing; Q4. The climate in Lhasa is dry, with notably low levels of precipitation.

4.2.1.2 Talent policy support in Lhasa

The measurement of talent policy support in Lhasa focuses on ten specific dimensions: the scale of financial incentives for talent introduction, the richness of talent recruitment activities, the maturity of market-based recruitment mechanisms (e.g., headhunting services), the quality of talent exchange and development platforms, the appeal of special talent programs, the extent of policy prioritization for talent, the scale of vocational skills training, the quality of services for card-holding talent, the degree of digitalization in talent services, and the richness of policy publicity and promotion activities.

Each dimension is operationalized into a corresponding item, resulting in a total of ten measurement items. The specific question items are as follows: A1. I believe that the financial subsidy policies for introducing information technology talent in my region are relatively strong; A2. I believe that the talent recruitment activities for the IT sector in my region are relatively abundant; A3. I believe that market-based mechanisms for talent introduction, such as headhunting services, are relatively mature in my region; A4. I believe that the platforms built in my region for information technology talent exchange and development are relatively well-established; A5. I believe that the special programs for information technology talent released in my region are highly attractive to me; A6. I believe that there is a strong policy inclination in favor of information technology talent in my region; A7. I believe that the vocational skills training programs for IT professionals in my region are extensive; A8. I believe that the services provided to card-holding talent in the IT services industry are considerate and comprehensive in my region; A9. I believe that the degree of digital empowerment in talent services for the IT industry is relatively high in my region; A10. I believe that the policy promotion activities related to the introduction, cultivation, evaluation, and service of information technology talent are relatively rich in my region.

4.2.1.3 Measurement of living security level in Lhasa

This study evaluates the level of living security in Lhasa based on several key aspects: ease of interaction with inland regions, convenience of daily commuting, educational security for children, opportunities for self-improvement and learning, medical access and service environment, coverage of talent housing programs, convenience of renting, and pressure of home ownership. The specific question items are as follows: B1. I believe communication and

exchange between my region and inland areas are convenient; B2. I believe daily commuting in my region is convenient; B3. I believe my region provides a high level of educational security for children; B4. I believe there are many opportunities for self-improvement and learning in my region; B5. I believe medical services in my region are easily accessible; B6. I believe the medical service environment in my region is very good; B7. I believe the coverage of talent-oriented housing programs in my region is high; B8. I believe renting a house in Lhasa is very convenient; B9. I believe the pressure of purchasing property in Lhasa is much lower than in most other provincial capitals.

4.2.1.4 Measurement of development potential of the information technology industry in Lhasa

The measurement of the development potential of the IT industry in Lhasa includes four main dimensions: market demand and share, infrastructure development, industrial ecosystem and cooperation environment, and innovation and R&D capacity. The specific question items are as follows: C1. I believe that the market scale of the IT industry in Lhasa is steadily expanding with a clear growth trend; C2. I believe that Lhasa has well-developed infrastructure in terms of telecommunications, networks, and data centers; C3. I believe that Lhasa performs well in industrial collaboration across the IT supply chain, mutual benefit among enterprises, and cooperation with other regions; C4. I believe that Lhasa performs well in enhancing technological innovation and increasing investment in R&D.

4.2.1.5 Measurement of Human Resource Management Practices (HRMP)

Human Resource Management Practices refer to the systematic processes implemented by enterprises to effectively allocate, develop, utilize, and manage human resources in alignment with strategic goals. These practices encompass recruitment and training, promotion systems, compensation and benefits, performance evaluation, and organizational culture, aiming to improve employee productivity, satisfaction, and loyalty for sustainable development.

This study focuses on measuring the following aspects of HRMP: employee skills training and career development planning, promotion systems, compensation and benefits, performance evaluation mechanisms, and the corporate culture environment. The specific question items are as follows: D1. Our company provides comprehensive skills training and career development planning for employees; D2. I am very satisfied with the promotion system in our company; D3. I believe our company’s compensation and benefits system is highly transparent; D4. I believe our company’s performance evaluation mechanism is scientific and effective; D5. I am very satisfied with the layout and decoration of our office environment; D6. I am very satisfied

with our company's leadership structure, interpersonal relationships, and institutional regulations; D7. I believe our company has a strong and positive corporate culture.

4.2.2 Measurement of mediating variables

4.2.2.1 Measurement of perceived health risk

Due to Lhasa's high-altitude environment, characterized by hypoxia, strong ultraviolet radiation, and other extreme climatic and geographic conditions, individuals working and living in the region may face significant plateau health risks. This study measures perceived health risk using the following four items: R1. I believe that long-term residence in Lhasa may cause chronic altitude sickness and increase the risk of cardiovascular and cerebrovascular diseases; R2. I believe that long-term residence in Lhasa increases the risk of catching colds and respiratory illnesses; R3. I believe that long-term residence in Lhasa tends to result in symptoms such as cracked skin, nosebleeds, and mucosal damage in the respiratory tract; R4. I believe that long-term residence in Lhasa increases the risk of developing skin cancer.

4.2.2.2 Measurement of place identity

Place identity refers to a psychological attachment to a place—an emotional bond formed through personal perceptions, preferences, evaluations, and behavioral tendencies related to the location. As an individual dimension of identity, it arises from regional characteristics and the interaction between people and place. This study draws on the scale developed by Williams and Vaske (2003), with item wording adapted to fit the research context. Measurement items are follows: E1. I identify with the Lhasa region; E2. I feel attached to the Lhasa region; E3. Lhasa has become a part of me; E4. The image of Lhasa is closely related to my personal identity; E5. Living and working in Lhasa is very meaningful to me.

4.2.2.3 Measurement of place dependence

Place dependence refers to a functional attachment to a location—based on the availability of resources, infrastructure, and environmental support. This study draws on the same (Williams & Vaske, 2003) scale to measure this construct, with adaptations made to suit the context of Lhasa. The specific question items are as follows: F1. I believe that the conditions provided in Lhasa are suitable for living and working; F2. Compared to other regions, I prefer living and working in Lhasa; F3. Compared to other regions, I believe my career prospects in Lhasa are better.

4.2.2.4 Measurement of perceived environmental uncertainty

Organizational environmental uncertainty refers to the inability of organizational members to accurately predict future internal and external changes, and the difficulty in forecasting outcomes. This study distinguishes between external environmental uncertainty and job insecurity, adopting the scales developed by Waldman et al. (2001) and Hellgren et al. (1999). The specific question items of external environmental uncertainty are as follows: G21. I think the external environment of our company is highly dynamic, with rapid changes in technology, economy, and culture, bringing both risks and opportunities; G22. I think the external environment our company faces is very risky, and a single wrong decision could lead to failure; G23. I think our company is under great external pressure, and it is difficult to meet future customer demands. The specific question items of job insecurity are as follows: G11. I am uncertain about what kind of position I will hold in this company in the future; G12. I often worry that I might have to leave this company before I choose to resign; G13. There is a risk that I may be forced to leave my current job within the next year; G14. I am concerned that I will soon become unemployed.

4.2.2.5 Measurement of job satisfaction

Job satisfaction is generally defined as an individual's emotional response to the role they play in an organization and is typically expressed in employees' attitudes toward their work. This study adopts the Job Diagnostic Survey (JDS) for measuring job satisfaction. The specific question items are as follows: H1. Overall, I am very satisfied with my current job; H2. Overall, I really enjoy my current job; H3. Overall, I would like to continue working in my current company.

4.2.3 Measurement of dependent variables

The dependent variable in this study is the level of talent agglomeration in information technology enterprises in Lhasa. It should be noted that talent agglomeration does not merely refer to the concentration of talent in geographical space. More importantly, it entails the stable retention and active engagement of talent within specific organizations or industries, forming a talent ecosystem that is conducive to enterprise development and innovation. Considering that it is relatively difficult to obtain data on the geographical concentration of talent in the Lhasa region, this research primarily reflects the stability and enthusiasm of talent within organizations, which are emphasized by talent agglomeration, based on employees' identification with, loyalty to, and willingness to contribute to their respective enterprises. Six

items have been designed accordingly. The specific measurement items are as follows: Y1. I am very willing to spend the rest of my professional career in my current company; Y2. I feel a strong sense of belonging to my current company; Y3. I believe my current company enables me to realize my personal aspirations; Y4. I am very willing to make contributions to my current company; Y5. When talking about employment, I actively promote the strengths of my current company as an employer; Y6. When someone asks me for job recommendations, I would first recommend my current company.

4.3 Data collection and analytical procedures

4.3.1 Data collection

To gain an in-depth understanding of the influencing factors of talent agglomeration in information technology (IT) enterprises in Lhasa, this study employed a combination of on-site enterprise visits and self-administered online questionnaires to collect primary data. The survey targeted individuals across multiple organizational levels, ranging from frontline employees to middle and senior managers, ensuring both the representativeness of the sample structure and the external validity of the conclusions.

The surveyed enterprises were all local IT firms of a certain scale, located in Lhasa High-tech Industrial Development Zone, Duilongdeqing District, and Liuwu New District. These enterprises operate in sectors such as software development, IT systems integration, smart hardware manufacturing, and big data services. The field investigation was conducted with the assistance of the HR departments of participating firms. Prior to the official questionnaire distribution, selected respondents participated in standardized training sessions and explanatory briefings to ensure uniform understanding of measurement items and authenticity in responses.

A total of 730 questionnaires were distributed, with 673 returned, yielding a response rate of 92.19%. After eliminating invalid samples—such as those with excessive missing data, extremely short completion times, logically contradictory answers, or highly similar response patterns—613 valid responses were retained, resulting in a valid response rate of 91.06%, which reflects strong data quality. The demographic distribution of the sample is representative and will be reported in detail in Chapter 5, “Descriptive Statistical Analysis”.

4.3.2 Data processing and analysis procedures

The data processing and analytical workflow of this study adhered strictly to the norms of

empirical research and data science methodology. Analyses were conducted using mainstream statistical software, including SPSS 27.0 and AMOS 28.0, and proceeded through the following five steps:

Data Entry and Preliminary Cleaning

Paper-based and online questionnaire responses were imported into SPSS 27.0. A unified coding and formatting protocol was applied. Outliers and missing values were handled, logically flawed responses were excluded, and variable labels and codes were assigned.

Descriptive Statistics and Correlation Analysis

Descriptive statistics were computed for demographic variables (e.g., gender, age, education level, years of service, job level, and income) to present the sample structure.

Pearson correlation analysis was conducted for all core variables to examine the significance and directionality of linear relationships, providing a basis for subsequent path analysis.

Reliability and Validity Testing

Reliability Test: Cronbach's α coefficients were calculated for all latent constructs; $\alpha \geq 0.7$ was considered acceptable for internal consistency.

Convergent Validity: Confirmatory Factor Analysis (CFA) was conducted using AMOS 28.0. Results included the Kaiser-Meyer-Olkin (KMO) value, Bartlett's test of sphericity, factor loadings, Average Variance Extracted (AVE), and Composite Reliability (CR), to assess the convergence of the measurement model.

Discriminant Validity: Model fit indices (e.g., χ^2/df, CFI, TLI, RMSEA) were compared using competing model strategies (e.g., merged factor vs. free factor models) to assess the independence of constructs.

Common Method Bias Testing

As all data were self-reported by single respondents, the potential for common method bias was considered. Harman's single-factor test was employed; if the first unrotated factor explained less than 40% of the variance, common method bias was deemed not a serious threat.

Hypothesis Testing and Mediation Analysis

Structural Equation Modeling (SEM) was used to estimate the overall fit and path coefficients of the proposed model.

Mediation effects were tested via the Bootstrap method (n = 5000 resamples), with standardized indirect effects, 95% confidence intervals (CIs), and significance levels reported.

If mediation effects were found significant, further differentiation between full mediation

and partial mediation models was conducted and their theoretical and practical implications were discussed in Chapter 6.

Chapter 5: Data Analysis and Empirical Testing

5.1 Sample distribution statistics

To comprehensively understand the structural characteristics of the sample, this study conducted detailed statistical analysis on the 613 valid questionnaires. The results are presented in Table 5.1. Overall, the sample demonstrates good representativeness and diversity, adequately reflecting the actual composition of employees in IT enterprises in Lhasa.

Table 5.1 Descriptive statistics of survey sample (N = 613)

Variable	Category	Frequency	Percentage (%)
Gender	Male	355	57.9
	Female	258	42.1
Marital Status	Unmarried	217	35.4
	Married	368	60.0
	Divorced	25	4.1
	Widowed	3	0.5
Age	≤25 years	95	15.5
	26–30 years	162	26.4
	31–35 years	120	19.6
	36–40 years	101	16.5
	≥41 years	135	22.0
Education	Junior high or below	10	1.6
	High school/vocational	79	12.9
	Associate degree	164	26.8
	Bachelor’s degree	316	51.5
	Master’s degree	35	5.7
	Doctorate	9	1.5
Tenure	≤1 year	99	16.2
	2–5 years	243	39.6
	5–10 years	119	19.4
	Over 10 years	152	24.8
Income Level	< ¥4,000	29	4.7
	¥4,000–¥7,000	105	17.1
	¥7,000–¥10,000	223	36.4
	¥10,000–¥15,000	194	31.6
	> ¥15,000	62	10.1
Job Position	General staff	418	68.2
	Junior management	84	13.7
	Middle management	90	14.7
	Senior management	21	3.4
Job Function	R&D roles	208	33.9
	HR/administration	100	16.3
	Product/marketing	148	24.1
	General administration	157	25.6

The sample exhibits a well-distributed structure across gender, age, education, income, job

tenure, position, and function. The data quality is high and suitable for supporting the subsequent model estimation and hypothesis testing.

5.2 Empirical analysis of core explanatory variables

To gain a deeper understanding of the key influencing factors behind talent agglomeration in information technology enterprises in Lhasa, this study conducted separate statistical and graphical analyses of five core explanatory variables based on the 613 valid survey samples. These analyses aim to provide a robust empirical foundation for the subsequent regression modeling and mediation effect testing.

5.2.1. Special climatic conditions of high altitude

As shown in Figure 5.1, the variable “Special Climatic Conditions of High Altitude” was measured using four specific items:

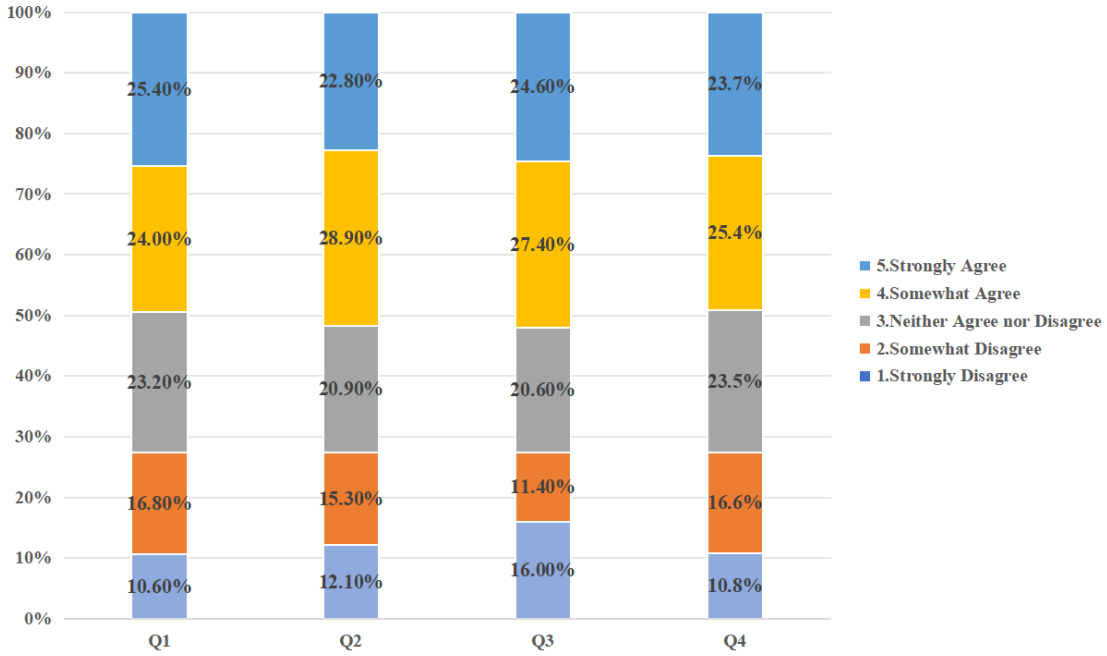


Figure 5.1 Survey data distribution chart on the special high-altitude climatic conditions in Lhasa

Q1: When you first arrived in Lhasa, did you experience symptoms of altitude sickness such as headache, chest tightness, or insomnia? If so, did the symptoms significantly affect your ability to work and live, to the extent of requiring medical attention?

Q2: Do you agree that ultraviolet radiation is particularly intense in Lhasa?

Q3: Do you often experience large temperature differences between day and night in Lhasa, requiring frequent changes in clothing?

Q4: Do you perceive the climate in Lhasa as dry with insufficient precipitation?

The survey results indicate that more than 70% of respondents experienced varying degrees of altitude sickness upon arrival in Lhasa, and approximately 25% stated that such symptoms significantly disrupted their work and daily routines. About 81% of participants strongly agreed that UV radiation in the region is intense. Additionally, 74% and 79% of respondents recognized the large diurnal temperature variation and the region's dry climate, respectively.

These findings confirm the salience of Lhasa's high-altitude characteristics in shaping respondents' perceptions of their living and working environments. The natural environmental challenges posed by high elevation are widely acknowledged and may serve as an inherent barrier to talent inflow.

The mean score for this variable reached 3.92 out of 5.00, with a standard deviation of 0.71, indicating a high level of consensus among respondents regarding the perceived impact of the high-altitude climate. This suggests that environmental constraints due to altitude are a shared and significant concern, and should be considered a critical factor limiting talent attraction and retention.

To evaluate the level of policy support for the introduction, cultivation, and service of information technology (IT) talents in the Lhasa region, this study designed ten measurement dimensions, covering multiple aspects ranging from subsidy mechanisms to digitalized service provision. The corresponding items are as follows:

A1: I believe the IT talent introduction policies in my region offer relatively strong financial subsidies.

A2: I believe that local talent recruitment activities are relatively abundant.

A3: I believe that market-oriented recruitment mechanisms (e.g., headhunting) are relatively mature.

A4: I believe the region has established a sound platform for IT talent exchange and development.

A5: I believe the specialized programs for IT talent introduced locally are attractive to individuals like me.

A6: I believe that local policies are preferential toward IT professionals.

A7: I believe the local vocational training system is relatively comprehensive.

A8: I believe the support services for certified talents are relatively thoughtful and considerate.

A9: I believe the level of digitalization in talent services is relatively high.

A10: I believe that local policy promotion activities are relatively abundant and that

information transparency is strong.

As illustrated in Figure 5.2, the distribution of the collected data exhibits a moderate positive skew. More than 60% of respondents expressed attitudes ranging from “moderately agree” to “strongly agree” across most of the surveyed dimensions, indicating a general recognition of the policy framework for IT talent in Lhasa. Among these items, A5 (attractiveness of specialized programs), A7 (effectiveness of skill training), and A9 (degree of digitalization in services) received notably higher ratings, suggesting that policy measures exert a certain degree of positive pull on perceived value among talents.

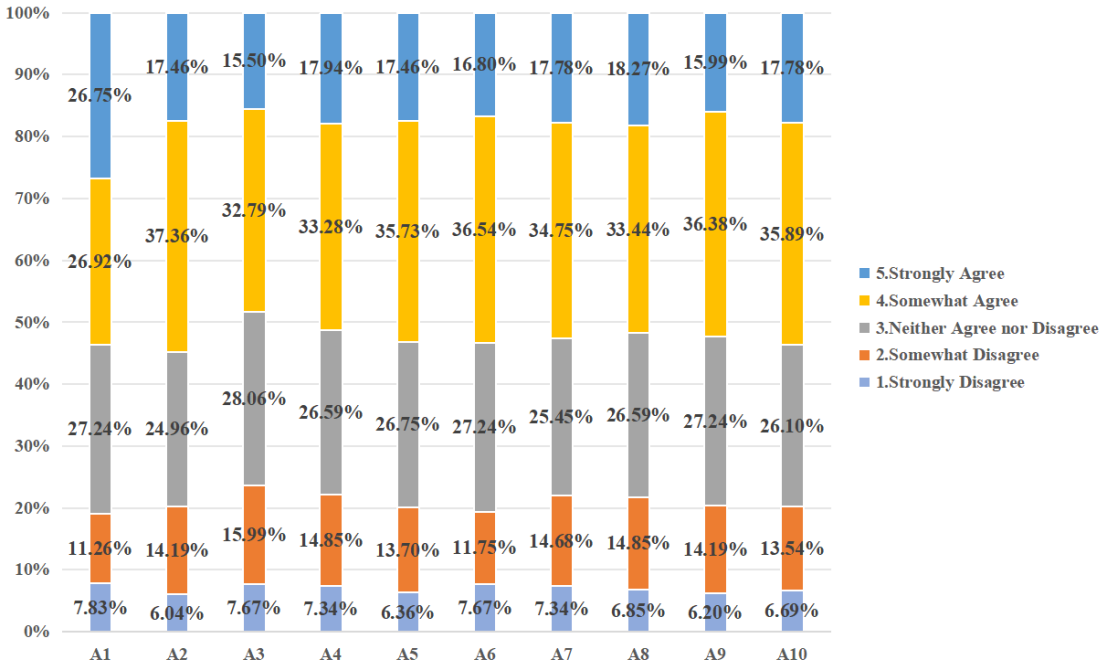


Figure 5.2 Distribution of survey data on talent policies in the Lhasa region

However, certain shortcomings remain. Specifically:

24.76% of respondents expressed “disagree” or “strongly disagree” with regard to A3 (the maturity of headhunting mechanisms);

22.19% of respondents believed that A4 (talent exchange and development platforms) have not yet been effectively established;

22.02% of respondents expressed dissatisfaction with the comprehensiveness of A7 (vocational training system).

These findings reveal that there is still room for improvement in the implementation of relevant policies in Lhasa, especially in areas such as the development of market-based talent recruitment mechanisms, the operation of specialized talent exchange platforms, and the systematization of vocational training programs. These areas require enhanced precision and targeted execution.

The overall mean score for this variable is 3.68 (on a five-point Likert scale), with a standard deviation of 0.85, indicating that most respondents hold a generally positive perception of the local policy environment. Nonetheless, the observed individual differences in perception suggest that the current structure of policy supply still allows for structural optimization and refinement.

To comprehensively assess the supportive role of living security conditions in talent agglomeration within the Lhasa region, this study designed nine observational items covering dimensions such as transportation accessibility, educational and medical resources, housing affordability, and personal development opportunities. The specific items are as follows:

B1: I believe that communication and exchange with inland regions from my area are relatively convenient.

B2: I believe that daily commuting in my area is relatively convenient.

B3: I believe that my area provides high-level support for spouse employment and children's education.

B4: I believe that my area offers ample opportunities for self-development and learning.

B5: I believe that accessing medical services in my area is relatively convenient.

B6: I believe that the medical service environment in my area is excellent.

B7: I believe that the coverage of talent-guaranteed housing in my area is relatively high.

B8: I believe that renting a house in Lhasa is very convenient.

B9: I believe that the pressure of purchasing a home in Lhasa is not high.

As illustrated in Figure 5.3, the survey results show that more than 70% of respondents expressed a "somewhat agree" or "strongly agree" attitude toward most of the living security items. Notably, the most positively perceived aspects were:

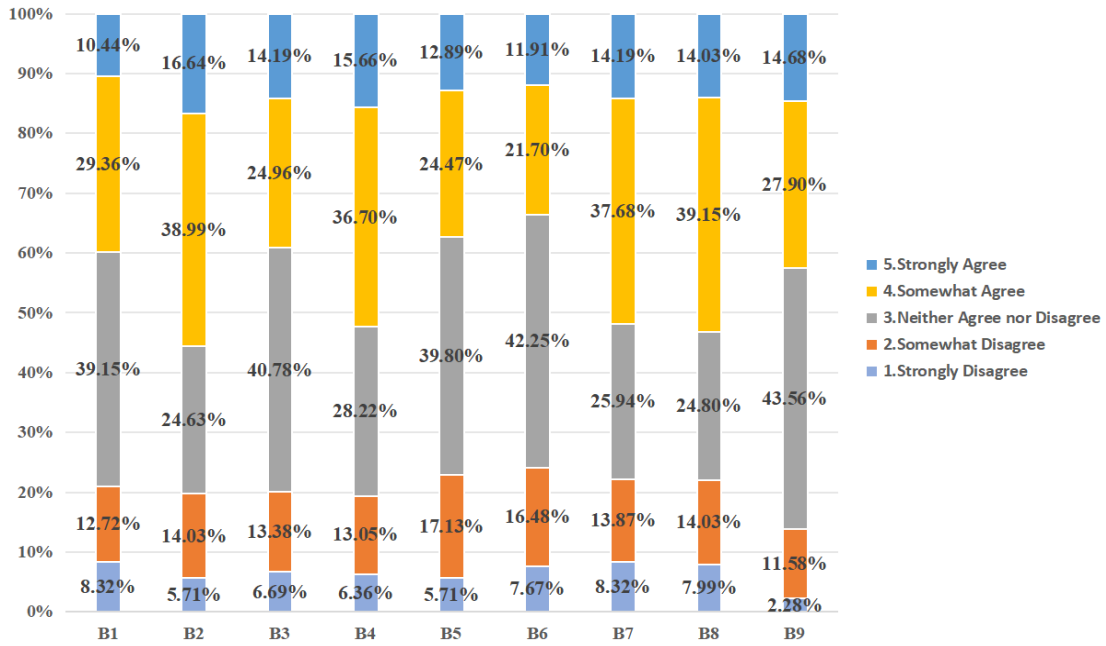


Figure 5.3 Survey data distribution chart on talent security level

Learning opportunities (B4): Over 80% of respondents agreed that Lhasa provides good opportunities for continued education and self-improvement.

Home purchase pressure (B9): Similarly, more than 80% believed that housing pressure in Lhasa is relatively low, indicating strong housing accessibility.

In addition, respondents generally expressed satisfaction with transportation conditions (B1, B2), medical accessibility (B5, B6), and the implementation of guaranteed housing policies (B7). These findings suggest that Lhasa has made notable progress in enhancing urban living conditions and improving overall livability.

However, despite this generally positive outlook, certain items such as spouse employment and children's education support (B3) and rental convenience (B8) still received a small proportion of neutral or negative feedback. This highlights the need for future policy improvements focused on family support systems and greater efficiency in the rental housing market.

The average score for this variable was 3.85 on a five-point Likert scale, with a standard deviation of 0.76, indicating that respondents' perceptions of living conditions in Lhasa are generally positive, with moderate variability across individuals—suitable for inclusion in structural modeling.

In summary, the level of living security in Lhasa has established a foundational basis for talent retention. It plays a positive role in attracting and stabilizing IT professionals, particularly through improvements in urban infrastructure, coordination between work and residence, and personal development expectations. This makes it a key environmental variable for enhancing

the talent agglomeration capacity of information technology enterprises.

To assess the development potential of the information technology (IT) industry—an essential pillar in the optimization of Lhasa's economic structure and its digital transformation—this study constructs four measurement items based on the following dimensions: industrial scale, infrastructure, ecosystem coordination, and innovation investment. The specific items are as follows:

C1: I believe that the market scale of the information technology industry in Lhasa is continuously expanding with a clear upward trend;

C2: I believe that Lhasa's infrastructure construction in areas such as communication, network connectivity, and data centers is relatively well developed;

C3: I believe that Lhasa performs well in terms of coordination across the upstream and downstream sectors of the IT industry chain, inter-enterprise cooperation, and cross-regional collaboration;

C4: I believe that Lhasa has made considerable efforts in enhancing scientific and technological innovation as well as R&D investment.

As shown in Figure 5.4, survey data indicate that most respondents expressed positive views across the four indicators, reflecting a generally optimistic perception of Lhasa's IT industry development potential.

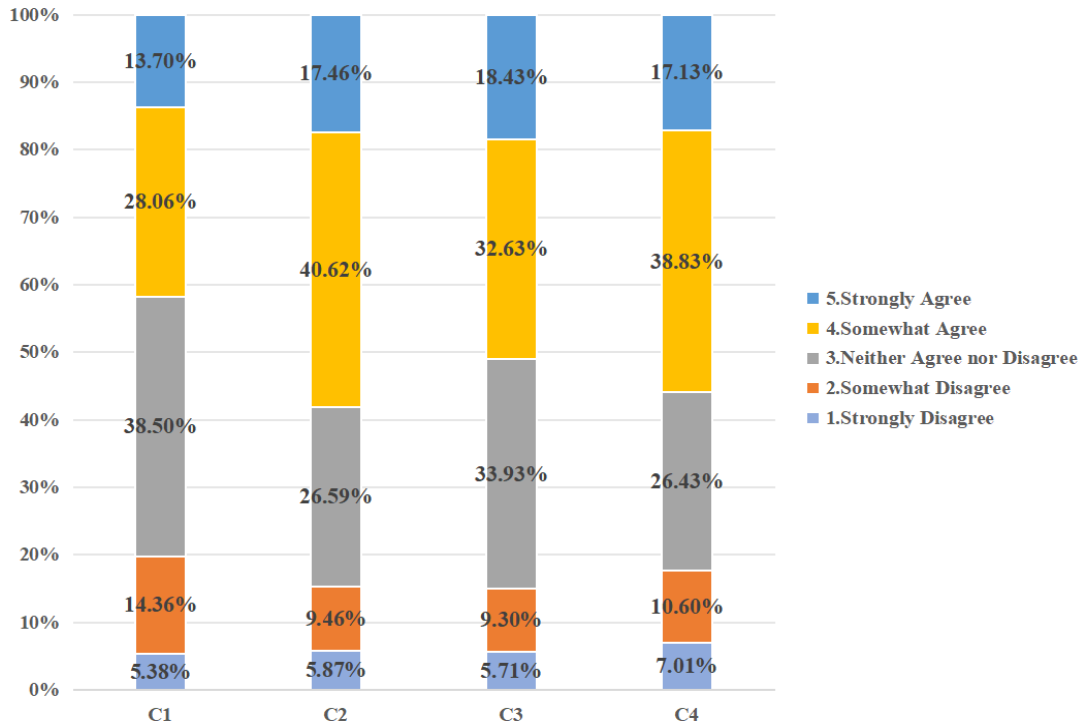


Figure 5.4 Survey data distribution chart of industrial development potential

In terms of distribution characteristics:

The perception of market scale growth (C1) is relatively high, with over 64% of respondents selecting "somewhat agree" or "strongly agree." However, 19.74% expressed disagreement, suggesting structural divergence in the perception of market momentum;

Regarding infrastructure development (C2), 15.33% of respondents held negative or reserved opinions, indicating that certain sub-regions may still face deficiencies in network or data transmission capabilities;

Recognition of ecosystem coordination and external cooperation (C3) was slightly lower than that of infrastructure, though a majority still responded positively. Only 14.01% expressed dissatisfaction, suggesting room for improvement in building synergistic mechanisms;

For technological innovation and R&D input (C4), although evaluations were largely favorable, 17.61% of respondents reported that the region's innovation performance did not meet expectations, reflecting that Lhasa's innovation capability is still in a developmental phase.

Overall, the mean score for the "IT industry development potential" variable is 3.71 on a five-point Likert scale, with a standard deviation of 0.81, indicating a generally favorable perception among respondents. Nonetheless, the presence of perceptual stratification suggests a trend of "overall optimism with structural differentiation," which offers empirical guidance for future industrial policy refinement.

In conclusion, the empirical performance of this variable provides foundational support for the testing of Hypothesis H4a: The development potential of the information technology industry positively affects talent agglomeration levels. Meanwhile, it also underscores the necessity for Lhasa to further strengthen its infrastructure and coordination mechanisms to unlock the IT industry's full potential in attracting high-level talent.

Human Resource Management Practices (HRMP) constitute a core mechanism influencing talent attraction and retention, with their effectiveness largely determining employees' job satisfaction and organizational commitment. To scientifically assess the level of HRMP in information technology enterprises in Lhasa, this study designed seven measurement dimensions:

D1: Whether the company provides comprehensive skills training and career development pathways for employees;

D2: Whether the promotion system is satisfactory to employees;

D3: Whether the compensation and benefits system is transparent and equitable;

D4: Whether the performance evaluation mechanism is scientific and effective;

D5: Whether the layout and aesthetic of the office environment are satisfactory;

D6: Whether the leadership structure, interpersonal relationships, and institutional

operations are perceived as satisfactory;

D7: Whether the corporate cultural atmosphere is considered positive.

As shown in Figure 5.5, the survey results indicate that most respondents hold a positive perception of their organizations' HRMP, particularly in relation to the physical office environment (D5), organizational interpersonal climate (D6), and corporate culture (D7). These findings suggest that IT enterprises in Lhasa generally place significant emphasis on the development of a supportive and humanized organizational environment.

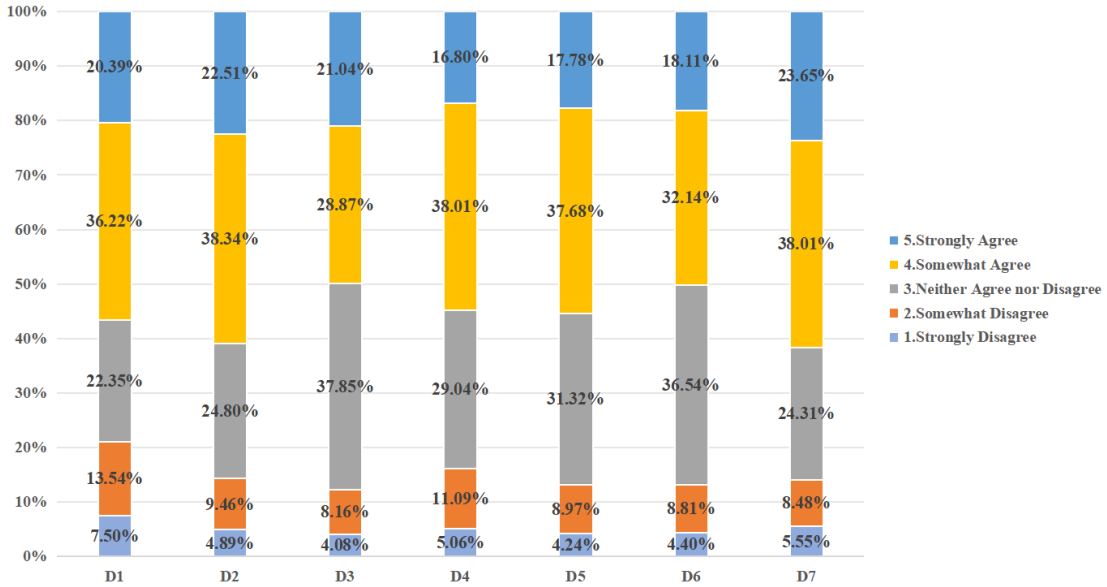


Figure 5.5 Distribution of survey data on Human Resource Management Practices (HRMP) in enterprises

However, the data also reveal several areas in need of improvement:

Over 20% of respondents expressed dissatisfaction with the support provided for employee training and career development (D1), suggesting that career advancement pathways remain limited and that training mechanisms are insufficiently established.

In terms of performance evaluation (D4), approximately 16% of participants noted a lack of transparency and scientific rigor, potentially undermining perceptions of fairness and meritocracy.

Regarding promotion systems and compensation transparency (D2, D3), a number of respondents expressed neutral or negative views, highlighting a need to refine the design and implementation of related policies.

The overall mean score for this variable was 3.73 (on a 5-point Likert scale), with a standard deviation of 0.78. This indicates that respondents' perceptions of HRMP in Lhasa's IT enterprises are generally above average, though inter-organizational disparities remain, suggesting uneven internal implementation and structural variation across firms.

5.3 Descriptive statistics and correlation analysis of key variables

This section aims to preliminarily verify the direction and significance of the relationships among core variables through descriptive statistics and Pearson correlation analysis. The goal is to provide theoretical support and empirical basis for subsequent mediation effect testing and structural model analysis.

5.3.1 Descriptive statistical analysis

A total of 11 core variables are included in this study, comprising five independent variables, five mediating variables, and one dependent variable. The detailed descriptive statistics are presented in Table 5.2.

Table 5.2 Descriptive statistics and correlation coefficient analysis (N = 613)

No.	Variable	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	C01	1.421	0.494	1																		
2	C02	1.697	0.568	.170	1																	
3	C03	3.031	1.390	.005	0.345	1																
4	C04	3.512	0.899	.132	.135	.020	1															
5	C05	2.529	1.034	.069	.301	.382	-.044	1														
6	C06	3.253	1.010	-.043	.299	.386	.282	.285	1													
7	C07	1.533	0.866	-.030	.275	.312	.207	.194	.476	1												
8	C08	2.414	1.198	.312	.135	.046	.211	.009	.121	0.044	1											
9	X1	3.350	1.246	-.034	-.018	.027	-.034	.114	-.027	-.017	-.067	1										
10	X2	3.428	1.003	.037	.053	.007	-.021	-.024	-.011	-.068	-.031	.245	1									
11	X3	3.323	0.897	-.005	.023	-.053	.057	-.079	-.021	-.056	.035	-.294	.513	1								
12	X4	3.455	0.965	.050	.085*	-.041	.059	-.106	.062	.048	.070	-.289	.467	.504	1							
13	X5	3.487	0.854	-.141	-.010	-.010	-.032	-.064	.016	-.063	-.010	-.304	.410	.429	.411	1						
14	M1	3.463	1.137	-.033	-.032	-.012	-.040	.049	-.025	-.039	-.045	.493	-.228	-.299	-.277	-.314	1					
15	M2	3.656	0.977	-.004	.055	.031	.122	-.069	.089*	.051	.081*	-.303	.347	.406	.423	.300	-.320	1				
16	M3	3.510	1.024	.020	.046	.009	.075	-.052	.070	.030	.078	-.315	.373	.449	.464	.336	-.326	.462	1			
17	M4	1.929	0.944	-.044	-.016	.107	-.084*	.062	.030	.025	-.115	.269	-.254	-.341	-.324	-.260	.260	-.328	-.352	1		
18	M5	3.581	0.992	.016	.061	-.016	.106	-.122	.132	.105	.136	-.441	.386	.393	.452	.406	-.429	.474	.476	-.320	1	
19	Y	3.492	0.954	-.053	.026	.023*	.072*	-.142	.072*	.055	.076	-.311	.381	.430	.483	.464	-.430	.507	.486	-.369	.448	1

Note: 1. **: $p < 0.01$; *: $p < 0.05$ (two-tailed). 2. Variable codes: C01 – Gender, C02 – Marital Status, C03 – Age, C04 – Educational Attainment, C05 – Years of Service, C06 – Income Level, C07 – Position Level, C08 – Job Type, X1 – High-Altitude Climatic Conditions, X2 – Regional Talent Policy Support, X3 – Livelihood Support, X4 – Industrial Development Potential, X5 – Human Resource Management Practices, M1 – Perceived Plateau Health Risks, M2 – Place Identity, M3 – Place Dependence, M4 – Perceived Environmental Uncertainty, M5 – Job Satisfaction, Y – Talent Agglomeration Level.

High-Altitude Climatic Conditions (X1): The mean value is 3.350 with a standard deviation of 1.246, indicating that respondents generally perceive notable adaptive challenges in Lhasa's climate, particularly regarding oxygen concentration, ultraviolet radiation, temperature variation, and aridity. However, individual perceptions vary significantly.

Regional Talent Policy Support (X2): The mean value is 3.428 and the standard deviation is 1.003. This suggests that while the policy environment is generally viewed positively, there are differing opinions regarding its effectiveness and enforcement.

Livelihood Support (X3): The mean is 3.323 with a standard deviation of 0.897, indicating a slightly favorable perception of local living conditions, with relatively concentrated respondent opinions.

Development Potential of the IT Industry (X4): The mean is 3.455 and the standard deviation is 0.965, reflecting a generally optimistic view of the IT sector's growth prospects, although evaluative divergence still exists.

Human Resource Management Practices (X5): The mean value is 3.485, with a standard deviation of 0.855, suggesting an overall positive perception of HRM quality in local enterprises, despite room for improvement in areas such as performance appraisal and training systems.

Regarding the mediating variables:

Perceived Plateau Health Risks (M1): The mean value is 3.463 with a standard deviation of 1.137, indicating a widespread awareness of potential health issues linked to the plateau environment, with significant variability among individuals.

Place Identity (M2): The mean is 3.656 and the standard deviation is 0.977, reflecting a relatively strong sense of identity with the locality, though with notable differences in degree.

Place Dependence (M3): The mean value is 3.510 with a standard deviation of 1.024, suggesting that most respondents experience a certain degree of dependence on Lhasa for residence and career development.

Perceived Environmental Uncertainty (M4): The mean is 1.929 and the standard deviation is 0.944, indicating a generally stable perception of the external environment.

Job Satisfaction (M5): The mean value is 3.581, with a standard deviation of 0.992, showing that overall employee satisfaction is relatively high, albeit with observable differences across individuals.

Concerning the dependent variable:

Talent Agglomeration Level (Y): The mean is 3.492 and the standard deviation is 0.954, which indicates that most respondents believe their enterprises have a certain capacity to attract

and retain talent, though perceptions vary.

5.3.2 Correlation analysis

Pearson correlation coefficients were used to examine the linear relationships among variables, with the correlation matrix displayed in Table 5.2. The key findings are as follows:

High-Altitude Climatic Conditions (X1) show a significant positive correlation with Perceived Plateau Health Risks (M1) ($r = 0.493$, $p < 0.01$) and a significant negative correlation with Talent Agglomeration (Y) ($r = -0.430$, $p < 0.01$), confirming the hypothesized negative impact of health challenges on talent retention.

Regional Talent Policy Support (X2) is significantly and positively correlated with Place Identity (M2) ($r = 0.347$, $p < 0.01$) and Talent Agglomeration (Y) ($r = 0.381$, $p < 0.01$), suggesting that talent policies can effectively enhance regional identification and clustering trends.

Livelihood Support (X3) shows strong positive correlations with Place Dependence (M3) ($r = 0.449$, $p < 0.01$) and Talent Agglomeration (Y) ($r = 0.430$, $p < 0.01$), demonstrating the significant role of quality of life in talent retention.

IT Industry Development Potential (X4) is negatively correlated with Perceived Environmental Uncertainty (M4) ($r = -0.324$, $p < 0.01$) and positively correlated with Talent Agglomeration (Y) ($r = 0.483$, $p < 0.01$), supporting the hypothesis that industrial growth reduces uncertainty and attracts talent.

Human Resource Management Practices (X5) are significantly and positively correlated with both Job Satisfaction (M5) ($r = 0.406$, $p < 0.01$) and Talent Agglomeration (Y) ($r = 0.464$, $p < 0.01$), indicating a direct impact of HR practices on employee satisfaction and organizational attractiveness.

Additionally, the relationships between the five mediating variables and Talent Agglomeration (Y) are as follows:

Perceived Plateau Health Risks (M1): significantly negatively correlated with Y ($r = -0.430$, $p < 0.01$);

Place Identity (M2): significantly positively correlated with Y ($r = 0.507$, $p < 0.01$);

Place Dependence (M3): significantly positively correlated with Y ($r = 0.486$, $p < 0.01$);

Perceived Environmental Uncertainty (M4): significantly negatively correlated with Y ($r = -0.369$, $p < 0.01$);

Job Satisfaction (M5): significantly positively correlated with Y ($r = 0.448$, $p < 0.01$).

Summary:

Overall, the correlation analysis results are consistent with the theoretical hypotheses proposed in this study. They validate the conceptual model of "antecedent variables–mediating variables–talent agglomeration" and provide a robust statistical and theoretical foundation for subsequent mediation effect tests and structural equation modeling (SEM).

5.4 Reliability and validity analysis

5.4.1 Reliability analysis

Reliability analysis is one of the most commonly used methods for evaluating the consistency and stability of measurement instruments. It directly reflects whether there is systematic bias in the data and whether the instrument possesses sufficient research reliability. A higher reliability indicates smaller systematic errors.

In this study, the reliability of the measurement scales was assessed using Cronbach's alpha coefficient and the Corrected Item-Total Correlation (CITC). This section reports the internal consistency of scales based on the survey responses. Specifically: Table 5.3 presents the reliability test results for the independent variables: High-Altitude Climatic Conditions, Regional Talent Policy Support, Livelihood Support, Industrial Development Potential, and Human Resource Management Practices; Table 5.4 reports reliability results for the mediating variables: Plateau Health Risks, Place Identity, Place Dependence, Perceived Environmental Uncertainty, and Job Satisfaction; Table 5.5 presents reliability test results for the dependent variable: Talent Agglomeration Level; Table 5.6 summarizes the Cronbach's alpha coefficients for all key variables.

Table 5.3 Reliability test results of scales for independent variables

Variable	Item	CITC	Cronbach's Alpha if Item Deleted	Cronbach 's Alpha
High-Altitude Climatic Conditions	Q1	0.897	0.941	0.956
	Q2	0.895	0.942	
	Q3	0.903	0.940	
	Q4	0.876	0.947	
Regional Talent Policy Support	A1	0.818	0.965	0.967
	A2	0.835	0.964	
	A3	0.831	0.964	
	A4	0.847	0.963	
	A5	0.851	0.963	
	A6	0.842	0.964	
	A7	0.854	0.963	
	A8	0.868	0.963	
	A9	0.863	0.963	
	A10	0.871	0.963	

Livelihood Support	B1	0.803	0.937	0.944
	B2	0.766	0.939	
	B3	0.786	0.938	
	B4	0.814	0.936	
	B5	0.820	0.936	
	B6	0.823	0.936	
	B7	0.800	0.937	
	B8	0.781	0.938	
	B9	0.653	0.943	
Industrial Development Potential	C1	0.788	0.906	0.921
	C2	0.824	0.895	
	C3	0.824	0.895	
	C4	0.832	0.892	
Human Resource Management Practices	D1	0.775	0.918	0.929
	D2	0.802	0.915	
	D3	0.716	0.923	
	D4	0.774	0.918	
	D5	0.796	0.916	
	D6	0.779	0.917	
	D7	0.775	0.918	

Table 5.4 Reliability test results of scales for mediating variables

Variable	Item	CITC	Cronbach's Alpha if Item Deleted	Cronbach 's Alpha
Plateau Health Risk	R1	0.910	0.947	0.961
	R2	0.915	0.945	
	R3	0.899	0.950	
	R4	0.891	0.952	
Place Identity	M11	0.870	0.927	0.944
	M12	0.854	0.930	
	M13	0.832	0.935	
	M14	0.855	0.930	
	M15	0.832	0.934	
Place Dependence	M21	0.830	0.863	0.910
	M22	0.839	0.855	
	M23	0.792	0.894	
Perceived Environmental Uncertainty	M311	0.653	0.914	0.918
	M312	0.724	0.907	
	M313	0.798	0.900	
	M321	0.732	0.907	
	M322	0.813	0.898	
	M323	0.765	0.903	
	M324	0.741	0.906	
Job Satisfaction	M41	0.879	0.902	0.937
	M42	0.880	0.900	
	M43	0.851	0.924	

Table 5.5 Reliability test results of the dependent variable (talent agglomeration)

Variable	Item	CITC	Cronbach's Alpha if Item Deleted	Cronbach's Alpha
Talent Agglomeration	Y1	0.653	0.914	0.946
	Y2	0.724	0.907	

Y3	0.798	0.900
Y4	0.732	0.907
Y5	0.813	0.898
Y6	0.765	0.903

Table 5.6 Summary of questionnaire reliability test results (N = 613)

Variable Type	Variable Name	Variable Code	Number of Items	Cronbach's α
Independent	High-Altitude Climatic Conditions	X1	4	0.956
	Regional Talent Policy Support	X2	10	0.967
	Livelihood Support Level	X3	9	0.944
	Industrial Development Potential	X4	4	0.921
	Human Resource Management Practices	X5	7	0.936
Mediating	Plateau Health Risk	M1	4	0.961
	Place Identity	M2	5	0.944
	Place Dependence	M3	3	0.910
	Perceived Environmental Uncertainty	M4	7	0.918
	Job Satisfaction	M5	3	0.937
Dependent	Talent Agglomeration	Y	6	0.946

According to the reliability results in Table 5.4 for the independent variables, the Cronbach's α coefficients for the independent variables in this study—special climatic conditions at high altitudes, regional talent policies, talent support levels, industrial development potential, and human resource management practice scales—all exceed 0.9. Additionally, the Corrected Item-Total Correlation (CITC) values for each item significantly surpass the critical threshold of 0.3 (Nunnally & Bernstein, 1994). Furthermore, no increase in Cronbach's α is observed upon the deletion of any individual item. These findings collectively indicate that the measurement instruments selected for this study exhibit strong reliability, and none of the items require removal.

Similarly, as shown in Table 5.5, the mediating variables—Plateau Health Risks, Place Identity, Place Dependence, Perceived Environmental Uncertainty, and Job Satisfaction—have Cronbach's α values of 0.961, 0.944, 0.910, 0.918, and 0.937, respectively. All CITC values exceed 0.6, significantly higher than the 0.3 threshold (Nunnally & Bernstein, 1994). No item deletion would enhance α, confirming excellent reliability for all five scales.

Table 5.6 presents the reliability result for the dependent variable. The Talent Agglomeration Level scale has a Cronbach's α of 0.946, with all CITC values above 0.6. The scale demonstrates excellent internal consistency, and all items are retained.

In conclusion, the Cronbach's α values for all key variables in this study are above 0.7,

which confirms that each measurement scale possesses high reliability (Nunnally, 1978), and the collected data are statistically acceptable for subsequent analysis.

5.4.2 Validity analysis

Validity testing is a scientific verification process used to evaluate whether a measurement instrument or method can accurately reflect the true level of the target variable. Its core purpose is to ensure the credibility of research data and the validity of conclusions. Validity refers to the extent to which a measurement tool or method accurately measures the construct it is intended to measure. Validity testing systematically analyzes the degree of consistency between the measurement results and the actual phenomena or theoretical constructs. Specifically, it refers to the extent to which items can truly measure the constructs intended by the research, typically representing the relationship between the items and their underlying variables. There are various types of validity, among which researchers commonly use convergent validity and discriminant validity for data testing. This study follows prior research by conducting convergent and discriminant validity tests on each scale.

The steps for validity testing are as follows:

First, the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test of sphericity were conducted to determine whether the scale data are suitable for factor analysis. The results are shown in Table 5.7. As presented in Table 5.7, the KMO values of all variables exceed 0.700, and Bartlett's test of sphericity reached significance at the 0.01 level. These results indicate that the data are appropriate for common factor extraction (Kaiser, 1974).

Table 5.7 KMO and bartlett's test of sphericity results for variables

Variable Name	KMO Value	Bartlett's Approximate Chi-Square	Degrees of Freedom	Significance (p)
High-altitude Special Climate	0.877	2660.685	24	0.000
Regional Talent Policies	0.965	6525.188	24	0.000
Living Security Level	0.943	4330.239	36	0.000
Regional Industry Development Potential	0.858	1789.275	6	0.000
Human Resource Management Practices	0.937	2962.214	21	0.000
Plateau Health Risk	0.877	2839.553	6	0.000
Place Identity	0.909	2792.024	10	0.000
Place Dependence	0.752	1250.845	3	0.000
Perceived Uncertainty	0.907	2838.709	21	0.000
Job Satisfaction	0.766	1601.357	3	0.000

Talent Aggregation	0.9	3598.125	15	0.000

Secondly, this study employed AMOS 28.0 software to conduct Confirmatory Factor Analysis (CFA) in order to assess convergent validity. Convergent validity refers to the degree to which all measurement items are correlated with the latent construct they are intended to measure. The standard criteria for evaluating convergent validity include: (1) all standardized factor loadings should exceed 0.50; and (2) the Average Variance Extracted (AVE) should be greater than 0.50 (Fornell & Larcker, 1981; Hair et al., 2010). Based on these standards, this study evaluated the internal convergent validity of the measurement model by calculating the AVE and Composite Reliability (CR) for each construct. The results are presented in Table 5.8.

Table 5.8 Confirmatory factor analysis of measurement model

Construct	Measurement Item	Standardized Factor Loading	CR	AVE
High-Altitude Special Climate Conditions	Q1	0.918	0.956	0.846
	Q2	0.920		
	Q3	0.937		
	Q4	0.903		
Regional Talent Policies	AX1	0.828	0.967	0.747
	AX2	0.844		
	AX3	0.845		
	AX4	0.863		
	AX5	0.865		
	AX6	0.861		
	AX7	0.873		
	AX8	0.886		
	AX9	0.883		
	AX10	0.890		
Living Security Level	BX9	0.594	0.942	0.644
	BX8	0.785		
	BX7	0.822		
	BX6	0.859		
	BX5	0.857		
	BX4	0.838		
	BX3	0.819		
	BX2	0.781		
	BX1	0.835		
Industrial Development Potential	CX1	0.843	0.921	0.745
	CX2	0.862		
	CX3	0.869		
	CX4	0.877		
Human Resource Management Practices	DX1	0.815	0.930	0.653
	DX2	0.832		
	DX3	0.750		
	DX4	0.807		
	DX5	0.827		
	DX6	0.813		
	DX7	0.811		
Plateau Health Risk	R1	0.933	0.961	0.859
	R2	0.943		
	R3	0.919		

	R4	0.914		
	M15	0.860		
	M14	0.894		
Place Identity	M13	0.863	0.945	0.774
	M12	0.883		
	M11	0.897		
	M21	0.886		
Place Dependence	M22	0.900	0.942	0.699
	M23	0.852		
	M324	0.784		
	M323	0.805		
	M322	0.852		
Perceived Uncertainty	M321	0.765	0.807	0.583
	M313	0.835		
	M312	0.761		
	M311	0.688		
	M43	0.889		
Job Satisfaction	M42	0.923	0.938	0.835
	M41	0.928		
	Y1	0.937		
	Y2	0.898		0.755
Talent Aggregation	Y3	0.897	0.948	
	Y4	0.877		
	Y5	0.764		
	Y6	0.785		

As shown in Table 5.8, all standardized factor loadings are above 0.7 and statistically significant at the 0.01 level. Moreover, the AVE values of all core variables—namely, high-altitude special climate conditions, regional talent policies, living security level, industrial development potential, human resource management practices, health risk, place identity, place dependence, perceived uncertainty, job satisfaction, and talent aggregation—are all greater than 0.50, while their CR values all exceed 0.80 (Hair et al., 2010). These results indicate good convergent validity, suggesting that the measurement scales adopted in this study are appropriate and reliable.

Finally, this study used AMOS 28.0 to conduct CFA on the sample data and adopted a competing model approach to evaluate the discriminant validity among different measurement constructs. Model fit was assessed using multiple indices to comprehensively evaluate the consistency between the model and the empirical data, including:

Chi-square/degrees of freedom ratio (χ^2/df) – a lower value indicates better fit; values less than 3 suggest a good model fit (Kline, 2016).

Comparative Fit Index (CFI) – compares the fit of the target model to a baseline model; values above 0.90 or ideally 0.95 indicate good fit (L. Hu & Bentler, 1999).

Tucker–Lewis Index (TLI) – similar to CFI, measures model improvement over a null model; values closer to 1 indicate better fit, with >0.90 considered acceptable (L. Hu & Bentler,

1999).

Incremental Fit Index (IFI) – adjusts for sample size and complements CFI; values ≥0.90 suggest acceptable model fit (Bollen, 1989).

Root Mean Square Error of Approximation (RMSEA) – measures discrepancy per degree of freedom; values <0.08 indicate acceptable fit, with values between 0.05 and 0.08 representing reasonable fit (Browne & Cudeck, 1993).

Based on these criteria, CFA was performed and the competing models were evaluated for discriminant validity. The results are summarized in Table 5.9. Among the nine competing models, the nine-factor model achieved the best fit, with $\chi^2/df = 2.321$, IFI = 0.939, TLI = 0.935, CFI = 0.939, and RMSEA = 0.050. These values meet or exceed the recommended thresholds (L. Hu & Bentler, 1999), indicating high model fit. Thus, the discriminant validity among the eleven latent constructs is confirmed, supporting their suitability for subsequent analysis.

Table 5.9 Comparative results of CFA for competing models

Model	Chi-square (χ^2)	Degrees of Freedom (df)	χ^2/df	CFI	IFI	TLI	RMSEA
One-Factor Model	26096.025	1829	14.268	0.370	0.371	0.349	0.147
Two-Factor Model	24281.166	1828	13.283	0.417	0.418	0.397	0.142
Three-Factor Model	23034.160	1826	12.615	0.450	0.451	0.430	0.138
Four-Factor Model	20847.530	1823	11.439	0.506	0.507	0.488	0.131
Five-Factor Model	19974.655	1819	10.981	0.529	0.530	0.510	0.128
Six-Factor Model	17074.874	1814	9.413	0.604	0.605	0.587	0.117
Seven-Factor Model	14258.606	1808	7.886	0.677	0.678	0.662	0.106
Eight-Factor Model	12011.413	1801	6.669	0.735	0.736	0.722	0.096
Nine-Factor Model	10662.701	1793	5.947	0.770	0.0.770	0.757	0.090
Ten-Factor Model	7631.346	1784	4.274	0.848	0.849	0.839	0.073
Eleven-Factor Model	4118.012	1774	2.321	0.939	0.939	0.935	0.050

The composition of the competing models is described as follows:

One-Factor Model: All eleven latent variables are combined into a single factor.

Two-Factor Model: The following nine constructs—high-altitude special climate conditions, regional talent policies, living security level, industrial development potential, human resource management practices, place identity, place dependence, perceived environmental uncertainty, and job satisfaction—are combined into one factor, while talent aggregation and health risk remain separate.

Three-Factor Model: High-altitude special climate conditions, regional talent policies, living security level, industrial development potential, human resource management practices, health risk, place identity, place dependence, and perceived environmental uncertainty are merged into one factor.

Four-Factor Model: High-altitude special climate conditions, regional talent policies, living security level, industrial development potential, human resource management practices, health risk, place identity, and place dependence are merged into one factor.

Five-Factor Model: High-altitude special climate conditions, regional talent policies, living security level, industrial development potential, human resource management practices, health risk, and place identity are merged into one factor.

Six-Factor Model: High-altitude special climate conditions, regional talent policies, living security level, industrial development potential, human resource management practices, and health risk are merged into one factor.

Seven-Factor Model: High-altitude special climate conditions, regional talent policies, living security level, industrial development potential, and human resource management practices are merged into one factor.

Eight-Factor Model: High-altitude special climate conditions, regional talent policies, living security level, and industrial development potential are merged into one factor.

Nine-Factor Model: High-altitude special climate conditions, regional talent policies, and living security level are merged into one factor.

Ten-Factor Model: High-altitude special climate conditions and regional talent policies are merged into one factor.

Eleven-Factor Model: Each of the eleven latent variables is treated as an independent factor.

5.5 Common method bias test

Given that the data for all core variables in this study were self-reported by respondents within the same time frame, and some variables originated from the same source, there is a potential risk of Common Method Bias (CMB). To ensure the rigor of the findings, this study addressed

this issue through both procedural controls and statistical testing:

In terms of procedural controls, following the recommendations of Podsakoff et al. (2003), several preventive measures were implemented during the survey design stage. First, the anonymity and academic nature of the study were explicitly emphasized in the questionnaire cover letter to alleviate respondents' social desirability pressure. Second, a combination of online and offline collection channels was utilized to enhance the heterogeneity of the sample. Furthermore, the phrasing of survey items was carefully adjusted to minimize response consistency tendencies among participants.

In terms of statistical testing, following the logic established by Podsakoff and Organ (1986), Harman's single-factor test was conducted. All measured items related to the eleven core constructs—namely, high-altitude special climate conditions, regional talent policies, living security level, industrial development potential, human resource management practices, health risk, place identity, place dependence, perceived uncertainty, job satisfaction, and talent aggregation—were subjected to an exploratory factor analysis (EFA).

The results of the Principal Component Analysis (PCA) without rotation revealed that 9 factors with eigenvalues greater than 1 were extracted. Specifically, the first principal factor accounted for 35.669% of the total variance, which is not only lower than the average level observed by Podsakoff et al. (2003) in similar studies but also significantly below the 40% threshold (Zhou & Long, 2004). Consequently, it can be concluded that no serious common method bias exists in this study, ensuring the robustness and validity of the research findings.

Table 5.10 Results of common method bias test (N = 613)

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	22.115	35.669	35.669	22.115	35.669	35.669
2	6.460	10.420	46.089	6.460	10.420	46.089
3	4.453	7.183	53.272	4.453	7.183	53.272
4	3.600	5.806	59.077	3.600	5.806	59.077
5	3.356	5.413	64.490	3.356	5.413	64.490
6	3.052	4.922	69.412	3.052	4.922	69.412
7	1.979	3.192	72.604	1.979	3.192	72.604
8	1.473	2.376	74.980	1.473	2.376	74.980
9	1.182	1.907	76.887	1.182	1.907	76.887

Note: With the extraction method being principal component analysis.

5.6 Hypothesis testing

5.6.1 Main effect testing

This study first tested the five main effects using SPSS 27.0. Five regression models were

constructed with the following independent variables: high-altitude special climate conditions (X1), regional talent policies (X2), living security level (X3), industrial development potential (X4), and human resource management practices (X5). The dependent variable in all models was talent aggregation (Y) in the information technology sector. Specifically, regression models were built corresponding to Model 8(M8) in Table 5.11. In the main effect testing process, each independent variable was first introduced into the regression model to examine its effect on talent aggregation. Subsequently, a set of control variables—gender, marital status, age, education level, tenure, income, job position, and job nature—were stepwise added to assess the stability and robustness of each independent variable's impact.

Table 5.11 Main effect regression results

Variable	Talent Aggregation (Y)									
	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10
X1	-0.468***	-0.458***								
X2			0.362***	0.366***						
X3					0.457***	0.447***				
X4							0.478***	0.466***		
X5									0.518***	0.510***
Gender		-0.169*		-0.172		-0.115		-0.171*		-0.006
Marital Status		0.035		0.028		0.022		-0.016		0.039
Age		0.039		0.013		0.042		0.054*		0.031
Education		0.037		0.038		0.006		0.032		0.044
Tenure		-0.097**		-0.157***		-0.147***		-0.111***		-0.145***
Income		0.040		0.055		0.064		0.031		0.040
Job Position		-0.009		0.036		0.031		-0.005		0.036
Job Nature		0.038		0.078*		0.053*		0.048		0.049*
R^2	0.373	0.396	0.145	0.194	0.185	0.221	0.234	0.260	0.215	0.250
Adjusted R^2	0.372	0.387	0.144	0.182	0.183	0.209	0.232	0.249	0.214	0.238

F	364.0***	43.9**	103.6***	16.1**	138.5***	18.9**	186.3***	23.6**	167.5***	22.3**

Note: * indicates $p < 0.05$; ** indicates $p < 0.01$; *** indicates $p < 0.001$. The same applies below. M1–M10 represent Model 1 through Model 10.

(1) Regression results of the impact of special climatic conditions

As shown in Table 5.11, M1, the regression coefficient of X1 (high-altitude special climate conditions) on Y (talent aggregation) is -0.468 ($p < 0.001$), indicating a significant negative effect of high-altitude climate on talent aggregation, thus providing preliminary support for Hypothesis H1a. After sequentially including all control variables, this negative effect remained significant. In the M2, the regression coefficient of X1 was -0.458 ($p < 0.001$), confirming that high-altitude special climate conditions have a significantly negative impact on the talent aggregation level in Lhasa's information technology enterprises.

This suggests that, after controlling for other variables, the harsh climate of the Lhasa region indeed reduces its ability to attract and retain talent in the IT sector. The rationale is that high-altitude environments may adversely affect physical health and impose constraints on both work and daily life for professionals, thereby weakening the region's attractiveness and increasing talent turnover. Even when talent is initially attracted, they may choose to leave due to challenges adapting to the high-altitude conditions.

(2) Regression results of regional talent policies

As shown in Table 5.11, M3, the regression coefficient of X2 (regional talent policies) on Y (talent aggregation) is 0.362 ($p < 0.001$), suggesting that regional talent policies in Lhasa have a significantly positive effect on talent aggregation. This positive effect remained stable and significant after including all control variables. In the M4, the coefficient increased slightly to 0.366 ($p < 0.001$), thereby confirming Hypothesis H2a.

This result demonstrates that even after controlling for demographic and job-related characteristics, Lhasa's talent policies play a critical role in enhancing talent aggregation in the local IT sector. The reasons are threefold:

Financial incentives and job benefits—such as talent subsidies, improved salary structures, and promotional opportunities—help improve the long-term career prospects for professionals, thereby increasing regional attractiveness.

Comprehensive talent development programs—including support for job design, interpersonal integration, and achievement recognition—enhance both internal and external talent appeal.

Advanced talent services—such as digital service platforms and data-driven talent management—improve the efficiency of talent matching, optimize talent circulation, and

promote deeper integration between talent and industry, ultimately leading to a stronger talent aggregation effect.

(3) Regression results of the level of talent security

According to M5 in Table 5.11, the regression coefficient of living security level (X3) on talent aggregation (Y) is 0.457 ($p < 0.001$), indicating that the living security level in Lhasa has a significantly positive effect on talent aggregation, which provides preliminary support for this relationship. After sequentially adding all control variables into the regression model, the influence of living security level on talent aggregation remains significantly positive. According to M6 in Table 5.11, the regression coefficient of X3 on Y is 0.447 ($p < 0.001$), again confirming the significant positive impact of living security level on talent aggregation. Therefore, Hypothesis H3a is supported.

This result suggests that, after controlling for other potential influencing factors, the living security level in Lhasa can effectively enhance the level of talent aggregation within the region's information technology enterprises. The underlying reasons are as follows: first, the living security level directly relates to the fulfillment of individuals' basic living needs, including transportation, housing, medical care, and education. A comfortable and convenient living environment provided by Lhasa significantly increases its attractiveness to high-level talent. When basic needs are met, individuals are more likely to remain in the region, thereby promoting talent agglomeration in local IT enterprises.

Furthermore, the availability and quality of public services—such as transportation infrastructure, healthcare systems, and educational resources—can reduce living costs associated with these areas. This contributes to an enhanced sense of satisfaction and well-being among professionals, making them more willing to live and work in Lhasa. Consequently, this improves the capacity of Lhasa's information technology sector to attract and retain skilled talent and facilitates the advancement of regional talent aggregation.

(4) Regression results of industrial development potential

As shown in M7 of Table 5.11, without considering control variables, the regression coefficient of industrial development potential (X4) on talent aggregation (Y) is 0.478 ($p < 0.001$), indicating that the development potential of the information technology industry in Lhasa has a significantly positive impact on talent aggregation, which provides preliminary empirical support. After gradually adding various control variables into the regression model, the effect of industrial development potential on talent aggregation remains significantly positive. In the M8, the regression coefficient of X4 on Y is 0.466 ($p < 0.001$), again confirming a significant positive influence, thus verifying Hypothesis H4a.

This result indicates that the development potential of Lhasa's information technology industry is relatively strong, which can offer extensive employment opportunities and career development prospects for IT professionals, thereby enhancing the level of talent aggregation. The underlying reasons are as follows: the innovation environment of the IT industry in Lhasa has been continuously improving, providing favorable conditions and atmosphere for innovation among information technology talents. Moreover, Lhasa has been actively promoting the digital transformation and upgrading of traditional industries such as equipment manufacturing, by integrating advanced information technologies. This signifies that the region possesses strong potential for IT industry development and a conducive innovation ecosystem. Consequently, it stimulates the innovative capacity and creativity of IT professionals, making them more inclined to pursue their careers in Lhasa. This, in turn, contributes to a higher level of talent aggregation in the city's information technology enterprises.

(5) Regression results of human resource management practices

As shown in M9 of Table 5.11, without accounting for control variables, the regression coefficient of human resource management practices (X5) on talent aggregation (Y) is 0.518 ($p < 0.001$), indicating a significantly positive effect of HRM practices in Lhasa's enterprises on the level of talent aggregation, thus providing initial empirical support. After sequentially including various control variables in the regression model, the positive influence of HRM practices on talent aggregation remains significant. According to the M10 of Table 5.11, the regression coefficient of X5 on Y is 0.510 ($p < 0.001$), confirming that the human resource management practices of information technology enterprises in Lhasa significantly promote talent aggregation, thereby validating Hypothesis H5a.

This result suggests that talent management practices in Lhasa's IT enterprises significantly enhance talent aggregation levels, in line with the theoretical expectations of this study. The reasons can be summarized as follows: First, HRM systems in Lhasa's IT sector are relatively well-established in terms of talent development and incentive mechanisms. These enterprises provide diverse training opportunities that help employees improve both their professional skills and overall competencies. In addition, companies often collaborate with employees to formulate career development plans, define promotion paths, and clarify growth objectives, thereby motivating them to continuously improve their capabilities and performance.

Moreover, IT enterprises in Lhasa implement competitive and equitable compensation structures based on job responsibilities, individual capabilities, and performance outcomes. Scientific and objective performance appraisal systems are also in place, offering regular evaluations and feedback, with corresponding rewards or penalties based on assessment results.

These mechanisms contribute significantly to attracting and retaining talent, thereby enhancing overall talent concentration in the region.

Finally, a positive corporate culture also plays an essential role. Through activities such as team building and enhanced internal communication, enterprises foster a supportive and harmonious working environment, which promotes employees' mental well-being and career development. This, in turn, strengthens team cohesion and collaboration, ultimately boosting the level of talent aggregation in Lhasa's information technology enterprises.

5.6.2 Mediation effect testing

In order to further examine the mechanisms through which high-altitude climatic conditions (X1), regional talent policies (X2), quality of living security (X3), industrial development potential (X4), and human resource management practices (X5) influence talent aggregation (Y) in information technology enterprises, this study constructed a series of mediation models incorporating five mediators: plateau health risks (MED1), place identity (MED2), place dependence (MED3), perceived environmental uncertainty (MED4), and job satisfaction (MED5). The SPSS PROCESS macro was employed to test the mediation effects, with the confidence level set at 95%. The bootstrapping method with 5000 resamples was applied to test the mediating roles of MED1–MED5 (Hayes, 2018). The results are presented in following Tables.

Models 1 and 2 in Table 5.12 examine the mediating effect of plateau health risks (MED1) without control variables, while Models 3 and 4 assess the mediating effect of plateau health risks in the relationship between high-altitude climatic conditions and talent aggregation after including control variables. According to the results of Model 3, the regression coefficient of high-altitude climatic conditions (X1) on plateau health risks (MED1) is 0.822 ($p < 0.001$), indicating that the high-altitude environment of Lhasa significantly increases the plateau health risks faced by individuals. Model 4 shows that the regression coefficient of X1 on talent aggregation (Y) is -0.150 ($p < 0.001$), and the regression coefficient of MED1 on Y is -0.374 ($p < 0.001$). These results suggest that plateau health risks partially mediate the negative relationship between high-altitude climatic conditions and talent aggregation, supporting Hypothesis H1b.

Table 5.12 Results of mediation test: plateau health risks

Variables	Model 1 M1	Model 2 Y	Model 3 M1	Model 4 Y
X1	0.815***	-0.183***	0.822***	-0.150***

MED1		-0.350***		-0.374***
Age			-0.021	0.031
Gender			-0.001	-0.170**
Marital Status			0.010	0.039
Education			-0.026	0.027
Years of Service			-0.058*	-0.119***
Income			0.038	0.054
Position Level			-0.026	-0.019
Job Type			0.018	0.045*
R^2	0.798	0.409	0.802	0.435
Adjusted R^2	0.797	0.407	0.799	0.427
F	2408.48***	210.61***	271.63***	46.35***

This finding implies that high-altitude climatic conditions in Lhasa reduce the level of talent aggregation partly by increasing the plateau health risks faced by talent. The underlying reasons are as follows: Lhasa, located on the Qinghai-Tibet Plateau at an altitude of approximately 3,650 meters, has thin air and low oxygen levels, which pose significant physiological challenges. The plateau health risks associated with such high-altitude environments—such as altitude sickness, respiratory diseases, and skin problems—directly affect individuals' physical well-being and quality of life, thereby reducing the region's attractiveness to talent. Furthermore, prolonged exposure to health threats may also trigger psychological issues such as anxiety and depression, which can negatively impact work performance and increase the likelihood of talent outflow, ultimately weakening the region's capacity to retain and attract information technology professionals.

Table 5.13 presents Models 1 and 2, which test the mediating role of place identity (MED2) in the absence of control variables. Models 3 and 4 further assess the mediating effect of place identity in the relationship between regional talent support policies (X2) and talent aggregation (Y) when control variables are included.

Table 5.13 Mediation test results: place identity

Variables	Model1 M2	Model2 Y	Model3 M2	Model4 Y
X2	0.338***	0.221***	0.342***	0.232***
MED2		0.416***		0.392***
Age			0.015	0.022
Gender			-0.094	-0.135*
Marital Status			0.031	0.005
Education			0.101*	-0.001
Years of Service			-0.083*	-0.124***
Income			0.056	0.033
Position Level			0.015	0.030
Job Nature			0.062*	0.053*
R^2	0.120	0.305	0.153	0.330
Adjusted R^2	0.119	0.303	0.140	0.319
F	83.49***	133.78***	12.12***	29.63***

According to the results of Model 3, the regression coefficient of regional talent support policies (X2) on place identity (MED2) is 0.342 ($p < 0.001$), indicating that talent policies in Lhasa significantly enhance individuals' sense of identification with the region. From Model 4, it can be seen that the regression coefficient of X2 on talent aggregation (Y) is 0.232 ($p < 0.001$), and that of place identity (MED2) on Y is 0.392 ($p < 0.001$). These findings demonstrate that place identity plays a partial mediating role in the positive relationship between regional talent policies and talent aggregation in Lhasa. In other words, regional talent support policies promote the aggregation of talent by enhancing individuals' place identity, thereby supporting Hypothesis H2b.

The possible reasons are as follows: On one hand, Lhasa clarifies specific criteria and benefits for introducing information technology professionals, such as standards and support measures for leading talents, key personnel, and cardholders. These clear guidelines allow talents to better understand their career prospects and welfare in Lhasa. Moreover, the city holds various policy outreach events—such as "Talent Week"—to raise awareness and foster engagement. Through these policies, Lhasa provides a strong foundation for regional economic development and innovation, thereby attracting a large number of high-quality IT professionals to work or start businesses in the region and improving their recognition and identification with Lhasa.

On the other hand, the enhanced place identity fostered by these talent policies strengthens the aggregation of IT talent in Lhasa. A strong sense of place identity increases individuals' feelings of belonging and integration, making them more willing to contribute to the development of the region. This sense of belonging reduces talent turnover and enhances talent retention, thereby contributing to a higher level of talent aggregation within Lhasa's IT enterprises.

Table 5.14 presents Models 1 and 2, which examine the mediating role of place dependence (MED3) without the inclusion of control variables. Models 3 and 4 incorporate control variables to assess the mediating effect of place dependence in the relationship between living security level (X3) and talent aggregation (Y).

Table 5.14 Mediation test results: place dependence

Variables	Model1 M3	Model2 Y	Model3 M3	Model4 Y
X3	0.513***	0.282***	0.509***	0.280***
MED3		0.341***		0.328***
Age			0.011	0.038
Gender			0.021	-0.122
Marital Status			0.022	0.015

Education			0.014	0.001
Years of Service			-0.049	-0.131***
Income			0.072	0.041
Position Level			0.007	0.029
Job Nature			0.039	0.040
R^2	0.202	0.292	0.214	0.318
Adjusted R^2	0.201	0.290	0.230	0.307
F	154.62***	125.79***	18.20***	28.12***

As shown in Model 3, the regression coefficient of living security level (X3) on place dependence (MED3) is 0.509 ($p < 0.001$), indicating that the living security conditions in Lhasa significantly enhance talents' sense of dependence on the region. According to the results of Model 4, the regression coefficient of X3 on talent aggregation (Y) is 0.280 ($p < 0.001$), while the coefficient of MED3 on Y is 0.328 ($p < 0.001$). These findings indicate that place dependence partially mediates the positive relationship between living security level and talent aggregation, thus providing support for Hypothesis H3b.

The underlying reasons may be summarized as follows: On one hand, comprehensive talent security policies can effectively strengthen individuals' dependence on a specific region. In Lhasa, initiatives such as providing talents with apartments and transitional housing help resolve accommodation issues for IT professionals, easing their financial burden. Additionally, Lhasa pays attention to the employment of spouses and the education of children, offering necessary support that reinforces talents' sense of belonging and dependence on the local area.

On the other hand, for many professionals, the choice of work location is not solely based on economic returns. More importantly, it involves finding a place conducive to both living and working. If individuals develop a strong sense of dependence on a particular location, they are more likely to remain in that region, thus increasing its level of talent aggregation. In Lhasa's case, talent-oriented support policies enhance place dependence among IT professionals, which in turn increases their level of embeddedness and decreases the likelihood of talent outflow, thereby promoting sustainable talent aggregation.

Table 5.15 presents the results of the mediation test for perceived environmental uncertainty (MED4). Models 1 and 2 examine the mediating effect of MED4 without control variables, while Models 3 and 4 test the mediation with control variables in the relationship between IT industry development potential (X4) and talent aggregation (Y).

Table 5.15 Mediation test results: perceived environmental uncertainty

Variables	Model1 M4	Model2 Y	Model3 M4	Model4 Y
X4	-0.317***	0.402***	-0.308***	0.390***
MED4		-0.240***		-0.247***
Age			0.064*	0.071*

Gender			0.027	-0.164*
Marital Status			-0.018	-0.019
Education			-0.065	0.017
Years of Service			-0.018	-0.116**
Income			0.055	0.047
Position Level			-0.019	-0.021
Job Nature			-0.073*	0.030
R^2	0.105	0.284	0.128	0.312
Adjusted R^2	0.104	0.282	0.115	0.301
F	71.62***	121.07***	9.84***	27.36***

As shown in Model 3, the regression coefficient of IT industry development potential (X4) on perceived environmental uncertainty (MED4) is -0.308 ($p < 0.001$), indicating that the development potential of Lhasa's IT industry significantly reduces individuals' perceived uncertainty about the environment. According to Model 4, the regression coefficient of X4 on talent aggregation (Y) is 0.390 ($p < 0.001$), and the coefficient of MED4 on Y is -0.247 ($p < 0.001$). These results demonstrate that perceived environmental uncertainty partially mediates the relationship between IT industry development potential and talent aggregation, thereby supporting Hypothesis H4b.

The reasons are as follows: On the one hand, the greater the development potential of the IT industry in Lhasa, the better the prospects for industrial agglomeration. This means the local IT sector is more capable of providing high-quality research platforms, employment opportunities, competitive salaries, and favorable working conditions, all of which help enhance both current and prospective talents' sense of job security. A well-developed IT industrial ecosystem also helps alleviate concerns related to technological change and market uncertainty, thus increasing talents' confidence in the region's development trajectory and reducing their perceived environmental uncertainty.

On the other hand, the reduction in perceived environmental uncertainty brought about by a strong IT development potential contributes to improving talent aggregation in IT enterprises. Talents' perception of environmental uncertainty influences their evaluation of and decisions about whether to work and settle in Lhasa. When such uncertainty is minimized—thanks to the promising development potential of the IT industry—talents are more likely to hold optimistic expectations and exhibit greater confidence in the region's future. As a result, they become more willing to live and work in Lhasa, thereby enhancing talent aggregation in the local IT sector.

Models 1 and 2 in Table 5.16 test the mediating effect of job satisfaction (MED5) without control variables, while Models 3 and 4 test the mediation effect of MED5 with control variables in the relationship between human resource management practices (X5) and talent

aggregation (Y).

Table 5.16 Mediation test results of job satisfaction

Variables	Model1 M5	Model2 Y	Model3 M5	Model4 Y
X5	0.471***	0.268***	0.473***	0.264***
MED5		0.529***		0.521***
Age			-0.033	0.048*
Gender			0.095	-0.058
Marital Status			0.078	0.002
Education			0.036	0.025
Years of Service			-0.136**	-0.074*
Income			0.124**	-0.018
Position Level			0.066	0.005
Job Nature			0.077*	0.006
R^2	0.165	0.284	0.224	0.477
Adjusted R^2	0.163	0.282	0.213	0.468
F	120.53***	121.07***	19.36***	54.88***

As shown in Model 3, the regression coefficient of human resource management practices (X5) on job satisfaction (MED5) is 0.473 ($p < 0.001$), indicating that sound HR management practices in IT enterprises significantly enhance employees' job satisfaction. Model 4 shows that the regression coefficient of X5 on talent aggregation (Y) is 0.264 ($p < 0.001$), and the coefficient of job satisfaction (MED5) on Y is 0.521 ($p < 0.001$). This demonstrates that job satisfaction partially mediates the positive effect of HR management practices on talent aggregation, thereby supporting Hypothesis H5b.

The main reasons are as follows: On one hand, well-developed HR management practices provide employees with clear career development paths, comprehensive training programs, a fair and competitive compensation system, an effective performance appraisal mechanism, and a positive corporate culture. These factors help employees improve skills and knowledge, meet their growth needs, foster a positive work atmosphere, and enhance their identification with the company's values and mission, thereby increasing job satisfaction. On the other hand, the improvement in job satisfaction resulting from these HR practices contributes to greater talent aggregation. High job satisfaction reflects employees' recognition and approval of the work environment, compensation, and career development opportunities. Positive perceptions often spread via word-of-mouth, attracting more potential talents to work and start businesses in Lhasa or its IT enterprises, further enhancing talent aggregation in the region.

Table 5.17 shows the Bootstrap test results for the mediation effects. It reveals that for the effect of high-altitude special climatic conditions (X1) on talent aggregation (Y), the 95% confidence interval (CI) for the mediating effect of health risk (MED1) does not include zero (CI = [-0.506, -0.410]), indicating a significant mediation effect (Hayes, 2018). Similarly, the

95% CIs for the mediating effects of place identity (MED2), place dependence (MED3), perceived environmental uncertainty (MED4), and job satisfaction (MED5) also exclude zero, confirming the presence of mediation in the respective models. This means: The effect of regional talent policy (X2) on talent aggregation is mediated by place identity (MED2); The effect of living security level (X3) on talent aggregation is mediated by place dependence (MED3); The effect of IT industry development potential (X4) on talent aggregation is mediated by perceived environmental uncertainty (MED4); The effect of HR management practices (X5) on talent aggregation is mediated by job satisfaction (MED5). In Table 5.17, BootSE refers to the bootstrap standard error, while BootLLCI and BootULCI represent the lower and upper levels of the 95% bias-corrected confidence interval, respectively. The indirect effect is considered statistically significant if the interval between BootLLCI and BootULCI does not include zero.

Table 5.17 Bootstrap mediation test results

High-altitude special climatic condition(X1)	→	Plateau Health risk (MED1)	→	Talent aggregation (Y)
	Effect	BootSE	BootLLCI	BootULCI
Total Effect	-0.458	0.025	-0.506	-0.410
Direct Effect	-0.150	0.053	-0.254	-0.046
Indirect Effect	-0.308	0.045	-0.402	-0.223
Regional talent policy (X2)	→	Place identity (MED2)	→	Talent aggregation (Y)
Total Effect	0.366	0.035	0.298	0.435
Direct Effect	0.232	0.034	0.164	0.299
Indirect Effect	0.134	0.022	0.094	0.178
Living security level (X3)	→	Place dependence (MED3)	→	Talent aggregation (Y)
Total Effect	0.447	0.038	0.371	0.522
Direct Effect	0.280	0.040	0.201	0.359
Indirect Effect	0.167	0.028	0.114	0.226
Industry development potential (X4)	→	Perceived uncertainty (MED4)	→	Talent aggregation (Y)
Total Effect	0.466	0.035	0.397	0.535
Direct Effect	0.390	0,036	0.319	0.460
Indirect Effect	0.076	0.017	0.045	0.113
HR management practices (X5)	→	Job satisfaction (MED5)	→	Talent aggregation (Y)
Total Effect	0.510	0.040	0.431	0.588
Direct Effect	0.263	0.037	0.191	0.336
Indirect Effect	0.246	0.034	0.184	0.316

5.7 Discussion on the mitigation pathways of adverse climatic impacts

As mentioned earlier, the Lhasa region is characterized by extreme climatic conditions. Through theoretical analysis and empirical testing, this study has confirmed that the high-altitude climatic conditions of Lhasa exert a significant negative impact on talent aggregation

in the local information technology (IT) sector. Conversely, four key factors—regional talent support policies, living security level, IT industry development potential, and enterprise human resource management practices—have been found to significantly enhance the talent aggregation level of IT enterprises in Lhasa.

This raises an important question: Can these four core factors help mitigate or offset the adverse impacts of climatic disadvantages on talent aggregation in Lhasa? If so, to what extent? Additionally, are there other potential factors that may serve to buffer the negative effects of harsh climatic conditions on talent attraction and retention?

To further explore these issues, a supplementary questionnaire survey was conducted. The specific measurement items are presented in Table 5.18.

Table 5.18 Survey on mitigation pathways for climatic disadvantages in Lhasa

Code	Survey Item	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
S1	I believe that further improvement of Lhasa's regional talent support policies can mitigate the negative impact of climatic conditions on talent aggregation.	1	2	3	4	5
S2	I believe that further improvement of Lhasa's living security level can mitigate the negative impact of climatic conditions on talent aggregation.	1	2	3	4	5
S3	I believe that further enhancement of Lhasa's IT industry development potential can mitigate the negative impact of climatic conditions on talent aggregation.	1	2	3	4	5
S4	I believe that further improvement of enterprises' HRM practices in Lhasa can mitigate the negative impact of climatic conditions on talent aggregation.	1	2	3	4	5
S5	I believe that further improvement of enterprises' HRM practices in Lhasa can mitigate the negative impact of climatic conditions on talent aggregation.	1	2	3	4	5
S6	Which of the following factors do you believe is the most effective buffer against the adverse effects of Lhasa's climatic conditions—i.e., improving which factor would most increase your willingness to continue living and working in Lhasa?	A. Talent support policies	B. Living security (e.g., transportation, healthcare, housing)	C. IT industry development level	D.HRM practices	E. Wage level
S7	To what extent would the factor selected above (S6) need to be	A. Less than 30%	B.30%-50%	C.50%-70%	D.70%-100%	E. More than

	improved for you to be more willing to stay in Lhasa?	100%

To more intuitively observe the pathways through which the adverse climatic conditions in Lhasa can be mitigated, this study conducted a descriptive statistical analysis based on 613 valid questionnaire responses. The results are presented in Figure 5.6 and Figure 5.7.

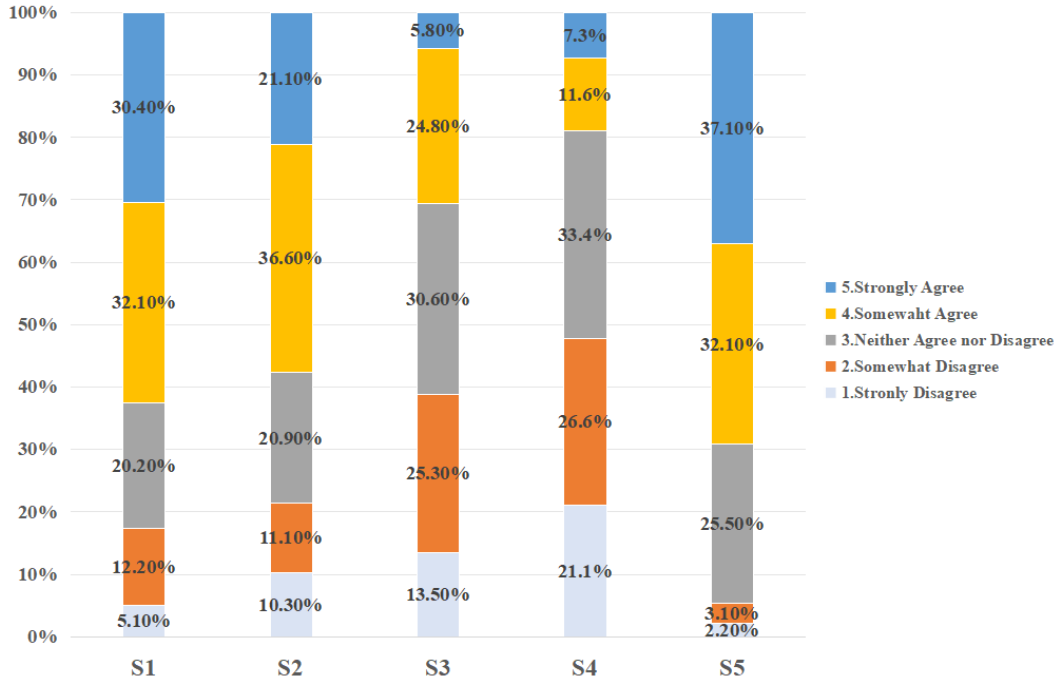


Figure 5.6 Distribution chart 1 of mitigation pathways for adverse climatic factors

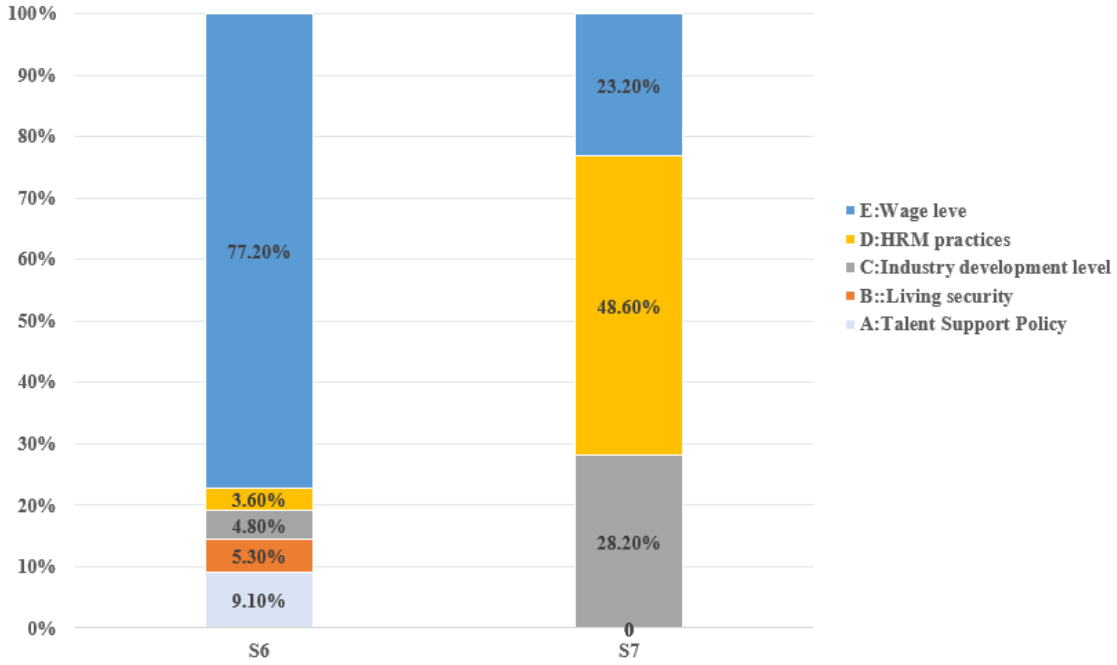


Figure 5.7 Distribution chart 2 of mitigation pathways for adverse climatic factors

As shown in Figure 5.6, over 80% of respondents believe that optimizing regional talent support policies can offset the negative impact of adverse climatic conditions on talent

aggregation. Approximately 78.6% of respondents agree that improving living security levels (such as transportation, medical services, and housing) can mitigate the climatic disadvantages. 61.2% believe that enhancing the development potential of the IT industry in Lhasa can counteract such negative effects. Meanwhile, 52.3% of respondents consider that improving HRM practices in local IT enterprises can serve as an effective mitigation strategy. Most notably, over 90% of respondents believe that increasing wage levels is a viable and crucial way to counteract the adverse impacts of Lhasa's climate on talent aggregation.

These findings indicate that among all surveyed factors, wage level is considered the most important buffer against climatic disadvantages, followed by regional talent support policies, living security level, IT industry development potential, and enterprise human resource management practices, in that order. Compared to the micro-level improvement of HRM practices, strategies such as raising wages, enhancing macro-level talent support policies, improving associated living security systems, and boosting the regional IT industry are more effective in mitigating the negative impact of climatic disadvantages on talent aggregation.

Figure 5.7 presents the response distribution for Survey Items S6 and S7. The results for S6 show that, compared with the other four factors—regional talent policies, living security, IT industry development, and HRM practices—more than 70% of respondents selected wage level as the most critical factor for mitigating the negative effects of Lhasa's climatic conditions. Regarding S7, over 20% of respondents believe that wage levels should be increased by 50% to 70%, over 40% believe that they should be increased by 70% to 100%, and nearly 40% suggest an increase of more than 100% would be necessary to retain talent in Lhasa under current climatic conditions.

In summary, this study concludes that the negative impact of Lhasa's unique climatic conditions on the talent aggregation of information technology enterprises can be effectively mitigated through the following approaches:

First, appropriately increasing the wage level for employees in Lhasa's IT enterprises. Salary is one of the most critical considerations for talents when choosing job locations and career opportunities, and it serves as a key factor in offsetting the adverse effects of the region's harsh climate. Competitive wages not only ensure basic living needs but also reflect personal value and drive professional development. Increasing salary levels in Lhasa's IT sector can significantly enhance talent attraction and retention. The Lhasa municipal government may establish a talent reward fund to recognize individuals who have made outstanding contributions, while enterprises should offer competitive remuneration packages, including plateau allowances, housing subsidies, and transportation subsidies, to attract and retain high-

level talents.

Second, improving regional talent support policies. The Lhasa government should introduce more attractive talent introduction policies and further refine mechanisms for talent recruitment and management. These include offering personal subsidies, research funding, position-related benefits, professional title evaluations, housing policies, and family settlement support to alleviate the economic burdens faced by talents living in high-altitude regions. Additionally, the government should establish clear definitions and classifications of talent, optimize the input-output efficiency of talent-related investments, and improve policy effectiveness, thereby ensuring institutional support for talent development in Lhasa.

Third, enhancing the working and living environment. The Lhasa government should focus on improving support facilities tailored to IT professionals. This includes constructing high-quality talent apartments equipped with comfortable furniture and home appliances; upgrading medical infrastructure with comprehensive health check-ups and healthcare services, especially for altitude sickness prevention and treatment; and addressing children's education by providing access to high-quality educational resources to ensure that the children of talents receive satisfactory schooling.

Fourth, strengthening the development of Lhasa's IT industry. The government should continue to formulate and improve policy measures supporting IT industry development—such as digital economy strategies and technological innovation plans—to ensure policy support for long-term growth. It is also necessary to align development efforts with Lhasa's resource endowments and industrial base, identifying key sectors such as big data, cloud computing, artificial intelligence, and the Internet of Things. Moreover, the region should strengthen regional cooperation and external openness, collaborating with surrounding areas to jointly promote IT industry growth. Demonstration applications and brand building should also be promoted—for instance, by launching pilot projects in areas like smart cities, smart healthcare, and smart education, generating replicable and scalable models, and cultivating a number of well-known IT enterprises and brands to enhance Lhasa's industrial reputation.

Fifth, improving enterprise-level human resource management practices to offset the negative influence of climatic conditions on talent aggregation. Enterprises should focus on refining incentive systems, particularly compensation mechanisms. For example, local firms can offer market-based salaries that reflect individual contributions, including base salaries, performance bonuses, and stock options. In addition, firms can implement promotion incentives and honor-based incentives, such as establishing clear career advancement pathways and offering technical awards, innovation prizes, and other forms of recognition for outstanding

contributions. These strategies can help mitigate the adverse impact of harsh climatic conditions on the aggregation and retention of IT talent in the region.

Chapter 6: Research Conclusions and Policy Recommendations

6.1 Conclusions

This study focuses on the issue of talent agglomeration in information technology (IT) enterprises in Lhasa. Based on a robust theoretical model and empirical analysis with a reasonable sample, five core factors and their mechanisms influencing talent agglomeration were identified and validated. The main findings are as follows.

First, high-altitude climatic conditions significantly suppress talent agglomeration, with plateau health risks serving as a mediating pathway.

The study finds that IT talents newly arriving in the plateau often face pronounced altitude sickness and physiological adaptation pressures, while long-term residence may lead to chronic diseases such as respiratory, cardiovascular, and ocular conditions—thus significantly increasing plateau health risks. In addition, the discomfort caused by the plateau environment can trigger psychological stress reactions such as anxiety and depression. These plateau health risks directly undermine the attraction and retention of talent and constitute a key mechanism leading to talent loss, thereby significantly lowering regional talent agglomeration levels.

Second, regional talent support policies significantly enhance talent agglomeration, with place identity acting as a mediator.

Through a series of targeted measures—such as talent subsidies, special support programs, networking platforms, and professional training—Lhasa has strengthened IT talents' perception of governmental support and local development prospects. These measures help foster a sense of psychological belonging and value identification, thereby enhancing place identity. The study demonstrates that strengthened place identity effectively reduces talent mobility tendencies, increases retention stability, and forms an endogenous mechanism for talent cohesion—thus improving overall talent agglomeration levels.

Third, improvements in living security significantly enhance talent agglomeration, with place dependence serving as a mediating factor.

The study finds that continued enhancements in Lhasa's housing support, spouse employment, children's education, medical resources, and transportation accessibility have significantly increased talents' evaluations of the city's livability and sustainability. Such

institutional support not only meets basic living needs but also cultivates structural dependence on local lifestyles—manifested as high levels of place dependence. Further analysis shows that stronger dependence leads to weaker responsiveness to external job opportunities, thus increasing talent retention and local absorptive capacity.

Fourth, the development potential of the IT industry significantly strengthens talent agglomeration capacity, with reduced organizational environmental uncertainty as a key mechanism.

In recent years, Lhasa's IT industry has demonstrated considerable growth potential in infrastructure, industrial synergy, policy support, and innovation ecosystems. The rising development outlook leads talents to form more positive expectations about enterprise viability and career opportunities, thereby reducing perceived environmental uncertainty within and outside organizations. This perception alleviation effectively reduces the intention to leave and strengthens the willingness of external talents to relocate, thus substantially improving regional talent agglomeration.

Fifth, enterprise human resource management (HRM) practices promote talent agglomeration by enhancing job satisfaction.

High-quality internal HRM practices—including structured recruitment and promotion systems, comprehensive training mechanisms, fair and transparent performance evaluations, and positive organizational culture—significantly increase employees' work identification and sense of professional belonging. The study finds that improved job satisfaction is a critical mediating mechanism for talent stability and expansion. It not only strengthens employees' intention to stay but also enhances organizational attractiveness through positive word-of-mouth, thereby effectively promoting talent agglomeration.

In summary, the talent agglomeration level of IT enterprises in Lhasa is shaped by a system of multidimensional factors. The mechanisms span external environmental conditions, policy frameworks, organizational practices, and individual psychological perceptions—constituting a complex structure-mechanism-behavior system. The empirical results of this study not only validate the applicability of the theoretical model but also provide scientific guidance for future policy optimization and organizational management.

6.2 Policy recommendations

Based on the research findings of this study, the following policy recommendations are proposed.

First, the high-altitude climatic conditions in Lhasa significantly reduce the level of talent agglomeration in the local IT enterprises. Therefore, it is necessary for the region to further consider how to mitigate the negative impact of such climatic conditions on talent attraction and retention. For external talents, understanding and adapting to the local climate is also essential. On the one hand, the Lhasa municipal government should actively take measures to reduce plateau health risks associated with extreme climate conditions—such as strengthening plateau medicine research and improving infrastructure—to enhance the living quality and working conditions for both residents and incoming talent. On the other hand, the government should strengthen public health education to raise awareness among talents about plateau health risks in high-altitude environments and equip them with appropriate coping strategies. Special attention should be given to vulnerable groups by offering targeted medical support and health guarantees.

Second, regional talent support policies in Lhasa can significantly improve the agglomeration level of IT talents. Hence, these policies should be further refined. Specifically, the local government should increase subsidies for attracting IT professionals, expand recruitment campaigns and policy promotion activities, and strengthen skill development training. For instance, Lhasa could explore establishing dedicated IT talent development funds, financed through public-private partnerships, to enhance compensation and benefits packages. It should also increase investment in training programs to attract and retain high-caliber professionals. Additionally, talent introduction criteria may be moderately relaxed—such as age, education, and work experience—under the premise of meeting basic standards, and targeted recruitment programs could be implemented for key positions and urgently needed talents. The city could also provide vocational training subsidies, skill certification subsidies, and skill enhancement subsidies tied to unemployment insurance. Furthermore, in the era of artificial intelligence, Lhasa can leverage digital technologies such as AI and big data to build and optimize platforms for IT talent development and collaboration—e.g., intelligent recruitment systems and personalized training programs—to further boost its talent appeal.

Third, improving the quality of life for IT talents in Lhasa can enhance their place dependence and thus promote talent agglomeration. To this end, efforts should be made to optimize housing policies, improve healthcare systems, strengthen education and training, refine policies for talent introduction and retention, and enhance overall living standards and cultural atmosphere. For example, the government and enterprises could jointly provide housing subsidies or construct talent apartments with supportive infrastructure like transport, education, and commercial services. Furthermore, increased investment in education, including

the construction of high-quality schools, can address the educational needs of talents' children.

Fourth, the development of the local IT industry can enhance the agglomeration of IT professionals. The Lhasa municipal government should further optimize the business environment and promote industrial innovation. It can formulate supportive policies—such as tax incentives, financial support, and talent introduction mechanisms—to create a favorable policy climate. A comprehensive industrial service system should also be established to assist with project application, technology consulting, and market development, thereby lowering the threshold for entrepreneurship and enterprise growth. Enterprises should be encouraged to increase R&D investment and promote innovation and commercialization of technological outcomes. Emerging industries such as cloud computing, big data, and artificial intelligence should be actively developed to enhance the competitiveness of the IT sector and expand its application scenarios and market space. The development of the IT industry in Lhasa can reduce perceived environmental uncertainty among talents and thus strengthen the region's talent agglomeration capacity.

Fifth, enterprise-level human resource management (HRM) practices can effectively enhance talent agglomeration. Therefore, IT enterprises in Lhasa should focus on improving their HRM systems by refining institutional frameworks, enhancing training and development, building performance-based compensation systems, strengthening HRM digital tools, and promoting corporate culture. Enterprises can develop tailored career paths and provide systematic training programs to improve employees' skills and qualifications, offering ample promotion opportunities to inspire motivation and creativity. Moreover, scientific and objective performance evaluation systems should be implemented to support HR decisions and ensure efficient and standardized operations. In terms of corporate culture, enterprises should enhance physical, institutional, and spiritual aspects. This includes improving the office environment and resources (material culture); developing clear, fair, and effective management systems such as compensation and performance review policies (institutional culture); and fostering a shared mission and vision while organizing cultural events to cultivate a cohesive and uplifting work atmosphere (spiritual culture). A well-developed HRM system can improve job satisfaction, which in turn contributes to stronger talent retention and attraction, ultimately improving talent agglomeration.

6.3 Discussion

This study centers on the issue of talent agglomeration in information technology enterprises in

Lhasa and constructs a multidimensional analytical framework of influencing factors. It systematically explores how high-altitude climatic conditions, regional talent policies, living security, industrial development potential, and enterprise-level HRM practices influence the level of talent agglomeration through mediating mechanisms. The findings indicate a significant interactive effect between external structural conditions (e.g., natural environment, industrial policy) and internal organizational mechanisms (e.g., HR practices, employee perception). These pathway mechanisms are not only logically sound from a theoretical perspective but also supported by empirical data.

First, from a theoretical contribution perspective, this study innovatively incorporates variables such as “plateau health risks” and “perceived environmental uncertainty” into the research framework of talent agglomeration. This broadens the theoretical boundaries of existing research on talent mobility and regional development and holds particular practical significance for the study of IT talent in underdeveloped plateau regions.

Second, from an empirical standpoint, the study employs structural equation modeling to test multiple mediation paths. It finds that psychological-behavioral variables such as place identity, place dependence, health risk perception, and job satisfaction play significant mediating roles in the process of talent agglomeration. These results provide empirical support for advancing the interactive “talent–organization–region” triadic model.

Third, from a managerial practice perspective, the findings offer clear directions for both local governments and enterprises in optimizing talent policies, enhancing service support, and fostering a favorable organizational ecosystem. For example, improving living security should not remain limited to financial subsidies but should also address comprehensive public services such as education, healthcare, and housing. Likewise, the development of a health adaptation support system in response to harsh plateau climatic conditions should not be neglected and should become an important component of future policy design.

In conclusion, this research not only deepens our understanding of the talent agglomeration issue in plateau regions but also provides theoretical insights and practical references for future context-specific and mechanism-oriented talent studies.

6.4 Limitations and future research

Although this study has achieved notable progress in both theoretical construction and empirical analysis, several limitations remain. These provide opportunities for further improvement and expansion in future research:

First, the study has limitations in its time dimension.

This research adopts a cross-sectional design, with data collected at a specific point in time. While this provides static evidence of structural relationships among variables, it falls short of capturing the dynamic evolution of these relationships. Variables such as "perceived environmental uncertainty" and "job satisfaction" are particularly susceptible to external factors like macroeconomic shifts or policy changes, which may lead to different mediating effects across time periods. Future research is encouraged to adopt longitudinal designs and collect panel data across multiple time points to validate the proposed mechanisms from a temporal perspective, thus enhancing the stability and generalizability of the findings.

Second, the range of antecedent variables remains limited.

This study focuses on five core dimensions, yet in real-world contexts, talent agglomeration may be influenced by a broader set of factors—such as organizational resource endowments (e.g., capital, technological platforms), the depth of industry–university collaboration, regional cultural atmosphere, and the strength of entrepreneurial ecosystems. Future studies may expand the theoretical model by incorporating a more comprehensive set of driving mechanisms, analyzed across multiple levels (individual–organizational–regional) and dimensions (institutional–cultural–capital), to construct a more holistic framework of influencing factors.

Third, caution is needed in generalizing the findings.

The data in this study are mainly drawn from IT enterprises in Lhasa, which are characterized by unique geographical, cultural, and policy environments. Therefore, the applicability of the findings to other regions—particularly more developed coastal areas—requires careful assessment. Future research could conduct comparative cross-regional studies to explore the commonalities and differences in mechanisms across regions at varying stages of development, thereby enhancing the external validity of the research.

In sum, this study represents a preliminary exploration into talent agglomeration in plateau regions. There is still ample room for refinement. Future studies may further advance in research depth, model breadth, and data scope to more comprehensively uncover the complex interplay between regional development and talent agglomeration.

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Annex

Survey Questionnaire

Dear Sir/Madam,

Greetings! Thank you for taking the time to participate in this special survey on "The Development of the Information Technology Talent Ecosystem in Lhasa." This questionnaire aims to systematically assess the current state of talent development amid the digital transformation of enterprises in Lhasa and provide empirical support for formulating regional IT talent recruitment and retention policies.

Research Value:

● To provide data support for the formulation of "Development Plan for Talent Agglomeration in Lhasa's IT Enterprises."

● To assist participating enterprises in optimizing HR strategies;

● To promote the construction of an IT industry ecosystem in the Tibet Autonomous Region.

Survey Instructions:

Structure: The questionnaire consists of three modules: business environment assessment, IT application level, and talent development needs. Estimated completion time is 8–10 minutes.

Response Guidelines: There are no right or wrong answers. Please respond truthfully based on your actual situation.

Quality Control: Three control questions (e.g., Q12 and Q28) are designed for consistency checks.

Privacy Protection Commitment:

✓ Fully anonymous (data encrypted via Wenjuanxing system)

✓ Data is used only by the research team after de-identification

✓ In compliance with the Personal Information Protection Law of China

Research Feedback:

Participating enterprises will receive:

● A customized Talent Development Diagnostic Report

● Benchmark Salary Data for IT professionals

● Priority invitations to future policy consultation forums

Your insights will make a significant contribution to enhancing the competitiveness of Lhasa's digital economy. Thank you again for your participation.

Part I: Basic Information

1. Gender: ☐ Male ☐ Female
2. Marital Status: ☐ Single ☐ Married ☐ Divorced ☐ Widowed
3. Age: _____ years old
4. Educational Background:

☐ Junior high school or below

☐ High school / Vocational school / Technical school

☐ Associate degree

☐ Bachelor's degree

☐ Master's degree

☐ Doctorate

5. Work Experience: You have been employed for _____ years, including _____ years at your current company.
6. Monthly Salary:

☐ Below 4,000 RMB

☐ 4,000 – 7,000 RMB

☐ 7,000 – 10,000 RMB

☐ 10,000 – 15,000 RMB

☐ Above 15,000 RMB

7. Current Position Level:

☐ Regular staff

☐ Front-line manager (e.g., team leader, supervisor)

☐ Mid-level manager (e.g., department/project/subsidiary manager)

☐ Senior executive (e.g., Chairman, CEO, General Manager, Deputy GM, Director)

8. Your Main Work Responsibilities:

☐ R&D / Technology

☐ Human Resources

☐ Product / Marketing

☐ Administration / General Affairs

Part II: Survey on High-Altitude Climate Conditions, Local Talent Policies, Living Support Systems, Industry Development Potential, and Corporate Systems & Culture

Instruction: The following items aim to understand the implementation of policies related to talent attraction in Lhasa and your company. Please answer based on your personal experience and perception. Mark the number that best matches your opinion. Higher numbers indicate greater satisfaction or stronger agreement.

Scale:

1 – Strongly Disagree 2 – Disagree 3 – Neutral 4 – Agree 5 – Strongly Agree

Variable	Code	Item	1	2	3	4	5
Climate	Q1	Upon arriving in Lhasa, you experienced altitude sickness symptoms (e.g., headache, chest tightness, insomnia), which sometimes required medical treatment and affected your work and life.	☐	☐	☐	☐	☐
	Q2	Ultraviolet radiation in Lhasa is relatively strong.	☐	☐	☐	☐	☐
	Q3	Lhasa has significant temperature differences between day and night, requiring frequent clothing adjustments.	☐	☐	☐	☐	☐
	Q4	The climate in Lhasa is dry with very limited precipitation.	☐	☐	☐	☐	☐
Talent Policy	A1	The talent subsidy policies for IT professionals in my area are relatively strong.	☐	☐	☐	☐	☐
	A2	My area organizes a rich variety of talent recruitment events for IT professionals.	☐	☐	☐	☐	☐
	A3	The market-oriented talent recruitment channels (e.g., headhunters) in my area are well-developed.	☐	☐	☐	☐	☐
	A4	The platforms for communication and development of IT talent in my area are well established.	☐	☐	☐	☐	☐
	A5	The IT talent programs launched in my area are attractive to me.	☐	☐	☐	☐	☐
	A6	My area provides strong policy preferences for IT professionals.	☐	☐	☐	☐	☐
	A7	There is strong vocational training support for IT professionals in my area.	☐	☐	☐	☐	☐
	A8	My area provides attentive services for certified IT professionals.	☐	☐	☐	☐	☐
	A9	The digitalization level of IT talent services in my area is high.	☐	☐	☐	☐	☐
	A10	The policy promotion activities related to IT talent attraction, training, evaluation, and services are abundant in my area.	☐	☐	☐	☐	☐
Living Support	B1	It is convenient to travel between my area and inland regions.	☐	☐	☐	☐	☐
	B2	Daily transportation in my area is convenient.	☐	☐	☐	☐	☐
	B3	My area provides high-level support for spouse employment and children's education.	☐	☐	☐	☐	☐
	B4	There are many opportunities for self-improvement and learning in my area.	☐	☐	☐	☐	☐
	B5	Medical services in my area are convenient.	☐	☐	☐	☐	☐
	B6	The medical service environment in my area is very good.	☐	☐	☐	☐	☐

	B7	Talent housing coverage in my area is relatively high.	☐	☐	☐	☐	☐
	B8	Renting a house in Lhasa is very convenient.	☐	☐	☐	☐	☐
	B9	The pressure to purchase a home in Lhasa is not high.	☐	☐	☐	☐	☐
	C1	The IT industry in Lhasa is expanding with a clear growth trend.	☐	☐	☐	☐	☐
	C2	Infrastructure in communication, networks, and data centers in Lhasa is relatively complete.	☐	☐	☐	☐	☐
Industry	C3	Lhasa performs well in IT industry value-chain cooperation, mutual benefit among companies, and cross-regional collaboration.	☐	☐	☐	☐	☐
	C4	Lhasa performs well in strengthening innovation and R&D investment.	☐	☐	☐	☐	☐
	D1	Our company provides complete skill training and clear career development paths for employees.	☐	☐	☐	☐	☐
	D2	I am very satisfied with the promotion system in our company.	☐	☐	☐	☐	☐
	D3	The compensation and benefits system in our company is transparent.	☐	☐	☐	☐	☐
HR Practices	D4	The performance evaluation mechanism in our company is scientific and effective.	☐	☐	☐	☐	☐
	D5	I am very satisfied with the office environment and decoration of our company.	☐	☐	☐	☐	☐
	D6	I am satisfied with our company's leadership structure, interpersonal relations, and regulations.	☐	☐	☐	☐	☐
	D7	The spiritual and cultural atmosphere of our company is excellent.	☐	☐	☐	☐	☐

Part III: Survey on Perceptions of Health Risk, Local Identity, Perceived Uncertainty, Risk Tolerance, and Job Satisfaction

Instruction: The following questions aim to understand your personal perceptions of living and working in Lhasa, including potential plateau health risks, your sense of belonging, uncertainty perception, and job satisfaction. Please respond based on your actual experiences. Higher numbers indicate greater satisfaction or stronger agreement.

Scale:

1 – Strongly Disagree 2 – Disagree 3 – Neutral 4 – Agree 5 – Strongly Agree

(1) Perception of Plateau Health Risks

Variable	Code	Item	1	2	3	4	5
Plateau Health Risk	R1	I believe that long-term residence in Lhasa may cause chronic altitude sickness and increase the risk of cardiovascular and cerebrovascular diseases.	☐	☐	☐	☐	☐
	R2	I believe long-term residence in Lhasa increases the risk of catching colds and respiratory diseases.	☐	☐	☐	☐	☐
	R3	I believe long-term residence in Lhasa may cause symptoms such as dry skin, nosebleeds, and respiratory tract mucosa damage.	☐	☐	☐	☐	☐
	R4	I believe long-term residence in Lhasa increases the risk of skin cancer.	☐	☐	☐	☐	☐

(2) Local Identity toward Lhasa

Variable	Code	Item	1	2	3	4	5
Local Identity	M11	I identify with Lhasa.	☐	☐	☐	☐	☐
	M12	I feel emotionally attached to Lhasa.	☐	☐	☐	☐	☐
	M13	Lhasa has become a part of who I am.	☐	☐	☐	☐	☐
	M14	The image of Lhasa is closely related to my personal identity.	☐	☐	☐	☐	☐
	M15	Living and working in Lhasa is meaningful to me.	☐	☐	☐	☐	☐

(3) Local Dependence on Lhasa

Variable	Code	Item	1	2	3	4	5
Local Dependence	M21	I believe Lhasa provides suitable conditions for living and working.	☐	☐	☐	☐	☐
	M22	Compared to other places, I prefer living and working in Lhasa.	☐	☐	☐	☐	☐
	M23	Compared to other places, I believe I can develop better in Lhasa.	☐	☐	☐	☐	☐

(4) Perceived Uncertainty about Organizational Environment

Variable	Code	Item	1	2	3	4	5
External Uncertainty	M311	I feel that our company operates in a dynamic environment, with rapid changes and opportunities in technology, economy, and culture.	☐	☐	☐	☐	☐
	M312	I feel the external environment our company faces is risky—one wrong decision could lead to failure.	☐	☐	☐	☐	☐

Job Insecurity	M313	I feel that our company is under great pressure from the external environment, making it hard to meet future customer demands.	☐	☐	☐	☐	☐
	M321	I am uncertain about what position I will hold in the company in the future.	☐	☐	☐	☐	☐
	M322	I often worry that I will have to leave this company before I decide to resign.	☐	☐	☐	☐	☐
	M323	Within the next year, I may be forced to leave my current job.	☐	☐	☐	☐	☐
	M324	I am concerned that I will become unemployed soon.	☐	☐	☐	☐	☐

(5) Job Satisfaction

Variable	Code	Item	1	2	3	4	5
Job Satisfaction	M41	Overall, I am very satisfied with my current job.	☐	☐	☐	☐	☐
	M42	Overall, I really enjoy my current work.	☐	☐	☐	☐	☐
	M43	Overall, I am very willing to continue working in this company.	☐	☐	☐	☐	☐

Part IV: Survey on Talent Agglomeration in Information Technology Enterprises

Instruction: The following items are intended to understand whether the current talent policies of Lhasa City and your company have achieved the expected level of talent agglomeration. Please respond based on your real feelings and experiences. Higher numbers indicate greater satisfaction or stronger agreement.

Scale:

1 – Strongly Disagree 2 – Disagree 3 – Neutral 4 – Agree 5 – Strongly Agree

Variable	Code	Item	1	2	3	4	5
Talent Agglomeration	Y1	I am very willing to spend the rest of my career at my current company.	☐	☐	☐	☐	☐
	Y2	I have a strong sense of belonging to my current company.	☐	☐	☐	☐	☐
	Y3	I believe my current company can help me realize my personal ideals.	☐	☐	☐	☐	☐
	Y4	I am very willing to contribute to my current company.	☐	☐	☐	☐	☐
	Y5	When talking about employment, I enthusiastically promote the strengths of my current company as an employer.	☐	☐	☐	☐	☐
	Y6	When someone asks me for job advice, I would first recommend my current company.	☐	☐	☐	☐	☐

Part V: Survey on Countermeasures to Offset the Negative Impacts of Harsh Climate Conditions in Lhasa

Instruction: This section is designed to assess your views on possible strategies to mitigate the negative impact of Lhasa's climatic disadvantages on talent agglomeration. Please answer truthfully based on your actual thoughts.

Code	Item	1	2	3	4	5
S1	I believe improving local talent support policies in Lhasa can offset the negative impact of harsh climate conditions on talent agglomeration.	☐	☐	☐	☐	☐
S2	I believe improving living 保障（e.g., transportation, healthcare, housing） in Lhasa can offset the negative climate effects on talent agglomeration.	☐	☐	☐	☐	☐
S3	I believe enhancing the development level of the information technology industry in Lhasa can offset the adverse climate effects on talent agglomeration.	☐	☐	☐	☐	☐
S4	I believe improvements in human resource management by local enterprises can offset the negative impact of Lhasa's climate on talent agglomeration.	☐	☐	☐	☐	☐
S5	I believe increasing employee salary levels in Lhasa-based enterprises can offset the negative impact of climate on talent agglomeration.	☐	☐	☐	☐	☐
S6	In your opinion, which of the following is the most effective factor to counterbalance Lhasa's climatic disadvantages? That is, if which factor improves, would you be more willing to stay and work in Lhasa?	A. Talent support policies	B. Living security (e.g., transportation, healthcare, housing, etc.)	C. Development level of the information technology industry	D. Enterprise-level human resource management practices	E. Salary levels
S7	In your view, how much improvement in your selected factor would make you more willing to stay and live/work in Lhasa?	A. Less than 30% improvement	B.30%-50%	C.50%-70%	D.70%-100%	E. More than 100% improvement