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Development of talent training mode for higher education institutions-enterprise cooperation in Tianjin City

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Abstract

The purpose of the study is to explore the level and composition of the development of talent training for higher education institutions-enterprise cooperation of 44 Chinese colleges and universities in Tianjin city. A mixed-methods approach was adopted for this research. After conducting an extensive literature review, a quantitative research methodology was employed using a 5-level Likert-scale questionnaire. The survey was distributed to 484 respondents, selected through stratified random sampling. An Exploratory Factor Analysis (EFA) was carried out to analyze the data, with a group of 9 experts providing an importance assessment of the identified factors. The EFA revealed that the factors influencing the development of the talent training mode can be grouped into eight key categories. These categories, ranked by priority, are: Career Planning Cognition (Mean=0.02, S.D=0.98), Employment Intention (Mean=0.01, S.D=0.92), Personal Ability (Mean=0.02, S.D=0.89), Employment Guidance (Mean=-0.01, S.D=0.85), Internship Practice (Mean=-0.02, S.D=0.80), Employment Mentality (Mean=0.03, S.D=0.78), New Technology Employment Market (Mean=0.05, S.D=0.76), Employment Resources (Mean=-0.01, S.D=0.70). Each factor was assessed for its mean score and standard deviation, indicating varying degrees of importance and variation in responses. The study concludes that effective talent training in colleges and universities depends on a combination of factors, with Career Planning Cognition and Employment Intention emerging as the most critical. The findings emphasize the need for a holistic approach that integrates both academic and industry perspectives to enhance the employability of graduates. The results of this research provide valuable insights for colleges and universities, enterprises, and policymakers in optimizing talent training modes. By focusing on the identified key factors, institutions can improve career guidance, enhance internship opportunities, and better align educational programs with the evolving demands of the employment market, particularly in the context of technological advancements.

Keywords: College and university, Development of talent training mode, Influencing factors, Institutions-enterprise cooperation, Tianjin City.

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1. Introduction

In recent years, the transformation of China's higher education system has become a focal point, particularly in terms of aligning academic training with the rapidly evolving demands of the labor market. The increasing emphasis on industry-academia collaboration has led to a paradigm shift in talent training models. As a key hub of economic development, Tianjin, with its unique geographical and industrial advantages, provides an ideal case for exploring the potential of higher education institutions' cooperation with enterprises.

The talent training models in higher education institutions have long been a subject of debate among policymakers, educators, and industry leaders. Traditional models, which have predominantly focused on theoretical and academic education, are often criticized for their disconnection from industry needs and their limited adaptability to the dynamic socio-economic landscape. This misalignment between educational output and industry demand has created an urgent need for innovative talent cultivation models that effectively integrate the strengths of both educational institutions and enterprises.

The importance of industry-education cooperation in improving the quality and relevance of talent training is increasingly recognized. Research has shown that such collaborative models not only bridge the skills gap but also cultivate a dynamic, adaptable workforce capable of addressing the challenges of the modern economy. Given Tianjin's strategic position as a hub for manufacturing and technological innovation, the city presents a unique opportunity to develop a localized and sustainable talent training model that supports the growth of both higher education institutions and key industries in the region.

This study aims to examine the development of a talent training model that integrates the resources and expertise of higher education institutions and enterprises in Tianjin. By reviewing existing research and current trends, the paper seeks to provide critical insights into the practical and theoretical implications of such models. The significance of this research lies in its potential to inform policy decisions, enhance educational practices, and contribute to the cultivation of high-quality, industry-relevant talent, not only within Tianjin but also across broader contexts in China.

2. Literature Review

The alignment between higher education and labor market needs has become a critical area of concern in contemporary educational research, especially in light of the evolving economic and technological landscape in China. As global and local labor markets undergo rapid transformation, it has become imperative for educational institutions to adapt their teaching models to equip graduates with the skills required by industries. The integration of industry and academia has emerged as a fundamental strategy to address the widening gap between academic training and labor market demands.

2.1. Industry-Academia Collaboration and Talent Development

Industry-academia collaboration has been an enduring theme in education research, particularly in the context of vocational and higher education. Globally, scholars have emphasized the importance of such partnerships in aligning academic training with industry requirements. The seminal work of Carnevale et al. [1] highlights that the gap between the skills acquired through higher education and those demanded by the labor market is a growing concern, necessitating closer ties between educational institutions and the private sector. In their analysis, they argue that employers increasingly value practical skills and industry-specific knowledge, which cannot be effectively taught through traditional educational methods alone. Billett [2] further emphasizes the role of workplace learning and internships as essential mechanisms for bridging the divide between theory and practice.

Within the Chinese context, the notion of "industry-education integration" has gained increasing prominence in national education policy. Liu and Zhang [3] discuss how China's educational reforms have focused on fostering closer cooperation between universities and enterprises, particularly in response to the needs of a rapidly changing industrial and technological landscape. Liu et al. [4] note that the demand for a workforce with specialized knowledge in emerging sectors such as artificial intelligence, biotechnology, and information technology requires universities to adapt their curricula to industry needs. The implementation of the "Industry-education Integration" strategy at the national and local levels aims to cultivate talent that meets the specific demands of industries in various regions, such as Tianjin, which has strong industries in manufacturing and advanced technology.

Tianjin, as a key industrial city, has made substantial strides in integrating higher education with local enterprises. Several studies emphasize the importance of developing specialized talent for Tianjin's growing high-tech sector. The local

government has implemented policies such as funding for university-enterprise collaborative projects, creating innovation-driven educational environments, and offering incentives for enterprises that collaborate with educational institutions. This has led to the development of a more dynamic and industry-relevant talent pipeline, supporting the broader economic goals of the city.

2.2. Factors Influencing Employment Outcomes

The relationship between higher education and employability is complex, with multiple factors influencing graduates' success in securing relevant employment. Various studies have identified key factors that significantly affect employability outcomes. The eight factors identified in this study Career Planning Cognition, Employment Intention, Personal Ability, Employment Guidance, Internship Practice, Employment Mentality, New Technology Employment Market, and Employment Resources are critical elements in understanding the factors influencing employability in the Chinese context.

Career Planning Cognition has been shown to significantly influence graduates' career outcomes. Zhou and Zhang [5] suggest that early career awareness plays a vital role in preparing students for the job market. In China, where competition for employment is intense, students' understanding of career paths, job roles, and industry expectations is crucial for guiding them through the employment process. Scholars argue that incorporating career development education early in university curricula can help students make informed decisions about their career paths, contributing to better alignment between educational outcomes and labor market needs [5].

Employment intention, or the intention to enter the labor market, has been linked to graduates' eventual employment success. Research by Guo et al. [6] suggests that students' employment intentions are influenced by various factors, including the perceived relevance of their academic programs, exposure to industry practices, and engagement with career services. Employment intention often shapes the strategies students adopt in their job search and influences the types of industries or roles they pursue. Furthermore, in China's rapidly evolving labor market, students' employment intentions are often shaped by their understanding of the job market, the economic conditions, and the availability of jobs in their fields of study.

Personal Ability encompasses not only academic knowledge but also transferable skills such as communication, teamwork, problem-solving, and adaptability. Personal abilities are highly valued by employers in China, where technical competence alone is not sufficient to ensure employability. Studies have shown that graduates with strong soft skills, including emotional intelligence and interpersonal communication, have a competitive advantage in the job market [7]. In this regard, higher education institutions in China are increasingly incorporating soft skills training into their curricula to enhance graduates' employability.

Employment Guidance and career counseling services play a central role in improving graduates' employability. Chen et al. [8] stress the importance of tailored career counseling that not only provides job-search support but also helps students identify their strengths, refine their career aspirations, and navigate the complexities of the labor market. This guidance often includes assistance with resume writing, interview preparation, and strategies for engaging with potential employers. The significance of effective career guidance in enhancing employment outcomes is particularly pronounced in China, where high levels of competition for jobs can create significant stress for students.

Internship Practice has been extensively studied as a key factor influencing employability. According to Wei and Tao [7], internships provide students with valuable hands-on experience that enhances their practical knowledge and work-related skills. Internship programs offer students a real-world understanding of the job market and industry expectations, increasing their employability upon graduation. In China, internships are increasingly being integrated into the curriculum, often in collaboration with local enterprises, allowing students to gain practical experience while also contributing to the development of industry-university partnerships.

Employment Mentality refers to the psychological factors that influence graduates' perceptions of their employment prospects and attitudes towards the job market. Studies suggest that graduates who maintain a positive, proactive mindset in the face of uncertainty and competition are more likely to succeed in finding employment [7, 9]. In a highly competitive environment like China, where graduate unemployment is a significant concern, fostering a resilient employment mentality is essential for students to navigate challenges and achieve career success.

Wei and Tao [7] pointed that New Technology Employment Market has become a pivotal factor in employment outcomes due to the rapid growth of industries driven by emerging technologies such as artificial intelligence, big data, and automation The demand for skilled workers in these fields is increasing, and higher education institutions must adapt to meet the needs of the new technology-driven employment market [10]. The integration of new technologies into higher education curricula and the fostering of collaboration between universities and tech-oriented enterprises are key strategies for ensuring graduates are prepared for these high-demand sectors.

Employment Resources, such as career fairs, job boards, alumni networks, and internships, are vital in connecting students with potential employers. Guo et al. [6] show that students who have access to robust employment resources have a higher likelihood of securing relevant employment. In China, universities are increasingly investing in career services and industry partnerships to provide students with the tools and resources necessary to navigate the job market successfully.

2.3. Industry-Education Integration in Tianjin

Tianjin represents an interesting case for examining the integration of higher education and industry, as it balances traditional manufacturing sectors with emerging high-tech industries. The city's efforts to align higher education with the needs of its key industries are essential for the development of a highly skilled workforce that can support its economic goals. Recent studies on Tianjin's higher education system [10] have shown that the city has made substantial investments in educational reforms aimed at improving the employability of graduates and fostering industry-relevant skills. Collaborative

initiatives between universities and local enterprises in Tianjin have become more common, with a focus on innovation, technology, and high-skilled talent cultivation.

The role of government policy in facilitating industry-education collaboration in Tianjin is critical. As noted by Zhang and Wang [11] government policies play a significant role in promoting the integration of industry and academia. These policies support the establishment of partnerships between universities and enterprises, encourage research and development collaborations, and provide financial incentives for businesses to engage in educational programs. The alignment of educational outcomes with the needs of local industries is seen as a key strategy for ensuring sustainable economic growth and increasing the city's global competitiveness.

3. Research Methodology

Quantitative research was used to conduct the research, followed by exploratory factor analysis (EFA).

3.1. Population and Samples

A probability sampling technique is used, as this study is generalized to colleges and universities in Tianjin city; therefore, researchers suggest that in case of high generalization, probability sampling in quantitative data is appropriate [12]. The study's population was 484 teachers and administrators in 44 colleges and universities in stratified and simple random sampling techniques were used to select the 484 participants. Table 1 shows sample collection.

Table 1.
Sample collection.

Category	n=484	Percentage
1. Gender		
Male	265	54.75
Female	219	45.25
2. Age		
under 25 years old	45	9.30
25 - 29 years old	152	31.40
30 - 39 years old	243	50.20
40-49 years old	30	6.20
Above 49 years old	14	2.90
3. Educational Background		
Bachelor	157	32.44
Master	233	48.14
Doctor	82	16.94
Postdoctoral appointment	12	2.48
4. Work Experience		
under 5 years	48	9.90
5 – 10 years	89	18.40
11 – 15 years	142	29.34
16 – 20 years	196	40.50
Above 20 years	9	1.86

3.2. Research Tools

A 130-item questionnaire was used to evaluate each participant's opinions concerning higher education institutions cooperation. A five-level educator opinion scale was used, which was reviewed by a panel of 9 education experts whose qualifications were no less than a doctorate. Each of the 130 items was then evaluated using the index of item-objective congruence (IOC) value. The questionnaire's aim, item clarity, comprehensiveness, completeness, meaningfulness, and significance for each item were evaluated. The IOC values for the study were 0.8 to 1.00, with items below 0.67 removed according to the experts' suggestions.

The questionnaire's reliability was then evaluated using 30 individuals who did not participate in the subsequent survey. The assessment of the 30 individual's questionnaire try-out reliability used Cronbach's alpha ($\alpha = .987$).

Before the final survey, the researcher sent a letter from the 44 colleges and universities in Tianjin city asking permission to collect survey data. Once each school granted permission, teachers were randomly selected and contacted with Line social media and given a questionnaire QR code to participate.

3.3. Data Analysis

From the development of talent training core factors analysis, the suitability test and the correlation coefficient matrix between the variables were examined using descriptive statistics (percentage, mean, and standard deviation), the Kaiser-Meyer-Olkin (KMO), and Bartlett's test of sphericity. Additionally, the analysis extracted the factors using principal

component analysis (PCA) to determine which variables were most important. It consisted of the factors, eigenvalues, percentage of variance, and cumulative percentage of variance.

The correlation between variables being more common as a constituent was more clearly defined by the varimax rotation method [1] to find the quality management core Factors by using the selection criteria for question variables with a factor loading $\geq .50$ and the number of variables in each component [2]. There must be at least three variables to be considered as one component.

4. Results

4.1. Correlation Matrix Suitability Results

Table 2 shows that the KMO (Kaiser-Meyer-Olkin) indicates that the observed variables' correlation matrix was not a unique matrix, which therefore shows that there are enough correlations between variables for variables analyzing indicators [2]. Confirmation of this was determined by the KMO Measure of Sampling Adequacy =0.989, which is considered excellent. Also, Bartlett's test of sphericity was used to test the desirability of proceeding to factor extraction [1]. It is a hypothesis test that the correlation matrix is an identity matrix. Determination was made that the Chi-Square = 61502.866 had a statistical significance Sig=.000, $p \leq .05$, indicating that the correlation matrix obtained is not a unity matrix. This confirmed that the variables are correlated and are suitable for factor analysis.

Table 2.
KMO and Bartlett Test.

KMO and Bartlett's Test		
KMO		0.987
Bartlett's Test of Sphericity	Chi-Square	61502.866
	df	8385
	Sig	0.000

4.2. Factor Extraction and Rotation

The researcher extracted the factors using the principal component analysis (PCA) to determine which variables were most important. It consists of the Factors, eigenvalues, percentage of variance, and cumulative percentage of variance (Table 3). Liu and Zhang [3] have suggested that factors with eigenvalues ≥ 1.00 be retained. Table 3 shows the Eigenvalues, which are the sum of the squares of the coefficients of each factor ≥ 1.00, and the 8 factors have a percentage of cumulative variance of 67.961%. The fifth and sixth factors are not grouped since fewer than three factors exist in an element. Additionally, in Tables 2 and 3, the descriptive definitions for each Factor are as follows:

Factor 1 = Career Planning Cognition
Factor 2 = Employment-Intention
Factor 3 = Personal Ability
Factor 4 = Employment Guidance
Factor 5 = Internship Practice
Factor 6 = Employment Mentality
Factor 7 = New Technology Employment Market
Factor 8 = Employment Resources

Table 3.
Total Variance Explained.

Total Variance Explained						
Factor	**Initial Eigenvalues**			**Extraction Sums of Squared Loadings**		
	Total	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**
1	69.425	53.404	53.404	17.641	13.57	13.57
2	3.740	2.877	56.281	12.976	9.982	23.552
3	3.010	2.316	58.597	11.424	8.788	32.339
4	2.883	2.217	60.814	11.155	8.581	40.92
5	2.431	1.870	62.684	9.285	7.142	48.062
6	2.337	1.798	64.482	8.897	6.844	54.906
7	2.331	1.793	66.275	8.517	6.551	61.457
8	2.192	1.687	67.961	8.455	6.504	67.961
Extraction Method: Principal Factor Analysis (PCA).						

Table 4 shows the study's analysis from the Varimax rotation, usually the second step in factor analysis, and a PCA, Abdi [13]. Factor rotation and a Varimax rotation transform the initial factors into new ones that are simpler to interpret. The results of the analysis of orthogonal rotation Factors by the varimax method and the variables in each component must have a weight of $\geq .50$ or more. The investigator chose the highest weight for each factor in the study's development of talent

Training for higher education Institution-enterprise cooperation core value analysis. A total of 130 items, since 40 of the factors that were scraped out are subtracted. Table 4 thus shows the remaining 8 factors with 90 items.

Table 4.
Varimax rotation.

Item	Factor loading coefficient								
	Factor 1	**Factor 2**	**Factor 3**	**Factor 4**	**Factor 5**	**Factor 6**	**Factor 7**	**Factor 8**	**Common Factor Variance**
19	0.666								.652
53	0.645								.705
2	0.626								.675
28	0.624								.652
66	0.619								.673
75	0.617								.670
17	0.613								.666
11	0.606								.603
24	0.603								.650
61	0.602								.690
32	0.587								.687
48		0.687							.677
44		0.665							.701
70		0.662							.675
59		0.660							.670
60		0.659							.688
77		0.659							.664
62		0.645							.680
82		0.645							.656
47		0.642							.670
27		0.637							.709
40		0.636							.673
38		0.631							.680
49		0.626							.704
46		0.625							.656
64		0.624							.676
85		0.609							.675
5		0.603							.676
33		0.599							.637
56		0.593							.652
81		0.586							.663
42			0.676						.603
54			0.658						.677
8			0.645						.600
21			0.636						.705
18			0.623						.677
45			0.620						.675
41			0.613						.681
39			0.610						.670
36			0.604						.664
16			0.600						.670
25			0.599						.675
30			0.594						.650
31			0.587						.637
12			0.578						.652
35				0.651					.640
74				0.646					.652
78				0.630					.676
50				0.625					.650
65				0.620					.677
67				0.620					.709
73				0.617					.683

72				0.606					.705
79				0.600					.652
29				0.594					.660
63				0.583					.671
76					0.606				.675
86					0.604				.675
92					0.592				.704
90					0.589				.652
95					0.588				.675
84					0.560				.692
89					0.552				.670
91					0.552				.650
87					0.551				.663
100					0.534				.637
102						0.633			.690
108						0.629			.673
109						0.612			.675
93						0.610			.705
112						0.577			.656
104						0.564			.652
98						0.559			.703
106						0.544			.679
119							0.624		.666
110							0.612		.705
113							0.608		.687
107							0.605		.652
118							0.604		.650
123							0.581		.670
120							0.572		.673
115							0.568		.603
130								0.649	.670
125								0.646	.652
127								0.621	.637
124								0.617	.676
121								0.604	.690
128								0.588	.680
129								0.580	.656
126								0.578	.709

Source: Extraction Method: Principal Factor Analysis
Rotation Method: Varimax with Kaiser Normalization.

In the scree plot shown in Figure 1, the slope between the 8th and 9th factors becomes less steep, indicating that the amount of information explained by the subsequent 9th factor decreases significantly. This suggests that the first 8 factors can cover most of the information; thus, selecting 8 factors is appropriate.

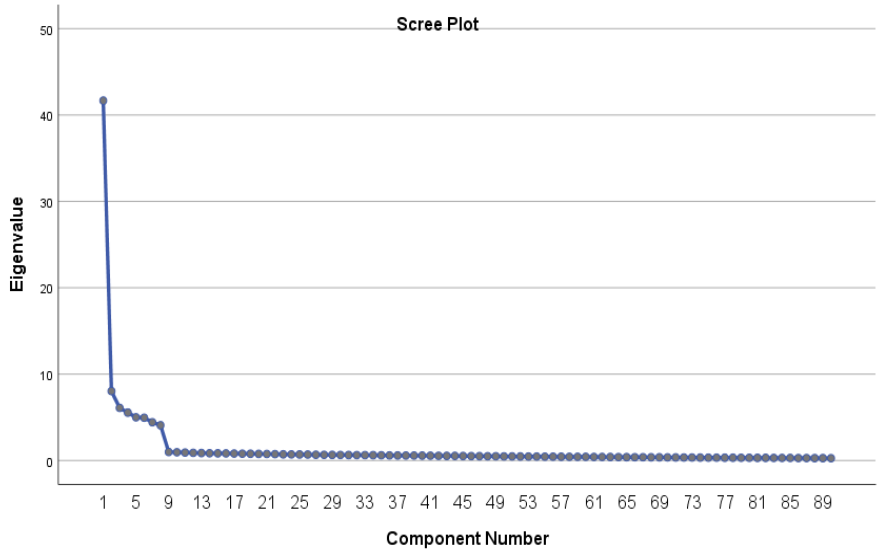

Figure 1.
Scree plot.

Table 5 shows the core Factors results arranged in order of Table 3's Eigenvalues.

Table 5.
Factors weight.

Factors	Percentage of Variance Cumulative %	
	Lowest	Highest
1	0.587	0.666
2	0.586	0.687
3	0.578	0.676
4	0.583	0.651
5	0.534	0.606
6	0.544	0.633
7	0.568	0.624
8	0.578	0.649

Table 6 shows the means, standard deviations, and opinion rankings of factors. Results revealed that overall, Factor 1 (Career Planning Cognition) was judged by the respondents to be the most important core element in the model (mean = 4.56, S.D. = .49). This was followed by the other three Factors that were nearly equal in their ranking scores.

Table 6.
Means, Standard Deviations, and Opinion Ranking.

Factors	Standardized mean	S. D	RANK
1	0.02	0.98	Highest
2	0.01	0.92	High
3	0.02	0.89	High
4	-0.01	0.85	High
5	-0.02	0.80	High
6	-0.03	0.78	High
7	0.05	0.76	High
8	-0.01	0.70	High

5. Conclusion and Discussion

5.1. Factor 1. Career Planning Cognition

Career Planning Cognition refers to the awareness and understanding of career paths and professional goals among students. The results suggest that students who have a clear understanding of their career trajectories are better equipped to align their academic choices with industry needs. This finding is consistent with previous research, which emphasizes the importance of early career planning for enhancing employability [4]. In China, where competitive job markets and diverse career paths exist, fostering career planning awareness among students is seen as critical [14]. This study further supports the argument that universities should integrate career guidance into their curricula to improve students' readiness for the labor market.

5.2. Factor 2. Employment-Intention

Employment intention refers to students' motivation and readiness to enter the job market. This factor reflects the proactive attitudes students have toward securing employment. The findings align with previous studies [15], which highlight the significance of employment intentions in shaping the career paths of graduates. A strong employment intention is often linked to better job-search behaviors and greater success in the labor market [16]. In the context of Tianjin, a city with diverse industrial sectors, understanding students' employment intentions can help educational institutions tailor programs that better align with market demands.

5.3. Factor 3. Personal Ability

Personal Ability encompasses the essential skills, including problem-solving, communication, and teamwork, that are critical for success in the workplace. This factor was found to significantly influence graduates' employability, reinforcing findings from studies by Li and Wang [16] which suggest that employers highly value these transferable skills in addition to academic qualifications. Personal abilities are increasingly becoming a determining factor in hiring decisions, particularly in fast-evolving industries where adaptability and innovation are valued [15]. Higher education institutions in Tianjin, therefore, must focus on cultivating these skills alongside technical knowledge.

5.4. Factor 4. Employment Guidance

Employment Guidance plays a crucial role in helping students navigate the complexities of the job market, including resume writing, interview preparation, and understanding employer expectations. The importance of career guidance is well-documented in the literature [8], and this study confirms that it has a substantial impact on graduates' successful transition into employment. Effective employment guidance services bridge the gap between academic learning and professional practice, providing students with the necessary tools to secure employment [6]. Universities in Tianjin can enhance their career services to improve students' job readiness and employability outcomes.

5.5. Factor 5. Internship Practice

Internship Practice is one of the most critical factors identified in this study. Internships provide practical experience and serve as a direct pathway for students to transition from academic settings to the professional world. The positive relationship between internships and employability has been consistently highlighted in global studies [17]. In China, internship programs that are closely linked with industries have been shown to increase job placement rates [9]. The results of this study emphasize the need for greater collaboration between universities and enterprises in Tianjin to create more internship opportunities that align with market demands.

5.6. Factor 6. Employment Mentality

Employment Mentality refers to students' psychological readiness and mindset toward the job market, including their adaptability and resilience in the face of challenges. This factor reflects the psychological preparation that is often overlooked in traditional educational models. Research by Zhou and Zhang [5] suggests that a positive and proactive employment mentality can significantly enhance students' job search outcomes, even in the face of intense competition. In Tianjin, a city with a rapidly changing industrial landscape, fostering a resilient employment mentality in students can help them better adapt to the dynamic labor market.

5.7. Factor 7. New Technology Employment Market

The New Technology Employment Market factor captures the growing importance of technological advancements in shaping the demand for skilled workers. As industries such as artificial intelligence, big data, and robotics expand, the demand for tech-savvy graduates has increased [5]. This finding aligns with the global trend of digital transformation, where the need for technologically proficient workers is more pronounced. In Tianjin, which has a strong focus on high-tech industries, educational institutions must continuously update their curricula to prepare students for these emerging fields. This requires a close partnership between academia and technology-driven industries.

5.8. Factor 8. Employment Resources

Employment Resources, including job fairs, career counseling services, and networking opportunities, are essential for facilitating the connection between graduates and potential employers. The availability and accessibility of these resources significantly impact job placement rates [6]. This study reaffirms the importance of robust employment resources, particularly in urban centers like Tianjin, where access to employment opportunities can vary across industries. Universities must ensure that students have access to comprehensive employment resources to maximize their chances of securing relevant positions in the workforce.

The eight factors identified in this study, Career Planning Cognition, Employment Intention, Personal Ability, Employment Guidance, Internship Practice, Employment Mentality, New Technology Employment Market, and Employment Resources, are integral to the development of an effective talent training model. Each factor plays a unique role in enhancing employability and bridging the gap between higher education and industry needs. These findings contribute to the growing body of literature on industry-education integration in China and provide practical implications for educational institutions, policymakers, and enterprises seeking to improve talent development models in Tianjin.

6. Future Recommendation

Although the study's goals and objectives have been met, there are a few inescapable constraints that must be addressed in this part for all future researchers to consider. Due to the tight timeline and scarce resources, research can only be broadly applied to colleges and universities in China. Therefore, in order to broaden the scope of the study and generalize it on a global scale, future research should include more participants from around the world. The employees of colleges and universities will have better knowledge, skills, and abilities as a result of the adoption of the quality management model in China. All graduates will benefit from updating their expertise in this way, enabling them to deliver the best services for colleges and universities.

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