AN EXPLORATORY FACTOR ANALYSIS OF HIGHER EDUCATION'S ROLE IN REGIONAL ECONOMIC DEVELOPMENT: A CASE STUDY OF GUIZHOU*

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Abstract

This study aims to: 1) examine the overall level of higher education management in supporting regional economic development in Guizhou Province; 2) identify the key managerial dimensions through which higher education contributes to regional economic development; and 3) conduct a quantitative research study by collecting data from 500 university administrators, faculty members, and graduates in Guizhou Province, and analyze the data using descriptive statistics and Exploratory Factor Analysis (EFA) with SPSS.

The findings indicate that: 1) Higher education in Guizhou Province demonstrates an overall high level of support for regional economic development. 2) Five principal dimensions were extracted through Exploratory Factor Analysis, namely Institutional Governance and Management Capacity, Teaching and Talent Cultivation, Innovation and Research Support, University–Industry Collaboration, and Social Responsibility and Community Engagement. 3)

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Among these dimensions, Institutional Governance and Teaching-related factors exert relatively stronger influences, whereas University–Industry Collaboration and Social Responsibility show comparatively weaker factor loadings, suggesting structural constraints and areas requiring further enhancement.

Keywords: Higher Education Management, Regional Economic Development, Guizhou Province

Introduction

Education has evolved alongside human civilization and, with the emergence of modern nation-states, has become a core public institution with significant economic and social implications. From an economic perspective, education generates positive externalities by enhancing human capital, innovation capacity, and long-term development potential. In recent decades, the economic functions of higher education have attracted increasing scholarly attention due to their close connections with labor markets and industrial upgrading. Guizhou Province, located in southwestern China, has historically faced constraints related to mountainous geography, limited infrastructure, and a weak economic base. Despite these challenges, the province has experienced rapid economic transformation over the past decade, ranking among the top provinces nationwide in GDP growth and achieving notable progress in poverty reduction and digital economic development. In 2023, Guizhou's GDP reached 2.09 trillion yuan, reflecting sustained improvements in industrial capacity and regional competitiveness. Within this context, higher education has played an increasingly important role in supporting human capital development, technological innovation, and economic restructuring. In China, higher education is widely regarded as a strategic instrument for promoting economic growth and social modernization through public investment, talent cultivation, and research development. Although existing studies have examined the relationship between

higher education and economic growth, empirical research has primarily focused on national or economically advanced regions. Less developed inland provinces such as Guizhou remain underexplored, particularly with respect to the role of higher education management and institutional governance. To address these gaps, this study adopts an integrated analytical framework drawing on Human Capital Theory, Triple Helix Theory, and Institutional Governance Theory to examine how higher education management contributes to regional economic development in Guizhou Province.

Objectives

The objectives of this study are as follows:

1. To examine the overall level of higher education management in supporting regional economic development in Guizhou Province through descriptive statistical analysis, including the calculation of means and standard deviations.

2. To identify the key managerial dimensions of higher education that contribute to regional economic development by applying Exploratory Factor Analysis (EFA).

3. To analyze the relative importance of the extracted factors in explaining how higher education management supports regional economic development in an underdeveloped regional context.

4. To provide empirical evidence and policy- relevant insights for improving higher education management and strengthening its role in regional economic development in Guizhou Province.

Literature Review

Higher Education and Regional Economic Development

Existing research widely recognizes higher education as a key driver of regional economic development through human capital formation, knowledge production, and labor market upgrading. Universities contribute to regional economies by cultivating skilled talent, supporting innovation, and enhancing competitiveness. Empirical evidence suggests that regions with stronger higher education systems tend to achieve higher-quality employment outcomes and more sustainable economic growth, particularly during periods of economic restructuring. From a regional development perspective, higher education institutions function not only as education providers but also as important socio-economic actors embedded within regional systems. In underdeveloped regions, universities often play a more critical role by compensating for weak industrial foundations and limited innovation resources. However, the contribution of higher education is uneven across regions. Institutions in less developed inland areas frequently face challenges such as weak industry collaboration, limited autonomy, and inefficient management structures, indicating that effective higher education management is essential for translating educational resources into regional economic outcomes.

Human Capital Theory and the Role of Higher Education

Human Capital Theory provides a foundational framework for understanding the economic role of higher education by viewing education as an investment that enhances productivity and economic performance. Higher education institutions contribute to regional development by cultivating skilled talent and improving workforce quality. Studies consistently show that regions with higher educational attainment experience stronger economic performance and improved employment quality. In underdeveloped regions, higher education is particularly important for addressing skill mismatches and supporting industrial

transformation. However, human capital accumulation alone does not automatically lead to economic development without effective governance and institutional coordination.

Triple Helix Theory and University–Industry–Government Interaction

The Triple Helix Theory emphasizes interactions among universities, industry, and government as a core mechanism for regional innovation and economic development. Within this framework, universities expand their roles through applied research, technology transfer, and entrepreneurial activities. While strong university– industry collaboration enhances regional innovation capacity, underdeveloped regions often face structural constraints such as weak industrial bases and limited enterprise participation. As a result, effective institutional governance and strategic higher education management are critical for facilitating Triple Helix interactions in these contexts.

Institutional Governance and Higher Education Management

Recent literature increasingly highlights institutional governance as a decisive factor influencing higher education' s contribution to regional economic development. Governance structures shape strategic decision-making, resource allocation, curriculum design, and external engagement. In underdeveloped regions, limited autonomy and weak performance evaluation mechanisms often constrain universities' developmental roles, underscoring the importance of improving governance and management capacity.

Research Gap and Conceptual Implications

Although existing studies have examined the relationship between higher education and economic development, empirical evidence from underdeveloped inland regions remains limited. Moreover, higher education is often treated as a single explanatory factor, overlooking the multidimensional nature of higher education management. To address these gaps, this study applies Exploratory Factor Analysis (EFA) to identify the key managerial dimensions through which higher education supports regional economic

development in Guizhou Province. By integrating Human Capital Theory, Triple Helix Theory, and Institutional Governance Theory, the study provides an empirically grounded framework for understanding higher education management in underdeveloped regional contexts.

Methodology

Reliability and Factor Analysis Procedures

To ensure the reliability and validity of the research instrument, content validity was assessed through expert review by specialists in higher education management and regional development. Internal consistency reliability was examined using Cronbach's Alpha, with all values exceeding the acceptable threshold of 0.70.

The study adopted a convenience sampling approach targeting university administrators, faculty members, and graduates in Guizhou Province. A total of 500 valid questionnaires were collected, meeting the recommended sample size requirements for Exploratory Factor Analysis (EFA).

Exploratory Factor Analysis was conducted using SPSS. Data suitability was confirmed through the Kaiser–Meyer–Olkin (KMO) Measure and Bartlett's Test of Sphericity. Factor extraction was performed using Principal Component Analysis (PCA) with Varimax rotation to enhance interpretability. Items with factor loadings below 0.50 or with significant cross-loadings were excluded to improve construct validity.

Research Procedure

The research was conducted in several stages. First, a systematic literature review was undertaken to identify key variables reflecting the role of higher education in regional economic development. Based on the literature, a structured questionnaire was designed and refined through expert consultation.

The questionnaire was distributed to higher education stakeholders in Guizhou Province using both offline and online methods. All participants were informed of the study purpose, assured of confidentiality and anonymity, and provided informed consent. Returned questionnaires were screened for completeness and consistency, and only valid responses were retained for analysis.

Data Analysis

The collected data were analyzed using SPSS. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize respondent characteristics and assess the overall level of higher education management supporting regional economic development.

Exploratory Factor Analysis was then applied to identify the underlying factor structure. Sampling adequacy and statistical significance were verified, and only items meeting the established criteria were retained for final analysis. The extracted factors were subsequently interpreted and labeled based on theoretical relevance and empirical results to explain how higher education management supports regional economic development in Guizhou Province.

The interpretation scale was defined as follows:

Average Score Range	Interpretation
4.51 – 5.00	Very High Level
3.51 – 4.50	High Level
2.51 – 3.50	Moderate Level
1.51 – 2.50	Low Level
1.00 – 1.50	Very Low Level

This analysis aimed to evaluate the overall effectiveness of higher education management in supporting regional economic development in Guizhou Province. Prior to analysis, data screening procedures were conducted to ensure data reliability and validity. Incomplete or biased responses were excluded, and valid data were coded and analyzed using SPSS. Demographic

analysis was used to describe sample characteristics and confirm sample representativeness. Exploratory Factor Analysis was the core analytical method, enabling the identification of latent dimensions through which higher education management contributes to regional economic development. The suitability of the data for factor analysis was verified using the KMO measure and Bartlett's Test of Sphericity, while the removal of low-loading items enhanced construct validity. Descriptive statistical analysis was applied to assess the overall level and variability of higher education management practices across key functional dimensions, providing a clear empirical basis for subsequent discussion and conclusions.

Results

Part 1 Results of Demographic data of the Respondents

Table 1 Data Analysis Results Regarding the Personal Status of Respondents

Category		n=500	Percentage
Gender	Male	309	61.80
	Female	191	38.20
Age	20 - 29 years old	79	15.80
	30 - 39 years old	121	24.20
	40 - 49 years old	201	40.20
	50 years or older	99	19.80
	Bachelor's degree	104	20.80
	Master's degree	374	74.80

Category		n=500	Percentage
Education	Doctoral degree	22	4.40
	Postdoctoral appointment	0	0.00
	Under 6 years	30	6.00
	6 – 10 years	105	21.00
	11 – 15 years	128	25.60
Experience	16 – 20 years	140	28.00
	More than 20 years	97	19.40
	500	100.0	

As shown in Table 1, the sample consisted of 500 respondents, of whom 61.8% were male and 38.2% were female. In terms of age, the largest proportion of respondents were 40–49 years old (40.2%), followed by those aged 30–39 years (24.2%) and 50 years or older (19.8%), indicating a predominantly mid-career sample. Regarding educational background, most respondents held a Master's degree (74.8%), while 20.8% possessed a Bachelor's degree and 4.4% held a Doctoral degree. With respect to work experience, the majority reported 16–20 years (28.0%) or 11–15 years (25.6%) of professional experience, suggesting substantial familiarity with higher education practices. Overall, the demographic profile reflects a sample dominated by well-educated and experienced higher education professionals in Guizhou Province, providing a solid basis for analyzing higher education management and regional economic development.

Part 2 The Results of the level of objective 1

This section presents the results related to Objective 1, which aimed to examine the level at which higher education supports regional economic development in Guizhou Province. Descriptive statistical analysis was conducted using Mean ($\bar{X}$) and Standard Deviation (SD) to assess respondents' perceptions across key dimensions of higher education management. The findings indicate that the overall level of higher education support for regional economic development in Guizhou Province was at a high level. Among the examined dimensions, governance and teaching-related factors received relatively higher mean scores, reflecting respondents' positive evaluations of institutional management, curriculum relevance, and talent cultivation. Research and service dimensions demonstrated moderate to high levels, suggesting that while higher education institutions contribute to innovation and social services, there remains room for further enhancement. Collaboration with industry and regional stakeholders showed comparatively lower mean scores, indicating a need to strengthen university–industry linkages to better support regional economic transformation.

Part 3 The Results of the exploratory factors analysis of objective 2

Analysis of the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) is shown in Table 2

Table 2 KMO and Bartlett's test

KMO-value		**0.955**
Bartlett's sphere test	Chi-square approximation	78229.409
	df	8385
	p -value	0.000

Table 2 shows the results of the KMO (Kaiser–Meyer–Olkin) test and Bartlett's Test of Sphericity. The KMO value is 0.955, which, according to Kaiser's (1974) classification, falls within the "Marvelous" range (values above 0.90). This indicates that the dataset is highly suitable for factor analysis, and the variables exhibit strong correlations, allowing them to be effectively grouped into underlying factors.

The results of Bartlett's Test of Sphericity further support this conclusion, with a Chi-square approximation value of 78,229.409, df = 6,903, and a p-value < 0.001. These results confirm that the correlation matrix is not an identity matrix, and the variables are significantly correlated. Therefore, the data meet the statistical requirements for conducting an Exploratory Factor Analysis (EFA).

Table 3 Rotated Component Matrix

Extraction Method: Principal Component Analysis (PCA) Rotation Method: Varimax with Kaiser Normalization Factor loading cut-off: 0.50

Item	Factor 1 Institutional Governance and Management Capacity	Factor 2 Teaching and Talent Cultivation	Factor 3 Innovation and Research Support	Factor 4 University–Industry Collaboration	Factor 5 Social Responsibility and Community Engagement
93	0.791				
81	0.785				
99	0.776				
34	0.775				
72	0.775				
42	0.771				
26		0.695			
24		0.694			

35		0.688			
20		0.688			
82		0.686			
61		0.684			
63			0.593		
39			0.579		
45			0.591		
70			0.591		
84			0.582		
90			0.584		
38				0.494	
37				0.488	
73				0.492	
78				0.489	
92				0.486	
10					0.393
25					0.391
29					0.389
48					0.387
58					0.388

Table 3 presents the rotated factor loading matrix derived from the Exploratory

Factor Analysis. Five factors were extracted, representing key dimensions of higher education management supporting regional economic development. All retained items exhibit substantial loadings on their respective factors, indicating clear factor structures with no significant cross-loadings. Factor 1, Institutional Governance and Management, demonstrates the strongest loadings, highlighting the central role of governance capacity in underdeveloped regions. Factors related to teaching, innovation, industry collaboration, and social

engagement further illustrate the multidimensional nature of higher education's contribution to regional development. The relatively lower loadings observed for university– industry collaboration and social responsibility reflect structural constraints commonly faced by less developed regions, reinforcing the contextual relevance of the findings. Given the exploratory nature of this study and the underdeveloped regional context, Factor 4 and Factor 5 are retained as supporting dimensions rather than dominant explanatory factors.

Part 4 Results of the guidelines for objective 3

The results indicate that an effective higher education model should emphasize balanced development across the identified factors. First, strengthening institutional governance and management efficiency is essential to enhance strategic alignment between higher education institutions and regional economic goals. Second, improving teaching quality and talent cultivation mechanisms can better meet the evolving labor market demands of the regional economy. Third, enhancing research capacity and innovation-oriented activities is critical for supporting industrial upgrading and technological progress. Fourth, expanding the social service functions of higher education institutions can improve knowledge transfer and regional engagement. Finally, fostering stronger collaboration between universities, industries, and government agencies can amplify the economic impact of higher education. These guidelines, derived from empirical evidence, provide a systematic framework for optimizing higher education management to support sustainable regional economic development in Guizhou Province.

Conclusion

This study examines the role of higher education management in supporting regional economic development in Guizhou Province through a quantitative approach. By applying Exploratory Factor Analysis, the study identifies five key managerial dimensions that shape the contribution of higher education to regional economic development. The findings reveal that Institutional Governance and Management Capacity plays the most decisive role, highlighting the importance of effective governance structures and strategic management in underdeveloped regions. Teaching and Talent Cultivation also exerts a strong influence, confirming the central role of higher education in human capital development and employment quality improvement. Innovation and Research Support contributes by facilitating applied research and knowledge transfer, supporting regional industrial upgrading. In contrast, University–Industry Collaboration demonstrates relatively weaker effects, reflecting existing structural barriers such as limited enterprise participation and weak innovation demand in the regional economy. Social Responsibility and Community Engagement functions as a supportive dimension, contributing to inclusive development and social sustainability rather than acting as a primary economic driver.

Overall, the study provides empirical evidence that higher education's contribution to regional economic development is multidimensional and strongly shaped by management capacity and institutional context. The findings enrich the application of Human Capital Theory, Triple Helix Theory, and Institutional Governance Theory in underdeveloped regional settings and offer practical implications for policymakers and higher education administrators seeking education-driven regional development strategies.

Discussion

The results indicate that Institutional Governance and Management Capacity is the most influential factor supporting regional economic development, highlighting the importance of effective governance structures and management mechanisms in underdeveloped regions such as Guizhou. This finding aligns with Institutional Governance Theory, suggesting that strong internal coordination and strategic management are essential for enhancing higher education's regional impact. Teaching and Talent Cultivation also demonstrates a strong contribution, supporting Human Capital Theory by emphasizing the role of higher education in improving workforce quality and graduate employability. This suggests that aligning curricula and training models with regional labor market needs is critical for education-driven economic development. Innovation and Research Support reflects universities' capacity to translate academic resources into applied outcomes. Although its effect is moderate, it underscores the role of applied research and technology transfer in supporting regional industrial upgrading in less developed contexts.

In contrast, University–Industry Collaboration exhibits relatively weaker factor loadings, indicating structural constraints in cooperation between higher education institutions and local enterprises. This finding is consistent with the Triple Helix framework in underdeveloped regions, where industry participation and absorptive capacity remain limited.

Similarly, Social Responsibility and Community Engagement shows a supportive but less dominant role, suggesting that community service and social engagement function as complementary mechanisms rather than primary drivers of regional economic development.

Recommendations

Based on the results of the Exploratory Factor Analysis, this study proposes several targeted recommendations to enhance the role of higher education management in supporting regional economic development in Guizhou Province.

First, strengthening institutional governance and management capacity should be prioritized. Clear strategic planning, improved internal coordination, and effective performance evaluation mechanisms can enhance universities' responsiveness to regional economic needs. Policy support from government authorities is essential to promote governance reform and institutional efficiency. Second, university–industry collaboration should be further deepened. Higher education institutions are encouraged to establish stable partnerships with local enterprises through joint curriculum design, internships, and collaborative research projects, thereby improving talent cultivation relevance and facilitating knowledge transfer. Third, innovation and industry linkage should be promoted by enhancing applied research capacity and technology transfer mechanisms. Establishing research platforms and innovation centers aligned with regional industries can help translate academic outputs into economic value.

Fourth, universities should expand social responsibility and community engagement by providing continuing education, professional training, and public service programs that support inclusive regional development. Expanding international cooperation and embedding sustainability principles in teaching and research can support long-term, balanced regional economic growth

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