

Research on the Practical Approach to the Construction of “National Pilot City of Industry-Education Integration” -A Case Study of Liuzhou in China

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Abstract

In recent years, the integration of industry and education has garnered significant attention as a crucial strategic direction for advancing educational reform in China. The National Development and Reform Commission, in collaboration with the Ministry of Education, issued a notice on the construction of industry-education integrated enterprises and pilot cities for industry-education integration in 2021. As a result, 21 cities and 63 enterprises were designated as national pilot cities and enterprises for industry-education integration, with Liuzhou City, Guangxi Province, being selected as one of the national pilot cities. This paper takes Liuzhou City as a case study to explore the practical pathways for constructing a "National Pilot City for Industry-Education Integration" from the perspectives of government, universities, and enterprises based on the Triple Helix theoretical framework and employing

a survey research method. The aim is to provide insights and references for similar cities in their explorations.

Keywords: National Pilot City of Industry-Education Integration, Practical Approach, Liuzhou, China

Research Background

On May 23, 2020, General Secretary Xi Jinping pointed out that “we should take meeting domestic demand as the starting point and foothold of development, and accelerate the construction of a complete domestic demand system” during his visit to the economic sector members attending the CPPCC meeting, and advocated “gradually forming a new development pattern with the domestic big cycle as the main body and the domestic and international dual cycles promoting each other” (Wu et al., 2021). Under the strategic guidance of this “dual circulation” development pattern, various provinces, cities, and industries have actively explored pathways to implement this strategy, aiming to achieve simultaneous economic development and growth of industries and enterprises. In this context, the high-quality development of higher education plays a pivotal role in supporting the realization of these strategic goals, with industry-education integration serving as a key approach to enhancing the quality of higher education.

In July 2021, General Office of the National Development and Reform Commission and General Office of the Ministry of Education jointly issued the *Notice on the Publication of the List of Industry-Education Integrated Enterprises and Pilot Cities for Industry-Education Integration*. This officially designated 21 national pilot cities for industry-education integration and 63 national industry-education integrated enterprises. As Guangxi’s sole representatives, Liuzhou City and Guangxi Bossco Environmental Protection Technology Co., Ltd. were selected as a national pilot city and enterprise for industry-education integration, respectively. This notice outlined a new reform pathway and mechanism focused on cities as nodes, industries as leverage points, and enterprises as key elements. It emphasized the improvement of development planning, optimization of resource allocation, innovation in talent training models, reduction of institutional transaction costs, development of major platforms, and in-depth exploration of institutional and mechanism innovations

In response, the Liuzhou Municipal People’s Government Office issued the *Work Plan for the Construction of Liuzhou as a National Pilot City for Industry-Education Integration* in July 2022. This document elaborated on the construction goals, pilot tasks, and listed key projects along with corresponding policy support measures. Additionally, a detailed project list and task breakdown were provided in the annexes, offering a clear action plan for the construction of the pilot city for industry-education integration.

Current Status of the Construction of Liuzhou as a National-Level City of Industry-Education Integration

Overview of Liuzhou's National-Level Industry-Education Integration City Construction

Liuzhou, as an important industrial city, regional center, and transportation hub in southwest China, holds a key position in Guangxi’s industrial landscape. Its industrial structure is diverse and multifaceted, with a “5+5” modern industrial cluster framework. This includes five traditional industries—automobile, steel, machinery, chemical, and light industry—and five emerging industries, which include high-end equipment manufacturing, next-generation

electronic information technology, energy conservation and environmental protection, biopharmaceuticals, and production-oriented services (Liuzhou Investment Promotion Bureau, 2023).

As Liuzhou's industrial structure continues to upgrade toward high-end, intelligent, and green industries, the demand for talent has also shifted significantly. Industry-education integration is seen as a crucial measure to link the education chain, talent chain, industrial chain, and innovation chain, addressing the mismatch between talent supply and demand during this transition.

Strengthening Top-Level Design and Clarifying Construction Goals. To promote the development of an industry-education integration city, Liuzhou formulated the "Work Plan for Building Liuzhou as a National-Level Industry-Education Integration Pilot City". This plan outlines a "3+3+1" target industrial system framework, focusing on three key areas: creating an advanced manufacturing industry-education integration system centered around "automobile + engineering machinery + light industry (smart appliances) "; building an emerging strategic industry-education integration system led by "intelligent rail + smart grid + biopharmaceuticals"; and enhancing a supporting service system in fields like industrial design and big data to provide comprehensive support for industry-education integration.

Integrating "Professions + Industries" to Stimulate an Internal Cycle. Liuzhou's "professions + industries" integration strategy emphasizes aligning professional education with industry upgrades and facilitating mutual promotion. This strategy effectively deepens industry-education integration in local economic development, creating a closed-loop mechanism that supports local industries while driving their transformation.

Building "Platforms + Carriers" to Expand the External Cycle. To expand the international platform for industry-education integration, vocational schools in Liuzhou leverage their strengths to innovate training models and collaborate with regions such as ASEAN. By developing international professional standards, Liuzhou is promoting the internationalization of vocational education ('Liuzhou City, Guangxi Zhuang Autonomous Region', 2024), not only boosting its educational brand influence but also setting an example for regional vocational education cooperation.

Current Status of Liuzhou's National-Level Industry-Education Integration Projects

As a national-level industry-education integration pilot city, Liuzhou released the Work Plan in July 2022, which outlines 43 specific construction projects. These projects include 19 school projects, 1 government project, and 23 enterprise projects, with a total investment of 28.96 billion yuan. However, the following challenges have been identified in the project's current phase:

The Problem of Dynamic Adaptation of Industry-Education Integration Projects to Industrial Development. The industry-education integration projects are required to closely follow industrial trends due to skill demands change rapidly as Liuzhou's industrial structure evolves. However, some projects had to be paused because of industrial development change. For example, the "Guangxi Rail Transit Industry Training College" project has been postponed due

to the suspension of Liuzhou's rail transit projects. Future development of this project depends on the revival of the rail transit industry. Additionally, Liuzhou is building a "5+5" modern manufacturing industrial cluster, requiring industry-education projects to focus on emerging industries, ensuring better support for industrial transformation. However, the current project plans do not adequately cover these emerging industries, highlighting a need for greater investment in these areas.

The Challenges in Diversified and Sustainable Funding. The advancement of industry-education integration projects heavily relies on funding, yet the current funding sources are relatively singular, relying mainly on government allocations and corporate self-financing. This limits project scale and speed, particularly under constraints in government funding. Projects like the "Luoke Design Academy" at Guangxi University of Science and Technology and the "Big Data Industry Application R&D Center" have faced slow progress or stagnation due to funding shortage. Hence, exploring diversified funding channels and ensuring sustainable financial support is crucial.

Cross-Team Collaboration Issues among Multiple Stakeholders. Industry-education integration involves collaboration among various entities, often leading to challenges in coordination, resource allocation, and task execution. For instance, projects such as the "Modern Equipment Manufacturing Training Base" at Guangxi Technician College and the "Industry-Education Integration Cooperation Center" at Liuzhou Institute of Technology face significant difficulties in cross-team cooperation. Establishing effective coordination mechanisms is essential for the successful execution of these projects.

The Challenges in Balancing Government Leadership with Market Demand. Government-led initiatives dominate industry-education integration projects, with less input from market-driven needs in the current landscape. Approximately 50% of the projects are government-funded, while corporate-led projects are mostly concentrated in state-owned enterprises. For instance, projects along the automotive industrial chain primarily focus on state-owned production enterprises, with few projects for upstream and downstream players like self-owned suppliers and distributors. This creates challenges such as mismatched market demand, limited industrial chain effects, lack of flexibility, and an absence of competitive dynamics.

Market Application Issues of Industry-Education Integration Projects. The ultimate goals of industry-education integration projects are to achieve market application, generating both economic and social benefits. Issues such as accurately measuring the effectiveness of these projects, ensuring high-quality talent training, and applying innovation and research achievements in actual production and services need to be addressed. Furthermore, ensuring the long-term sustainability of industry-education integration mechanisms remains a key challenge for the stakeholders involved.

Triple Helix Theory

The concept of the "Triple Helix" originated in the field of biology in the 1950s (Yi-shou et al., 2024) and was introduced into the social sciences in the mid-1990s by American scholar Etzkowitz and Leydesdorff (1995), who proposed the Triple Helix model of university-industry-government interaction. This theory highlights the dynamic and interdependent relationship

between universities, industries, and governments, working together to enhance regional innovation capacity and economic prosperity. Its core lies in integrating the distinct value systems of these three sectors, creating a collaborative force that unifies knowledge, production, and administration.

National-level city projects for the industry-education integration, guided by the government and deeply involving universities and enterprises, aim to strengthen the seamless connection between the education and industrial chains, thereby promoting deeper integration of academia, industry, and R&D. These projects span various dimensions, including infrastructure development, research collaboration, and talent cultivation system building. The government plays a pivotal role in planning, resource allocation, and oversight by formulating policies, providing resources, and ensuring coordination mechanisms to ensure orderly project advancement. Universities leverage their research capabilities, academic strengths, and talent resources to meet industry demands through academic-industry-research cooperation and horizontal research partnerships, providing intellectual support and skilled talent for industrial upgrading. Enterprises, as market entities, actively participate in these projects by offering practical platforms, technical guidance, and market demand insights, jointly exploring development pathways with universities, accelerating the commercialization of scientific and technological achievements, and supporting industrial structure optimization and economic growth.

Pathways to Promoting the Construction of Liuzhou as a City Integrating Industry and Education

Based on the content and characteristics of the Triple Helix theory model, this section proposes targeted implementation pathways for constructing a national-level industry-education integration city from the perspectives of the government, universities, and enterprises, focusing on the issues present in project development.

Government Perspective

Market-Driven Optimization of Top-Level Design. To optimize the top-level design of industry-education integration projects, the government should continuously monitor and analyze both domestic and international market dynamics, as well as the latest trends in Liuzhou's industrial development. This will ensure that the projects are closely aligned with evolving market demands. This approach necessitates the integration of technological innovation resources, the strengthening of collaborations with national and international research institutions, and the establishment of an efficient platform for innovation and entrepreneurship to expedite the commercialization of scientific and technological advancements. Furthermore, incorporating an international perspective in the top-level design—by leveraging advanced educational concepts and resources—will broaden students' global outlook and enhance Liuzhou's industrial competitiveness in the global market. Additionally, implementing a flexible adjustment mechanism will ensure that the top-level design remains responsive to market and technological changes, thereby providing sustained support for industrial upgrading in Liuzhou.

Strengthening Policy Refinement for Effective Execution. The Liuzhou government should further refine its supportive policies by clarifying specific incentives and rewards, potentially drawing from the successful examples of cities like Shenzhen and Tianjin, which are also

developing national-level industry-education integration initiatives. This process requires not only careful policy formulation but also continuous monitoring of implementation and stakeholder feedback. By leveraging real-time monitoring of project indicators and utilizing big data analysis, the government can gain deeper insights into market responses, talent development outcomes, and corporate involvement, providing a scientific foundation for policy adjustments. A framework that combines both "rigid and flexible" policies can be adopted, ensuring stability while maintaining adaptability to changing conditions, thus supporting the effective execution of industry-education integration projects.

Incentivizing Enterprises and Building a Diversified Integration Ecosystem. Enterprises are pivotal to the success of industry-education integration, with projects tailored to their needs yielding the most substantial benefits. The government should promote flexible enterprise participation aligned with their developmental priorities and establish mechanisms for dynamic engagement. By drawing from successful practices in cities like Shenzhen and Tianjin, phased integration of enterprises that aligns with Liuzhou's industrial planning can be fostered. Clearly defining the roles and responsibilities of businesses and encouraging open, two-way communication between enterprises and educational institutions will enhance collaboration. Additionally, the implementation of diverse incentive mechanisms—such as tax breaks, financial subsidies, and research support—can stimulate enterprise innovation and drive further progress in industry-education integration.

Creating a Scientific Benefit Evaluation System for Continuous Improvement. To ensure that projects achieve their intended social, economic, and educational outcomes, the government should establish a comprehensive evaluation system. This system should evaluate contributions in areas such as employment generation, industrial upgrading, social stability, local economic growth, and educational enhancement. Regular evaluation reports should be produced, outlining project impacts, identifying challenges, and offering recommendations for optimization. Additionally, stakeholder satisfaction surveys from students, enterprises, and educational institutions will provide valuable feedback, informing necessary policy adjustments and project improvements.

Enhancing Financial Support and Creating Special Financial Products. Given the substantial financial demands of industry-education integration projects, the government should enhance the financial infrastructure to ensure stable funding support. This includes establishing dedicated investment funds, attracting external capital, and developing financial products such as "integration project loans" and "research project loans" tailored to specific project needs. Strengthened financial regulation and risk management practices will be essential to ensure compliance and the effective utilization of resources, providing a solid financial foundation for the development of national-level industry-education integration cities.

Enterprise Perspective

Defining Talent Needs Based on Industrial Development. Enterprises, as the central driving force in the industry-education integration system, must accurately identify their talent needs to establish a solid foundation for project development. By analyzing market and technological trends, enterprises can effectively communicate their specific knowledge and skill requirements to higher education institutions. Through close collaboration, both parties

can create educational programs that align with strategic business objectives, fostering innovation and supporting industrial transformation.

Long-Term Cooperation for Talent Development. While focusing on short-term economic gains, enterprises should also adopt long-term strategies by integrating with the education system to build a stable talent pipeline. Collaborating with universities to design talent development plans that align with market demands ensures graduates are well-prepared for the workforce. Offering internships and practical training opportunities will further enhance students' skills, making them more competitive and ready for future employment.

University Perspective

Accurately Aligning Educational Goals with Industry Needs. Universities should deepen their understanding of industry demands and establish strong partnerships with enterprises to track market trends and optimize course content. By leveraging technologies like big data and AI, universities can analyze industrial trends and adapt their educational strategies accordingly to ensure relevance.

Building Interdisciplinary Teams Based on Market Needs. Universities should promote interdisciplinary collaboration, integrating knowledge from various fields to create platforms that enhance students' capabilities. Engaging in real-world problem-solving will reinforce theoretical knowledge and help develop the comprehensive skills required in today's diverse industrial landscape.

Strengthening Teaching, Research, and Services. Universities must reform teaching methods to align more closely with industry needs, while also enhancing research efforts to expedite the commercialization of scientific outcomes. By offering professional consulting services to enterprises, universities can further demonstrate their societal impact.

Creating International Education Brands and Expanding Global Cooperation. Universities should focus on developing internationally recognized education brands and foster collaboration with global academic and research institutions. This will enhance their reputation, expand cooperative opportunities, and attract international students and scholars.

Result-Oriented Evaluation System. A scientific evaluation system should be implemented to assess the effectiveness of industry-education integration projects. Regular assessments and adjustments will ensure that projects meet their objectives and remain adaptable to evolving conditions.

Conclusion

In the context of a new development pattern, this paper uses Liuzhou in Guangxi Zhuang Autonomous Region as a case study, analyzing its construction process as a national pilot city for industry-education integration. Focusing on the tasks of project development, the paper tracks the progress and implementation of the projects. Through survey methods, this paper reveals the problems encountered and their root causes. Based on the Triple Helix theory, targeted strategies are proposed in this paper from the perspectives of government policy guidance, enterprise-driven demand, and educational innovation. The bottom-up research

approach in this paper focusing on practical challenges and solutions, contrasts with the commonly used top-down paradigm.

This paper makes significant contributions both theoretically and practically. Theoretically, firstly, it employs the Triple Helix theory as an analytical framework to explore the dynamic interplay among government, higher education institutions, and enterprises, thereby deepening the application of this theory within the realm of industry-education integration. Secondly, by using a specific case study, the paper materializes the academic-industry-government interaction model from the Triple Helix theory into practical pathways for industry-education integration in Liuzhou, enhancing the theory's operability and practical relevance. Thirdly, the paper expands the knowledge system of industry-education integration by incorporating the practical experiences from Liuzhou, Guangxi, China, thus providing new material for knowledge accumulation in this field.

In terms of practical contributions, the paper primarily explores the pathways for Liuzhou to become a national-level city for industry-education integration. The findings not only offer guidance for Liuzhou's development but also provide valuable insights and lessons for other cities seeking to navigate similar integration pathways. Furthermore, the policy recommendations and implementation strategies proposed in the paper serve as important reference points for relevant government departments when formulating policies related to industry-education integration.

Future research could focus on constructing an evaluation system for the effectiveness of "National Industry-Education Integration Cities," which would serve as a critical supplement to the current study and help comprehensively assess the actual impacts of integration projects. In addition to Liuzhou, in-depth case studies of other national or regional pilot cities for industry-education integration could be conducted to uncover commonalities and differences in experiences, thereby providing broader references for global practices in industry-education integration.

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