

Supply-side reform of Henan's language services industry under the Belt and Road Initiative: logical rationale, practical challenges, and optimization pathways

*Mingming Zhang, Jiang Cai**

Zhengzhou Technical College, Zhengzhou, China

*Corresponding Author. Email: zhlwub@163.com

Abstract. The Belt and Road Initiative (BRI) has generated vast and multi-tiered language service demands across over 60 partner countries, exposing structural mismatches in the supply systems of inland Chinese provinces. Henan Province, despite its strategic position as a BRI logistics hub anchored by the Zhengzhou China-Europe Railway Express node, faces a particularly acute gap between its language services supply capacity and the escalating demand profile. This paper adopts a "demand-pull—supply structure—institutional adaptation" three-dimensional analytical framework to systematically diagnose the supply-side structural deficiencies of Henan's language services industry and identify targeted optimization pathways. Through a synthesis of Chinese-language empirical studies and international literature, this paper reveals four complementary structural challenges: talent supply mismatch, technology adoption lag, institutional fragmentation, and a critical evidence deficit. Building on the theoretical logic of supply-side reform adapted to an inland-province context, a four-pillar optimization strategy is proposed encompassing talent restructuring, technology empowerment, market integration, and institutional innovation. The findings suggest that Henan's language services industry, when reformed through coordinated intervention, can transform from a fragmented cost-driven sector into a corridor-anchored regional language services hub.

Keywords: language services industry, supply-side reform, Belt and Road Initiative, Henan Province, language policy, talent cultivation, institutional adaptation

1. Introduction

Language services constitute a foundational support industry in the globalized economy, playing a pivotal role in cross-border trade, cultural exchange, and technology transfer [1]. Since the Belt and Road Initiative (BRI) was launched in 2013, China's deepening cooperation with partner countries has generated vast and diverse language service demands spanning over 60 official languages across more than 65 countries and regions [2]. The BRI's policy framework, centered on infrastructure connectivity, trade facilitation, and people-to-people bonds, has created a multi-layered demand structure extending beyond translation and interpretation to encompass localization, cross-cultural consulting, and language technology development [3].

Henan Province occupies a distinctive position within this national landscape. As a major inland province with a population exceeding 99 million and home to Zhengzhou—a key BRI node city and origin of the China-Europe Railway Express—Henan possesses unique geographic advantages and growing cross-border economic activity in sectors including mechanical manufacturing, construction, energy, and cross-border e-commerce [4]. However, Henan's language services supply system faces structural mismatches in scale, composition, and quality relative to the multi-level BRI demands it confronts [5].

Existing research on Henan's language services has focused on three themes: demand-side analysis of enterprise needs [4], industry structure diagnosis [5, 6], and talent cultivation models [7]. Technical communication in China has also been examined from pedagogical and market perspectives [8]. However, these studies have treated demand analysis, supply diagnosis, and institutional reform as separate domains. A unified analytical framework integrating these dimensions within the theoretical logic of supply-side structural reform has been absent.

This paper adopts a "demand-pull—supply structure—institutional adaptation" three-dimensional analytical framework, illustrated in Figure 1, to address this gap. The framework analyzes demand-pull mechanisms driven by the BRI's multi-layered language needs, supply-side structural characteristics of Henan's language services, and institutional adaptation between policy and market mechanisms. The framework is benchmarked against language service ecosystems in advanced Chinese provinces (Guangdong, Beijing, Shanghai) to evaluate Henan's supply-side reform feasibility.

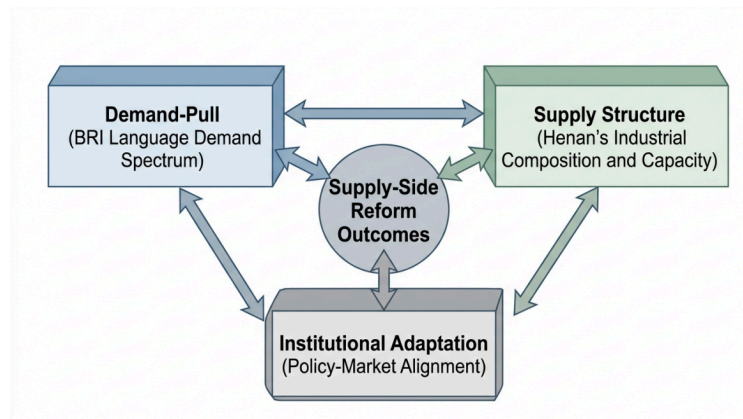


Figure 1. Three-dimensional analytical framework for language services supply-side reform

2. Demand-pull mechanisms of the Belt and Road Initiative on language services

The BRI has fundamentally reshaped the language service demand landscape, creating a multi-dimensional pull mechanism extending beyond traditional translation to encompass localization, cross-cultural consulting, and technology-mediated communication [2].

2.1. The BRI language demand spectrum: scale, diversity, and complexity

The linguistic landscape of BRI partner countries spans over 60 official languages, including major lingua francas (English, Russian, Arabic) and regional languages (Turkish, Persian, Urdu, Vietnamese, Thai, Burmese) [3]. This complexity is compounded by the diversity of service modes required: from traditional translation to software localization, multimedia subtitling, and transcreation of marketing materials [9].

The demand for non-common languages presents a particularly acute challenge. Song's survey of Henan-based enterprises found that while English and French remain the highest-demand languages, the need for Russian, Serbian, Turkish, and other corridor-specific languages has grown substantially [4]. Enterprises reported that providers frequently cannot deliver the specific non-common language pairs they require, forcing relay translation through English, which compromises quality [4].

The demand structure can be conceptualized as a three-tier hierarchy. The first tier comprises basic communication needs: document translation, on-site interpretation, and cross-cultural mediation. The second tier encompasses specialized sectoral needs: legal, medical, engineering, and financial translation [5]. The third tier represents strategic demands: language intelligence for policy analysis, cultural soft power projection, and national language capacity building [10]. This structure implies that demand is not merely growing in volume but evolving in complexity, shifting from commoditized translation services toward knowledge-intensive, technology-mediated language solutions.

2.2. Demand-to-supply transmission pathways

BRI-induced language demands reach the supply side through three channels. Market procurement involves enterprises directly contracting language service providers for specific assignments [4]. Government policy mandates—provincial BRI implementation plans, foreign trade promotion policies, and education reform directives—signal priority areas for language service development [5]. Talent market signals—wage premiums for non-common language skills and recruitment patterns—influence university program enrollment [11]. However, these channels are fragmented in Henan: market signals do not aggregate into systematic demand intelligence, policy mandates are issued by separate departments with limited alignment, and talent market signals operate with a significant time lag [10]. The result is a reactive rather than anticipatory demand-to-supply transmission system.

2.3. Global language services competition and China's positioning

The language services industry is globally competitive, with market revenues exceeding USD 50 billion concentrated in Europe, North America, and increasingly Asia [1]. China's industry has grown rapidly but remains characterized by price competition rather than quality differentiation, with a fragmented structure of micro and small enterprises. Technology adoption lags behind European counterparts in neural machine translation integration and language data infrastructure [9]. This global positioning has direct implications for Henan: as an inland province, its enterprises compete primarily on cost, limiting their ability to invest in technology, talent development, and quality certification. Addressing this positioning requires shifting the competitive basis from cost to specialization, technology, and quality.

3. Structural diagnosis of Henan's language services supply system

A systematic diagnosis of Henan's language services supply structure requires examination across three dimensions: supplier composition, service portfolio, and capacity distribution.

3.1. Industry landscape: enterprise scale, distribution, and specialization

Henan's language services industry is characterized by enterprise atomization. The overwhelming majority of providers are micro-enterprises with fewer than 10 employees, operating primarily in translation and interpretation [6]. This fragmentation impedes economies of scale, limits service depth, and constrains market visibility against providers from Beijing, Shanghai, or Guangdong. The geographical distribution is heavily

concentrated in Zhengzhou, with limited presence in prefecture-level cities such as Luoyang and Nanyang, which have significant BRI-facing manufacturing activities [12]. Most providers focus on general business translation, with limited capacity in technical, legal, or localization services [13].

3.2. Service portfolio and language pair coverage

The service portfolio remains concentrated in English-Chinese translation, reflecting the historical dominance of English in China's foreign language education [14]. Coverage of non-common BRI languages—including Russian, Arabic, Turkish, Persian, Urdu, Vietnamese, Thai, and Burmese—is estimated to be below 15% of total service capacity [4]. This gap is structural: the limited non-common language capacity is concentrated in a small number of providers and available only for the most commonly requested language pairs. The range of service types is also narrow, with traditional translation and interpretation dominating output, while localization, transcreation, language technology consulting, and cross-cultural training remain underdeveloped [15]. This narrowness, as classified in Table 2, reflects both demand-side factors and supply-side constraints including limited technology adoption, talent shortages, and the absence of industry standards.

Table 1. Structural comparison of language services supply systems across Chinese provinces

Dimension	Henan	Guangdong	Beijing/Shanghai
Enterprise scale	Micro-dominated	Mixed, with leading firms	Large firms with global reach
Service diversity	Translation-focused	Diversified	Full-spectrum
Non-common language coverage	Below 15%	25–35%	40–60%
Technology adoption	Below 30%	50–65%	70–85%
Industry association	Absent	Active	Active

Table 2. Classification of language service types and their supply status in Henan

Service type	Example services	Supply status in Henan	Key constraint
Traditional translation	Document translation, on-site interpretation	Dominant; over 80% of output	Low value-add; price competition
Specialized sectoral	Legal, medical, engineering, financial translation	Limited; below 20% of providers	Domain expertise shortage
Localization	Software, website, multimedia localization	Emerging; below 10% of providers	Technology and talent barriers
Language technology	CAT tools, MT post-editing, terminology management	Nascent; below 15% adoption	Cost and training barriers
Cross-cultural consulting	Cultural adaptation, risk assessment, brand transcreation	Minimal; few dedicated providers	Market awareness and demand
Language training	BRI language training, corporate language programs	Moderate; concentrated in Zhengzhou	Curriculum and instructor gaps

3.3. Inter-provincial benchmarking: Henan vs. advanced language service hubs

As summarized in Table 1, Henan lags across all five diagnostic dimensions when compared with Guangdong, Beijing, and Shanghai. The enterprise scale gap is particularly consequential: the absence of leading firms means Henan lacks the anchor enterprises that in coastal hubs drive technology adoption, set quality standards, and compete for high-value contracts. The technology adoption gap—with Computer-Assisted Translation (CAT) tool penetration below 30% and AI-assisted translation below 15%, compared with 70–85% in Beijing and Shanghai [15]—reflects both the cost sensitivity of micro-enterprises and the absence of a provincial technology infrastructure. The institutional gap is equally significant: Henan has no provincial language services industry association, meaning the industry lacks collective voice, self-regulation mechanisms, and a platform for coordinating with government and academia [6].

4. Theoretical logic and adaptation framework for supply-side reform

4.1. Theoretical lineage: from supply-side economics to language industry reform

The intellectual lineage of supply-side structural reform traces from classical supply-side economics—emphasizing factor productivity and institutional cost reduction—through China's 2015 supply-side reform agenda, to knowledge-intensive service industries. The adaptation to language services introduces a distinctive feature: demand heterogeneity as a structural parameter. Unlike manufacturing sectors where supply-side reform addresses overcapacity of homogeneous products, language services reform must address undercapacity of heterogeneous, demand-specific services [5].

The core concepts map onto the language services context as follows: structural optimization refers to rebalancing the service portfolio from overrepresented English-Chinese general translation toward underrepresented non-common language pairs, specialized domains, and technology-enabled services; total factor productivity improvement involves increasing output per unit of labor, capital, and technology input through better training and process standardization; and institutional transaction cost reduction addresses barriers created by fragmented policy-making, absent industry standards, and information asymmetries between demand and supply sides [7].

4.2. Operationalizing the three-dimensional framework for Henan

The three-dimensional framework can be operationalized with province-specific indicators. Demand-pull intensity is measured by BRI project density, enterprise export volume to BRI countries, and the linguistic diversity of destination markets. Supply structure is assessed through enterprise size distribution, service type coverage, language pair availability, and technology adoption rates. Institutional adaptation is evaluated through policy instrument coverage, market access conditions, and industry association activity. When operationalized, the framework reveals that Henan's institutional adaptation dimension is the weakest link: provincial policy instruments lag behind market signals by an estimated 3–5 years [10]. This institutional lag creates a structural drag on supply-side adjustment, slowing the reallocation of resources toward high-demand service categories.

4.3. Adaptation logic: inland province constraints and BRI node opportunities

Henan's supply-side reform pathway must be designed for its dual identity as an inland province and a BRI logistics hub. The standard model of language service industry development—exemplified by Beijing, Shanghai, and Guangdong—relies on a virtuous cycle of market depth, talent agglomeration, and international

connectivity. This model is not directly replicable in Henan because the province lacks deep international business networks and concentrations of multinational corporations. The proposed adaptation logic inverts the coastal model: rather than building language service capacity from general market depth, Henan should anchor capacity building in specific BRI corridor demands. Zhengzhou's role as a China-Europe Railway Express node creates a natural demand anchor for Russian, Central Asian languages, and European languages along the railway corridor. The China-Pakistan Economic Corridor and Bangladesh-China-India-Myanmar corridor create additional demand anchors for Urdu, Bengali, and Burmese [3]. This corridor-anchored approach reduces investment risk by tying capacity building to observable demand and creates a differentiated competitive position.

5. Practical challenges in Henan's language services supply-side reform

The translation of the theoretical framework into practical reform confronts four interrelated structural challenges that together create a low-equilibrium trap: each deficiency reinforces the others, and isolated interventions in any single dimension are unlikely to produce sustained improvement.

5.1. Talent supply mismatch: higher education output vs. BRI demand

Henan's higher education system produces a substantial number of foreign language graduates annually—predominantly in English, with smaller cohorts in Japanese, Russian, and Korean. However, the talent profile is misaligned with BRI demand in three respects. First, the language portfolio is concentrated in English, while non-common languages relevant to BRI corridors—Turkish, Persian, Urdu, Vietnamese, Thai, Burmese and Serbian—are offered at very few institutions [13]. Second, the skill profile is predominantly language-only: graduates lack domain-specific knowledge and technology skills that BRI-facing enterprises require [7]. Third, brain drain to coastal cities compounds the supply shortfall, as graduates are drawn to Beijing, Shanghai, and Guangzhou for higher salaries and better professional development opportunities [4].

Song's survey of 66 enterprises in Henan found that demand for language technology service talent is the most prominent, that demand for senior translation talent is the largest, and that most employers require technical document translation services. Critically, language-background translation talent is in higher demand than talent with other professional backgrounds combined with language skills [13]. This challenges the assumption that domain experts with supplementary language skills can substitute for professional language service providers; it suggests that the reform priority should be to deepen the professional competence of language graduates through technology training, domain specialization, and practical experience.

5.2. Technology adoption gap: digital transformation in Small and Medium-sized Enterprises (SME) language services

Technology adoption in Henan's language services sector remains low, with CAT tool penetration estimated below 30% and AI-assisted translation below 15% [15]. The cost barrier is significant: professional CAT tool licenses represent a substantial investment for micro-enterprises. The training barrier is equally important: effective use of translation management systems requires technical skills that many practicing translators do not possess [16]. The scale barrier compounds both: without sufficient translation volume, the productivity gains from technology adoption do not justify the fixed costs of acquisition and training.

The technology gap has structural consequences beyond productivity. It limits the service types that Henan-based providers can offer, creates a quality ceiling without translation memory and machine translation post-editing workflows, and reinforces the talent drain as professionals who wish to work with advanced

technology are drawn to coastal cities [17]. International evidence from healthcare sector machine translation adoption suggests that successful technology integration requires not only tool acquisition but also workflow redesign, user training, and quality assurance protocols [18]—institutional supports that are largely absent in Henan's current ecosystem.

5.3. Institutional fragmentation and the research gap

The institutional environment for language services in Henan is characterized by fragmentation across three dimensions. Government policy-making is siloed: the Commerce Department focuses on trade facilitation, the Education Department on foreign language program design, the Culture and Tourism Department on cultural exchange, and the Science and Technology Department on language technology innovation. No single department has a mandate to coordinate language services as a cross-cutting industry [19]. The absence of a provincial industry association means enterprises lack collective representation, market information sharing, and self-regulatory capacity. Third, the interface between academia and industry is weak, with mechanisms for industry input into curriculum design being informal and episodic [7].

Compounding these institutional gaps is a critical evidence deficit. The four challenges and their corresponding reform strategies are summarized in Table 3. There has been no systematic survey of Henan's language services market size, enterprise demographics, or revenue structure. The demand-side surveys that exist—notably Song's studies of enterprise needs [4] and talent demand [13]—are valuable but limited in scope and frequency. There is no longitudinal data on industry growth, technology adoption trends, or reform outcomes. This evidence deficit constrains evidence-based policy design: without reliable market data, government planning documents set aspirational targets rather than evidence-grounded benchmarks.

Table 3. Structural challenges and corresponding reform strategies for Henan's language services supply-side reform

Challenge	Manifestation	Current strategies	Future directions
Talent mismatch	English-dominant output; limited non-common language capacity; brain drain	Curriculum diversification at individual universities [7]	Provincial talent reserve pool; tripartite training alliances; targeted recruitment programs
Technology lag	CAT tool penetration below 30%; AI translation below 15%	Isolated enterprise-level adoption	Provincial shared technology platform; SME subsidies; technology-training integration
Institutional fragmentation	Siloed policy-making; no industry association; weak academia-industry links	Ad hoc inter-departmental coordination	Provincial language services development plan; industry association establishment; cross-departmental task force
Evidence deficit	No systematic market survey; no longitudinal data; no outcome evaluation	Academic studies on specific topics	Provincial language services market observatory; annual industry report; reform outcome monitoring framework

6. Optimization pathways: policy recommendations for Henan's language services industry

Building on the diagnostic analysis and theoretical framework, this section proposes a four-pillar optimization strategy. The four pillars are designed as an integrated package, as depicted in Figure 2: their combined effect is greater than the sum of individual interventions because each pillar addresses a constraint that limits the effectiveness of the others.

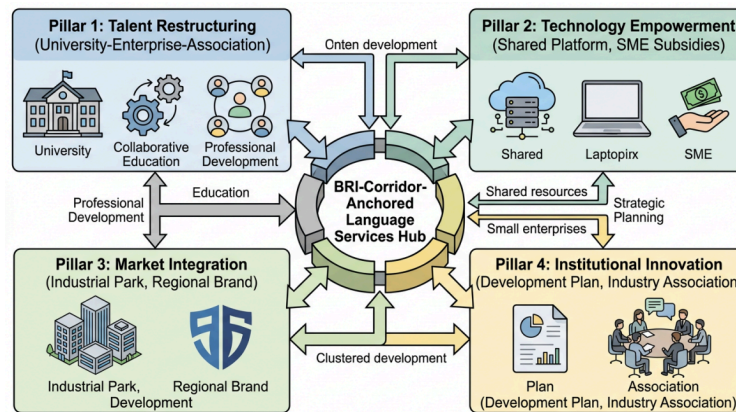


Figure 2. Four-pillar optimization strategy for Henan's language services supply-side reform

6.1. Talent cultivation system restructuring

The first pillar addresses the talent supply mismatch through a tripartite "university-enterprise-industry association" talent cultivation model. The core mechanism is to establish formal alliances between university language programs, language service enterprises, and the provincial industry association, with shared responsibility for curriculum design, practical training, and graduate placement. This model has three components. The first is a non-common language talent reserve pool: a provincial program that identifies priority BRI corridor languages, funds dedicated enrollment quotas, provides scholarships tied to service commitments, and maintains a registry of qualified non-common language professionals. The second is a technology-training integration requirement: all foreign language degree programs should include mandatory coursework in CAT tools, machine translation post-editing, terminology management, and translation project management, delivered in partnership with technology providers and enterprises [7]. The third is a high-end talent recruitment program offering competitive incentives for experienced language professionals to relocate to or remain in Henan.

Song's findings indicate that the current talent deficit is driven not only by insufficient supply but also by misalignment between the skills graduates possess and those employers require [13]. Closing this alignment gap through curriculum reform, practical training, and industry engagement is likely to yield faster returns than simply expanding enrollment capacity.

6.2. Technology empowerment and market integration

The second pillar combines technology empowerment with market integration, recognizing that these dimensions are mutually reinforcing. The technology component centers on a provincial shared language technology platform: a cloud-based infrastructure providing CAT tools, machine translation engines, terminology databases, and quality assurance modules to registered Henan-based enterprises on a subsidized

basis. By pooling demand across enterprises, the platform achieves the utilization volume that justifies infrastructure investment, and per-enterprise technology adoption costs could be reduced by an estimated 60% [15]. The platform should be complemented by a technology training program and a subsidy program for enterprises exceeding minimum utilization thresholds.

The market integration component centers on enterprise incubation and clustering. A Zhengzhou language services industrial park—modeled on successful examples in Beijing and Shanghai but anchored in BRI corridor demand—would provide shared infrastructure, business services, and networking opportunities, prioritizing enterprises serving non-common BRI languages and specialized domains. The development of "Henan Language Services" as a regional brand, supported by quality certification standards, would increase the visibility and credibility of provincial providers [12].

6.3. Institutional innovation and BRI corridor-specific strategies

The third pillar addresses institutional fragmentation through four elements: a provincial language services industry development plan, issued jointly by the Commerce, Education, Culture and Tourism, and Science and Technology departments, setting quantitative targets with clear departmental responsibilities; the establishment of a Henan Language Services Industry Association, with government facilitation but enterprise leadership, providing collective voice, standard-setting, and policy advocacy functions [14]; a cross-departmental language services task force with representation from government, industry, and academia; and a provincial language services market observatory, housed in a university research center, conducting systematic annual surveys of market size, enterprise demographics, demand patterns, and technology adoption.

The fourth pillar operationalizes the corridor-anchored strategy through differentiated language service portfolios. For the China-Central Asia-West Asia corridor, the priority languages are Russian, Kazakh, Uzbek, Turkish, and Persian, with sectoral focus on energy, infrastructure, and agriculture. For the China-Pakistan Economic Corridor, the priority languages are Urdu and English, with sectoral focus on infrastructure, energy, and trade facilitation. For the Bangladesh-China-India-Myanmar corridor, the priority languages are Bengali, Burmese, and Hindi. For the China-Indochina Peninsula corridor, the priority languages are Vietnamese, Thai, Khmer, and Lao [5]. This differentiated approach, summarized in Figure 3, converts Henan's inland location into a corridor-hub advantage: by specializing in the language services demanded by the specific corridors that pass through or near the province, Henan can build deep, defensible expertise that generalized coastal providers are less likely to develop.

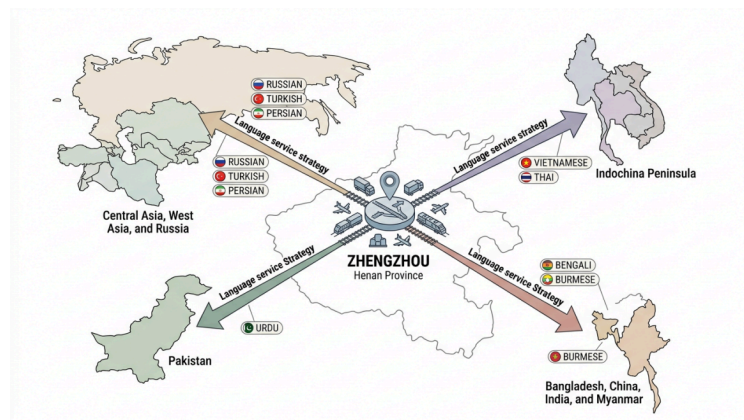


Figure 3. Corridor-specific language service strategy for Henan Province under the Belt and Road Initiative

7. Conclusion and outlook

This paper has applied a "demand-pull—supply structure—institutional adaptation" three-dimensional analytical framework to diagnose the structural contradictions in Henan's language services supply-side reform and to identify targeted optimization pathways. Four principal findings emerge.

First, the BRI generates a progressive, three-tier demand-pull mechanism—from basic communication needs through specialized sectoral requirements to strategic language capacity demands—that collectively exposes the structural inadequacy of Henan's current language services supply. The demand for non-common BRI languages, domain-specific translation, and technology-enabled language services far exceeds the supply capacity of the province's predominantly micro-enterprise, English-focused, and technology-limited service providers.

Second, Henan's language services supply system exhibits four complementary structural deficiencies: enterprise atomization, service portfolio narrowness, non-common language capacity gaps, and institutional fragmentation. These deficiencies interact to create a low-equilibrium trap in which each constraint reinforces the others, and isolated interventions are unlikely to produce sustained improvement.

Third, the adaptation of supply-side reform logic to an inland-province context requires a distinct pathway from the coastal model. Rather than building language service capacity from general market depth, Henan should anchor capacity building in the specific demands of the BRI corridors that pass through or near the province, leveraging Zhengzhou's role as a China-Europe Railway Express node to create a differentiated competitive position.

Fourth, a four-pillar optimization strategy—talent restructuring, technology empowerment, market integration, and institutional innovation—when implemented as an integrated package, can transform Henan's language services industry from a fragmented cost-driven sector into a corridor-anchored, quality-certified, and digitally enabled regional language services hub.

Several open research questions remain. Systematic empirical surveys of Henan's language services market—covering enterprise demographics, revenue, service portfolios, technology adoption, and talent flows—are urgently needed. Longitudinal studies of reform outcomes, including controlled comparisons of provinces implementing different strategies, would provide the evidence base for evaluating reform effectiveness. Comparative case studies of language service ecosystem development in inland versus coastal provinces would deepen understanding of location-specific constraints and opportunities. Finally, the impact of emerging language technologies—particularly large language models and neural machine translation—on the structure and competitiveness of provincial-level language service industries warrants continued investigation. The broader implications of this paper extend beyond Henan to other inland provinces facing similar challenges of matching language service supply to BRI-driven demand, and to the national-level question of how China's language capacity strategy can be operationalized through provincial-level reform.

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