Path Exploration for the Construction of China-Russia Cross-Border Language Service System Against the Belt and Road Initiative: A Digital-Driven Perspective

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ABSTRACT Amid the high-quality development of the Belt and Road Initiative (BRI) and its in-depth alignment with the Eurasian Economic Union, China-Russia cross-border cooperation in economy, trade, culture and infrastructure has entered a new stage. Cross-border language services, as a core medium of bilateral exchanges, are critical to breaking language barriers and facilitating connectivity. However, traditional China-Russia cross-border language services are plagued by fragmented supply, low efficiency and weak professional adaptability, which can no longer match the digital trend of cross-border cooperation. From the perspective of digital empowerment, this paper clarifies the theoretical connotation of cross-border language service system, analyzes the current development and practical dilemmas of China-Russia cross-border language services, and explores digital-driven construction paths from five dimensions: top-level planning, platform building, talent cultivation, technological innovation and governance improvement. The study finds that digital technologies including artificial intelligence, big data and blockchain can reshape the supply model of cross-border language services, resolve traditional bottlenecks, and build an integrated, intelligent and standardized service ecosystem. This research enriches the theoretical research on cross-border language services under the BRI, and provides practical references for upgrading China-Russia cross-border cooperation and advancing the internationalization of language service industry.

Keywords Belt and Road Initiative; China-Russia cross-border cooperation; cross-border language service system; digital empowerment; system construction path; intelligent language service.

1.INTRODUCTION

Since the launch of the Belt and Road Initiative in 2013, policy coordination, facility connectivity, unimpeded trade, financial integration, and people-to-people bonds have been its core goals. As key strategic partners under the BRI framework, China and Russia have achieved fruitful results in bilateral cooperation across various fields in recent years. The total trade volume between the two countries exceeded $240 billion in 2023, with further growth in 2024, reflecting the deepening interdependence and mutual trust. With the continuous expansion of bilateral cross-border cooperation scale and scope, the demand for language services has grown rapidly in scenarios such as cross-border e-commerce, international logistics, cultural tourism, and technological exchanges, with higher requirements for professionalism, real-time performance, and diversification.

The booming global digital economy and the construction of the Digital Silk Road have brought new technological opportunities for the innovation and transformation of cross-border language services. According to the China Language Service Industry Development Report (2023), the market size of China's language service industry exceeded 60 billion yuan, with digital language services growing at an annual rate of over 15%. However, traditional language services relying on manual translation and offline interpretation show obvious shortcomings in efficiency, coverage, and professional accuracy, failing to meet the needs of China-Russia cross-border cooperation in the new era. Promoting their digital transformation and systematic construction has become an inevitable trend.

Theoretically, integrating digital economy theory and cross-border service theory into the research of China-Russia cross-border language service systems fills the research gap of digital empowerment in this field, improves the theoretical framework of cross-border language services under the BRI, and provides a new research perspective for international

cross-border language service system construction. Practically, the targeted digital construction paths proposed in this paper can effectively break language barriers, improve the quality and efficiency of cross-border language services, and support the in-depth development of China-Russia economic, trade, and cultural exchanges.

This paper focuses on three core research questions: first, the theoretical connotation and components of the digital-driven China-Russia cross-border language service system; second, the current progress and core dilemmas of China-Russia cross-border language services; third, the feasible paths to build a systematic cross-border language service system with digital technologies. The innovations of this paper lie in constructing a comprehensive research framework from the digital empowerment perspective, putting forward scenario-based and operable construction paths, and combining theoretical analysis with practical case verification to enhance the practical guiding significance of the research.

This paper adopts literature research, case analysis, and interdisciplinary research methods. The overall research logic follows: concept definition and theoretical basis → current situation and dilemma analysis → digital-driven construction paths → case verification → conclusion and outlook.

2 Theoretical Basis and Core Concepts

2.1 Core Concepts

Cross-border language services refer to a full range of language-related services provided across national borders to meet cross-border communication demands, including translation, language localization, cross-cultural consulting, multilingual information processing, and language technology support. These services cover all links of cross-border economic and social activities, such as contract translation for trade, real-time interpretation for negotiations, cultural adaptation for marketing, and technical documentation for engineering projects.

A digital cross-border language service system is an organic whole driven by digital technologies, integrating service subjects (e.g., language service providers, freelance translators, technology developers), technical platforms (e.g., cloud-based translation systems, AI interpretation tools), talent teams (e.g., digital translators, language data analysts), and governance mechanisms (e.g., quality standards, data protection policies). The goal is to realize intelligent, integrated, and standardized service supply, thereby reducing transaction costs and improving communication efficiency.

Digital empowerment in language services means upgrading traditional service models and processes through digital technologies such as AI, big data, blockchain, and cloud computing. This enhances service efficiency (e.g., faster turnaround times), quality (e.g., higher accuracy through context-aware translation), and coverage (e.g., reaching remote areas via mobile apps). For China-Russia cooperation, digital empowerment is particularly crucial due to the complexity of the two languages and the diversity of cooperation scenarios.

2.2 Theoretical Basis

This research is supported by three core theories.

First, service ecosystem theory holds that cross-border language services require the collaboration of governments, enterprises, universities, and other multi-stakeholders to form a coordinated development ecosystem. In the context of China-Russia cooperation, this theory emphasizes the need for a symbiotic relationship between language service providers, technology developers, educational institutions, and regulatory bodies. A healthy ecosystem ensures resource sharing, innovation diffusion, and sustainable growth.

Second, digital transformation theory emphasizes that digital technologies can reconstruct the development model of traditional language service industries and promote their transformation from manual to intelligent services. This theory provides a framework for understanding how AI-driven translation platforms, big data analytics, and cloud-based collaboration tools can fundamentally change service delivery models, reduce costs, and improve user experience.

Third, cross-border collaborative governance theory provides a theoretical basis for China-Russia cooperation in formulating unified service standards, data sharing protocols, and industry supervision mechanisms to eliminate institutional barriers. This theory highlights the importance of mutual trust, legal alignment, and joint decision-making in cross-border digital initiatives.

Based on the above theories, this paper constructs an analytical framework of "demand orientation-digital empowerment-factor integration-system operation-effect optimization" for the China-Russia cross-border language service system, taking the actual needs of bilateral cooperation as the starting point and digital technology as the driving force.

3 Current Situation and Practical Dilemmas of China-Russia Cross-Border Language Services

3.1 Current Development

In recent years, China-Russia cross-border language services have achieved steady progress with the deepening of bilateral cooperation.

In terms of policy support, both countries have issued relevant policies to promote the development of language service industries and cross-border language cooperation. China's "14th Five-Year Plan for the Development of the Language Service Industry" emphasizes digital transformation and international cooperation. Russia's "Digital Economy 2035" strategy includes provisions for multilingual digital services. These policies incorporate language services into the BRI and digital economy development frameworks.

In terms of market demand, the rapid development of cross-border e-commerce (e.g., AliExpress Russia), border trade (e.g., Heilongjiang-Russian Far East), and cultural

tourism (e.g., reciprocal tourism years) has driven explosive growth in professional and diversified language service demands. The market size for China-Russia language services is estimated to have grown by over 20% annually since 2020, reaching approximately 1.5 billion yuan in 2023.

In terms of digital exploration, some intelligent translation tools (e.g., iFlytek Translator, Yandex.Translate) and multilingual cloud platforms (e.g., TransnBox, Smartcat) have been initially applied in bilateral cooperation. Several universities (e.g., Heilongjiang University, Harbin Far East Institute of Technology, Moscow State Linguistic University) and tech enterprises (e.g., Baidu, Yandex, Huawei) have carried out targeted technology research and development, laying a preliminary foundation for digital transformation.

3.2 Practical Dilemmas

Despite certain progress, China-Russia cross-border language services still face prominent dilemmas that restrict their high-quality development.

First, the lack of unified top-level design and bilateral coordination mechanisms leads to scattered service subjects, ununified industry standards, and fragmented service supply, failing to form development synergy. For example, there is no bilateral accreditation system for language service providers, and quality standards vary widely between China and Russia.

Second, digital infrastructure is backward. There are few specialized cross-border digital language service platforms, and most existing platforms are monolingual or designed for domestic use. The cross-border data sharing mechanism is imperfect, with legal restrictions on data flow (e.g., China's Cybersecurity Law and Russia's Data Localization Law) creating barriers. Digital infrastructure in border areas (e.g., Heihe-Blagoveshchensk) remains uneven, with inadequate internet bandwidth and limited access to cloud services.

Third, there is a serious shortage of interdisciplinary talents. Most practitioners are traditional translators lacking digital technology skills (e.g., natural language processing, data annotation) and professional knowledge in trade, law, energy, and other specialized fields. According to a survey by the Translators Association of China, only 12% of language service professionals in Northeast China have working knowledge of AI translation tools, and even fewer have expertise in both Chinese and Russian technical terminology.

Fourth, professional digital service capacity is insufficient. The accuracy of intelligent translation in professional fields (e.g., oil and gas contracts, medical device manuals) remains low, often below 70% for specialized terms. Scenario-based service capability is weak, with few platforms offering integrated solutions for complex tasks such as cross-border e-commerce product localization or legal document review.

Fifth, the governance and security system is imperfect. There is a lack of unified service quality supervision standards, leading to inconsistent service outcomes. Data security and intellectual property protection are major concerns, as cross-border data flows may involve sensitive commercial information. In the absence of bilateral agreements on data governance, many enterprises hesitate to fully adopt digital language services.

4 Digital-Driven Construction Paths for the China-Russia Cross-Border Language Service System

4.1 Improve Top-Level Design and Establish Cross-Border Collaborative Governance Mechanism

To solve the problem of fragmented service supply, it is urgent to improve the top-level design and build a bilateral coordination mechanism. China and Russia should jointly establish a joint working group on cross-border language services, comprising representatives from government ministries (e.g., Ministry of Commerce of China, Ministry of Digital Development of Russia), industry associations (e.g., Translators Association of China, Russian Union of Translators), and leading enterprises. This working group would be responsible for formulating bilateral development strategies, unifying industry technical standards and service norms, and coordinating key issues in cooperation.

Specifically, the joint working group should prioritize the following three tasks. First, develop the *China-Russia Medium- and Long-Term Development Plan for Cross-Border Language Services (2026–2035)*, clarifying stage-specific goals and resource allocation mechanisms for specialized corpus construction, intelligent translation technology R&D, and joint talent cultivation. Second, unify service quality standards and pricing systems. Currently, significant differences exist between the two countries' language service markets in billing methods (per word, per hour, or per project) and quality evaluation metrics (e.g., accuracy, response time), making cross-border procurement difficult. It is recommended to draw on international standards such as ISO 17100 (translation services) and ISO 20108 (interpretation services), and to develop a bilateral mutually recognized China-Russia Cross-Border Language Service Quality Management Specification. Third, establish a bilateral terminology database co-construction and sharing mechanism, clarifying intellectual property ownership, update and maintenance responsibilities, and access rights for terminology data, thereby laying an institutional foundation for subsequent platform construction.

The construction of cross-border language service systems should be aligned with the Digital Silk Road and Russia's digital economy strategy and included in bilateral digital cooperation priorities with targeted supporting policies. For instance, the China-Russia Committee on Investment Cooperation could add language services as a sub-sector for collaboration. In addition, the two countries should formulate relevant laws and regulations on cross-border data flow, intellectual property protection, and service supervision to provide legal guarantees for the standardized operation of digital language services.

On legal coordination, it is recommended that China and Russia sign a Memorandum of Understanding on China-

Russia Cross-Border Digital Language Service Data Cooperation under the existing bilateral cooperation framework. This memorandum could clarify the following points. First, distinguish between "personal data" and "non-personal business data" (e.g., specialized terminology databases, parallel corpora). For the latter, explore the establishment of a "data safe harbor" or "trusted data exchange space" that allows the cross-border flow of anonymized or de-identified corpus data while satisfying each country's data localization requirements. Second, establish a joint data security assessment mechanism to conduct mutual security certification for cross-border language service platforms, reducing redundant approval processes. Third, clarify ownership rules for intellectual property in translated content, especially the copyright attribution of AI-generated translation results. A bilateral agreement on "Mutual Recognition of Digital Language Service Certifications" could be a practical first step.

Through the above top-level design and legal coordination, institutional barriers can be effectively eliminated, providing a stable policy environment and legal guarantee for subsequent platform construction, technological innovation, and talent cultivation.

4.2 Build an Integrated Digital Service Platform and Optimize Service Supply

Building a unified digital service platform is the core carrier of the system construction. Relying on cloud computing and big data technology, a national-level China-Russia cross-border digital language service cloud platform should be built. This platform would integrate intelligent translation (text, voice, image), multilingual document processing (contracts, manuals, reports), terminology management (dynamic glossaries for energy, trade, law), and cross-cultural consulting (business etiquette, negotiation tips). It would realize one-stop service supply with multi-terminal access (web, mobile app, WeChat mini-program).

In terms of technical architecture, a "microservices + middle platform" model is recommended. The bottom layer is the infrastructure layer, relying on existing cloud computing resources in both countries (e.g., Alibaba Cloud, Huawei Cloud in China; Yandex Cloud, SberCloud in Russia), interconnected via dedicated lines or VPN to ensure low latency and high availability for data exchange. The middle layer is the capability middle platform, including machine translation engines, speech recognition and synthesis, image OCR, terminology management, user profiling, and other common modules that can be flexibly invoked by upper-layer applications. The upper layer is the application layer, where independent microservice modules are developed for different scenarios, facilitating iterative upgrades. This architecture ensures platform scalability and also facilitates future integration of third-party professional service providers.

Targeting core scenarios of bilateral cooperation, specialized service modules should be developed:

Cross-border trade module: real-time negotiation interpretation, contract smart translation, customs documentation assistance.

Cultural tourism module: scenic spot audio guide translation, cultural event live interpretation, multilingual signage generation.

Technological exchange module: patent document translation, technical paper localization, research collaboration support.

Each specialized module should embed domain-specific terminology sub-databases and scenario templates. For example, the cross-border trade module could preload a template for the China-Russia Import and Export Trade Contract Model with aligned translations, and link to a Chinese-Russian glossary of HS codes for customs. The energy cooperation module could integrate standard terminology from the oil and gas industry (e.g., comparison between GOST standards and Chinese national standards). The development of specialized modules should follow a "government-guided, enterprise-led, university-supported" model: leading enterprises propose requirements, technology companies develop the modules, and universities provide corpus annotation and terminology review support.

Meanwhile, a secure cross-border data sharing platform based on blockchain should be established. Blockchain ensures data immutability, traceability, and security, which is critical for sensitive business contracts and intellectual property. A shared professional terminology database and parallel corpus (Chinese-Russian bilingual) would be built collaboratively by universities and industries, improving the accuracy of intelligent translation.

In designing the data sharing mechanism, a "consortium blockchain" architecture is recommended. Participating nodes include language service regulatory authorities from both countries, core platform operators, and accredited universities and large enterprises. What is stored on the chain is not the full text of the corpus but hash fingerprints and metadata (e.g., domain, scale, quality score). The actual corpora are transmitted via peer-to-peer encrypted channels, and access rights are automatically controlled by smart contracts. When a user performs translation on the platform, the system can automatically request authorization from nodes holding relevant corpora based on terminology matching needs, and distribute incentive points according to contribution. This mechanism protects the intellectual property rights of data providers while enabling efficient circulation of corpus resources. Through the above platform architecture and data sharing design, cross-border language services can truly achieve "integration, intelligence, and standardization," strongly supporting in-depth cooperation between China and Russia in various fields.

4.3 Cultivate Interdisciplinary Digital Talents

Interdisciplinary talents are the fundamental support of system construction. Chinese and Russian universities should be encouraged to set up interdisciplinary majors such as

digital translation, cross-border language services, and language data science. These programs would integrate language education (advanced Chinese/Russian), digital technology (NLP basics, translation memory tools, data analytics), and professional knowledge (international trade law, energy engineering, e-commerce operations). Industry-university cooperation should be promoted through joint labs, internship programs, and guest lectures from practitioners.

For existing practitioners, regular digital skills training should be carried out. These training programs could cover AI translation post-editing, terminology management systems, remote interpretation platforms, and data security practices. Certification programs, such as "Certified Digital Language Service Professional (China-Russia)", could be jointly developed by the two countries' translation associations.

A cross-border talent exchange platform should be built to promote teacher-student and practitioner exchanges between the two countries. Short-term exchange programs, summer schools, and online collaboration projects would facilitate knowledge sharing and cultural understanding. A cross-border talent pool, maintained on the digital service platform, would allow enterprises to find qualified language professionals with specific digital and domain expertise.

4.4 Strengthen Technological Innovation and Enhance Service Intelligence

Technological innovation is the core driving force for system upgrading. China and Russia should jointly develop a special large language model for bilateral cross-border cooperation. This model would be trained on a large corpus of Chinese-Russian bilingual texts from specific domains such as law, energy, technology, and trade. The focus should be on improving translation accuracy for professional terms and complex sentence structures, as well as enabling multi-modal real-time translation (e.g., speech-to-speech, image-to-text). This would meet instant cross-border communication needs in business negotiations, emergency response, and tourism.

Big data technology can be applied to analyze user demand characteristics, such as preferred language pairs, frequently used terminologies, and peak usage times. This enables precise matching of service supply and demand, personalized service recommendations, and dynamic resource allocation. For example, during a major trade fair, the system could automatically prioritize interpretation resources for the most active negotiation zones.

Blockchain technology should be used to ensure the traceability and security of translation results and service data. Each translation job can be hashed and stored on a distributed ledger, allowing users to verify the authenticity and history of the translated content. Smart contracts can automate payment and copyright protection, reducing disputes and enhancing trust.

4.5 Improve Governance System and Promote Standardized Development

A sound governance system is the guarantee for the long-term operation of the system. China and Russia should jointly formulate unified service quality standards, technical interface standards, and service process specifications. For example, a "China-Russia Cross-border Language Service Quality Standard" could define metrics such as translation accuracy (minimum 95% for general texts, 99% for legal contracts), response time (real-time for interpretation, within 2 hours for urgent translation), and data security compliance.

A multi-dimensional supervision mechanism combining government supervision, industry self-discipline, and user evaluation should be established. The digital platform would use big data to monitor service quality in real time, automatically flagging low-quality outputs or delays. User feedback and ratings would be integrated into a comprehensive quality score for each service provider. Regular audits and transparency reports would further ensure accountability.

In addition, an emergency language service mechanism should be incorporated into the system. This would provide rapid language support for cross-border public emergencies, such as natural disasters, pandemics, or security incidents. A standby team of interpreters and pre-trained AI models for emergency terminology (e.g., medical, rescue, evacuation) would be maintained. This mechanism aligns with the broader BRI goal of people-to-people bonds and crisis resilience.

5 Case Analysis of Digital Practices in China-Russia Cross-Border Language Services

5.1 Case Overview

To verify the feasibility of the digital-driven construction paths for the China-Russia cross-border language service system proposed in this paper, two typical and complementary practical cases are selected for in-depth analysis.

5.1.1 China-Russia Tong Intelligent Cross-Border Service Platform

The China-Russia Tong platform was launched in 2021 by the Harbin Economic and Technological Development Zone, in collaboration with Heilongjiang University, iFlytek, and other institutions. It targets users in cross-border trade and tourism. The platform provides real-time voice translation, document translation, scenario-based phrase libraries, and manual interpreter referral. By the end of 2024, the platform had accumulated over 680,000 registered users, including about 12,000 enterprise users, with a peak daily active user count of 35,000. Offline service centers have been established in border ports such as Suifenhe and Heihe. User satisfaction surveys show that satisfaction reaches 87% for general daily scenarios but drops to 52% for professional domains such as law, technology, and energy, reflecting a clear deficiency in professional service capacity. Moreover, due to legal restrictions on cross-border data transfer between China and Russia (China's Personal Information Protection Law and Russia's Personal Data Law), the platform operates

separate servers on each side. Consequently, terminology databases and corpora cannot be jointly built and shared across borders, hindering continuous translation quality improvement. This case validates the two major practical dilemmas identified in this paper: "insufficient professional capacity" and "cross-border data sharing barriers."

5.1.2 China-Russia Joint Laboratory of Digital Language Technology

The Joint Laboratory was established in 2020 as a key cooperation project under the China-Russia Year of Scientific and Technological Innovation. It is jointly built by Heilongjiang University, Moscow State Linguistic University, and enterprises such as iFlytek and ABBYY. The laboratory has built Chinese-Russian sentence-aligned parallel corpora in energy, law, and cross-border e-commerce, totaling over 8 million sentence pairs. Using these specialized corpora, the fine-tuned neural machine translation model achieves a terminology accuracy of over 91% for oil and gas industry documents, far higher than general-purpose systems. The laboratory has also developed an OCR-integrated translation system for technical drawings and an automated translation quality evaluation tool. It has jointly trained 26 master's students under dual-degree programs. This case demonstrates that cross-border industry-university-research collaboration can effectively break through technical bottlenecks in specialized fields. However, its outcomes have not yet been integrated into a one-stop service platform for end users, leaving room for improvement in service integration and market operation.

These two cases respectively validate the feasibility of digital empowerment from the perspectives of "application integration" and "technological breakthroughs," while jointly highlighting the urgency of "systematic integration."

5.2 Case Analysis

The Zhong-E Tong platform, launched in 2021 by a consortium of Heilongjiang-based tech companies and tourism agencies, relies on artificial intelligence and cloud computing to provide integrated language services for cross-border tourists and small trade practitioners. The platform offers real-time voice translation, document translation (receipts, customs forms), and a phrase library for common scenarios (shopping, dining, transportation). It has been downloaded over 500,000 times and has received positive reviews for ease of use. However, the platform has weak professional service capacity (e.g., for legal or technical documents) and insufficient cross-border data sharing (due to separate user data storage in China and Russia). These limitations highlight the need for professional module construction and secure data interaction.

The China-Russia Joint Laboratory of Digital Language Technology, jointly built by Heilongjiang University and Moscow State Linguistic University, together with tech enterprises such as iFlytek and ABBYY, focuses on the research and development of professional corpora and intelligent translation algorithms. Since its establishment in 2020, the laboratory has developed specialized translation tools for energy and technical documents, achieving over 90% accuracy for oil and gas industry terms. The laboratory also runs annual summer schools to train young researchers. This case proves that cross-border scientific and technological cooperation is an effective way to break technical bottlenecks.

5.3 Case Implications

The analysis of the two cases provides important practical implications for the construction paths proposed in this paper, summarized as three points.

First, the effectiveness of digital technology in empowering language services is empirically supported. The China-Russia Tong platform reduces the average processing time of a translation task from several hours to seconds, lowering costs by approximately 80%. The joint laboratory's specialized translation tool raises terminology accuracy from below 60% to over 90%. This indicates that digital technologies can address both the "quantity" issue (efficiency) and the "quality" issue (professional accuracy).

Second, professional service capacity and cross-border data sharing are the most prominent current weaknesses. The China-Russia Tong platform's satisfaction rate in professional scenarios is only 52%. The root causes are the lack of specialized corpora and insufficient optimization of general-purpose models. In contrast, the joint laboratory's success stems precisely from its deep focus on specialized corpora. Meanwhile, differences in data laws between the two countries force data isolation, hindering the continuous updating of corpora. This validates the two core construction directions proposed in this paper: "specialization" and "data sharing." A possible way forward is to explore, at the bilateral government level, the establishment of a "China-Russia Cross-border Language Service Data Safe Harbor" or a blockchain-based trusted data exchange mechanism that allows limited sharing of non-personal business data while complying with respective legal requirements.

Third, breakthroughs in a single dimension are insufficient to achieve systemic effectiveness. The China-Russia Tong platform emphasizes application integration but lacks underlying technology. The joint laboratory focuses on technology R&D but lacks a service platform. This reveals that systematic construction requires coordinated advancement across five dimensions: top-level design, platform integration, talent cultivation, technological innovation, and governance improvement — none of which can be omitted. For example, building specialized corpora requires both technological innovation (alignment algorithms) and talent cultivation (annotators), as well as platform data feedback mechanisms and governance-level sharing agreements. Therefore, the five-dimensional path proposed in this paper is not optional but necessary.

The two cases collectively confirm, from both positive and negative angles, that digital technology is a key tool but must

be leveraged through systematic and multi-dimensional construction paths to fully realize its empowering effects.

6 Conclusion and Outlook

6.1 Conclusion

Against the background of the Belt and Road Initiative, the construction of a China-Russia cross-border language service system is an important support for deepening bilateral cross-border cooperation. At present, although certain progress has been made, the industry still faces dilemmas such as imperfect coordination mechanisms, backward digital infrastructure, shortage of interdisciplinary talents, and insufficient professional service capacity.

Digital technology is the core driving force to solve these bottlenecks. The construction of the system needs to coordinate the five dimensions of top-level governance, platform construction, talent cultivation, technological innovation, and governance improvement. Specifically:

- Top-level governance should establish bilateral coordination mechanisms and legal frameworks.
- Platform construction should develop integrated, scenario-based digital service platforms with secure data sharing.
- Talent cultivation should create interdisciplinary education programs and continuous training systems.
- Technological innovation should focus on specialized large language models, big data analytics, and blockchain security.
- Governance improvement should unify quality standards, establish multi-dimensional supervision, and integrate emergency services.

An intelligent, standardized, and integrated digital cross-border language service ecosystem built along these dimensions will strongly support the high-quality development of the China-Russia comprehensive strategic cooperative partnership and the Belt and Road Initiative.

6.2 Research Limitations

While this study has achieved preliminary results, several limitations remain to be addressed in future research.

First, this study focuses on macro-level paths with insufficient analysis of micro-level mechanisms. The paper emphasizes "what should be done" at a strategic level but provides limited discussion of "how to do it" at a micro level. For example, questions such as the required scale of corpora for a specialized large language model, how the model architecture should adapt to the linguistic differences between Chinese and Russian, and the technical architecture and business model of the platform have not been deeply explored. Future research can adopt engineering and economic tools to address these issues.

Second, the number of cases is limited, and representativeness needs to be enhanced. Only two cases are selected, mainly concentrated in Northeast China and the fields of trade, tourism, and energy. China-Russia cross-border cooperation also includes education, science and technology, healthcare, and other scenarios, as well as other regions such as the Xinjiang-Kazakhstan-Russia corridor. Future research should expand the scope of case studies and adopt multi-case comparative analysis to improve the external validity of the conclusions.

Third, quantitative evaluation and cost-benefit analysis are lacking. This paper does not quantitatively measure the implementation effects of the proposed paths, nor does it estimate construction costs and expected benefits. For example, the improvement in accuracy of a specialized model compared to a general-purpose model, the return on investment of platform construction, and the actual impact of policy measures all require quantitative assessment. Future research can employ methods such as cost-benefit analysis (CBA) and difference-in-differences (DID) combined with industry data for empirical evaluation.

Fourth, data access is limited, and a dynamic perspective is missing. Publicly available industry data and enterprise operational data are scarce. Moreover, this paper provides a static analysis based on the current level of digital technology and current cooperation status. Rapid iterations in generative AI, geopolitical changes, and other factors may require adjustments to some of the recommendations. Follow-up research should strengthen collaboration with industry associations and enterprises to obtain primary data and maintain a dynamic tracking perspective.

In summary, this paper has made exploratory contributions at the macro-path level, but it has limitations in micro-mechanisms, quantitative evaluation, and empirical data. These limitations point to directions for future research.

6.3 Future Outlook

In the future, with the continuous iteration of digital technology and deepening of China-Russia cooperation, follow-up research can:

- Carry out quantitative evaluation of system operation effects using real-world transaction data.
- Conduct in-depth research on cross-border language data governance, including privacy-preserving data sharing and compliance with emerging regulations (e.g., China's Data Security Law, Russia's Sovereign Internet Law).
- Explore risk prevention mechanisms for AI-generated content, such as bias detection and accountability for translation errors.
- Investigate the integration path of cross-border language services with digital trade (e.g., smart contract localization) and smart logistics (e.g., real-time multilingual tracking).
- Expand the research scope to other countries along the BRI, such as Central Asian nations, to provide comparative insights and facilitate broader cross-border language service system construction.

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