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Empowering Inbound Tourism Facilitation in Chengdu through University-Based AI Foreign-Language Services—Intrinsic Mechanisms and Realization Pathways

Yue Huang[1,*] and Lingchen Yang[1]

[1] Chengdu College of Arts and Sciences, Chengdu, China
* Correspondence: Yue Huang, Chengdu College of Arts and Sciences, Chengdu, China

Abstract: Against the backdrop of China's stepwise expansion of visa-free transit policies and the intensifying competition among destinations for inbound tourists, language services have become a critical bottleneck—and a strategic lever—for inbound tourism facilitation. This paper investigates how university-based AI foreign-language services can empower inbound tourism facilitation in Chengdu, a representative inland hub city in western China. Drawing on language service theory, the triple-helix model of collaborative innovation, prosumption theory, and the emerging emotion-economy perspective, the paper constructs a "supply chain–scenario chain–value chain" coupling framework to explain the intrinsic mechanism through which university AI foreign-language services translate linguistic resources into tourism facilitation productivity. The framework identifies three sequential mechanisms—barrier removal through information accessibility, scene co-creation through prosumption, and cultural translation through emotional resonance—embedded in the full tourist journey from pre-arrival to post-departure. On this basis, the paper proposes four realization pathways: full-chain scenario embedding, the construction of Chengdu-oriented multilingual corpora and vertical large language models, the cultivation of "foreign language + AI" composite talent and volunteer networks, and collaborative governance with human-in-the-loop quality assurance. The study extends the triple-helix model into the public-service domain of inbound tourism, enriches the theory of language service empowerment, and offers actionable implications for Chengdu's bid to become an international consumption center city and a world-class tourist destination. The proposed framework and pathways are also transferable, with contextual adaptation, to other inland hub cities seeking to convert visa-free policy traffic into sustainable tourism consumption.

Keywords: universities; artificial intelligence; foreign-language services; inbound tourism; tourism facilitation

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1. Introduction

China's inbound tourism market has entered a period of policy-driven resurgence. Since December 2024, the country's transit visa-free policy has been upgraded to 240 hours, covering 24 provinces, 60 ports, and 54 countries, forming one of the world's most liberal cross-border mobility frameworks [1]. The effect has been immediate: visa-free entries by foreign nationals rose from 1.988 million in the first quarter of 2024 to 6.57 million in the first quarter of 2025. Econometric analyses confirm that visa-free policies significantly increase inbound tourist arrivals at the city level, although the conversion from "policy traffic" to sustained visitor engagement remains uneven across destinations. As policy research emphasizes, the visa-free policy itself does not attract tourists; what truly sustains their presence is high-quality tourism supply, cultural appeal, and a convenient, language-accessible service environment.

Language is the first interface of that environment. Research on inbound tourism consistently shows that foreign visitors obtain information predominantly through online

channels, prefer independent and small-group travel, and rank humanistic experience, cuisine, and cultural depth among their top motivations [2]. Yet language barriers persist across the entire tourist journey—from pre-trip information acquisition and itinerary planning to on-site navigation, consumption, assistance in urgent situations, and post-trip sharing. Existing studies therefore call for a full-chain, multi-level language service system spanning the stages before arrival, during the stay, and after departure. What remains under-theorized, however, is who should supply such a system, through what organizational arrangement, and by what causal mechanism language services are converted into tourism facilitation outcomes.

This paper argues that local universities—particularly in inland hub cities such as Chengdu—are uniquely positioned to act as the organizational hub of AI-enabled foreign-language services for inbound tourism. Universities concentrate multilingual talent, disciplinary knowledge, and research capacity; they are increasingly embedded in regional opening-up strategies through collaborative innovation models involving government, industry, and academia, co-producing solutions aligned with user demand [3]. Meanwhile, generative artificial intelligence (AI), large language models (LLMs), and retrieval-augmented generation (RAG) have dramatically lowered the marginal cost of multilingual content production and real-time cross-lingual interaction, while simultaneously raising the premium on the high-order human capabilities that universities cultivate. The convergence of these two developments raises a theoretically and practically significant question: how can university AI foreign-language services empower inbound tourism facilitation, and through what intrinsic mechanisms and realization pathways?

Chengdu represents a critical case [4]. As the largest city in western China, a national central city, and an aviation hub with two international airports, Chengdu is covered by the 240-hour transit visa-free policy and has made the construction of an international consumption center city and a world-renowned tourist destination a strategic priority. It possesses globally recognizable cultural symbols—the giant panda, Sanxingdui gold masks, Jinsha sunbird, Sichuan opera, tea-house culture, and hot-pot cuisine—and has already experimented with AI-assisted international communication through initiatives such as the "PandaGuide" one-stop service platform for foreign nationals. Yet like many non-first-tier cities, Chengdu faces shortages of high-quality multilingual tourism services, fragmented supply among government agencies, enterprises, and universities, and a structural mismatch between foreign-language talent cultivation and real-world scenario demand. The Chengdu case thus offers both theoretical leverage—its endowments and operational conditions are representative of a broad category of inland hub cities—and practical urgency.

This paper adopts a conceptual, theory-building approach [3]. It synthesizes policy documents, empirical studies on visa-free and inbound tourism, and recent scholarship on AI in tourism and language education, and builds an analytical framework that links university AI foreign-language services to inbound tourism facilitation outcomes. The design follows the logic of abductive theory building: the framework is induced from the observed pattern—visa-free policy traffic rising while destination conversion lags—and from the documented limitations of fragmented, technology-only responses, then disciplined by established theoretical perspectives to ensure internal coherence and falsifiability. The analysis proceeds in four steps: a review of the theoretical foundations (Section 2); a diagnosis of the Chengdu context (Section 3); the construction of the intrinsic mechanism framework (Section 4); and the derivation of realization pathways (Section 5). Section 6 discusses theoretical and practical implications, and Section 7 concludes.

The paper makes three contributions [5]. First, it extends the application of the collaborative innovation model from industrial innovation to the public-service domain of inbound tourism, identifying universities as the core "capability supplier" rather than a peripheral talent donor. Second, it constructs a "supply chain–scenario chain–value chain" coupling framework that integrates prosumption theory and the emotion-economy perspective to explain the intrinsic mechanism of language service empowerment. Third,

it translates the framework into a full-chain, scenario-specific realization pathway tailored to Chengdu, offering policy implications for similar inland destinations.

2. Literature Review and Theoretical Grounding

2.1. Language Services and Inbound Tourism Facilitation

Language service is broadly defined as the use of language, linguistic knowledge, language technology, and their derivatives to meet the needs of language life. In the context of visa-free transit, language services have evolved in three stages: from instrumental assistance—including broadcasts and bilingual signage—through systematic construction involving multi-scenario multilingual service systems, to intelligent empowerment enabled by AI translation devices, multilingual platforms, and integrated digital public service infrastructure. Analysis of policy texts issued between 1994 and 2025 shows that provisions related to language services peaked in 2024, with increasing emphasis on multilingual precision, comprehensive scenario coverage, and deep technology integration; simultaneously, issuing institutions form a hierarchical network spanning immigration, culture and tourism, commerce, and local governments, reflecting strengthened cross-provincial and cross-departmental coordination [6]. A systematic weakness has also been identified: services concentrate heavily on the pre-arrival and in-stay stages, while post-departure continuity—such as feedback collection, sustained engagement, and organic word-of-mouth cultivation—remains conspicuously underdeveloped.

On the demand side, analysis of authoritative inbound tourism reports indicates that approximately 90 percent of foreign visitors obtain destination information online, 66 percent travel independently or semi-independently, 88 percent stay between four and fifteen days, and more than 60 percent originate from Asian source markets [2]. These behavioral patterns generate fragmented, mobile, and highly personalized translation needs that traditional guide-interpreting and group-tour services are ill-suited to address. In response, a collaborative innovation model for tourism translation services has been proposed, integrating government, enterprise, university, and societal stakeholders: inbound tourists serve as the demand-driven impetus for innovation; language service enterprises act as core implementers; universities contribute intellectual resources and specialized talent; and government provides strategic direction through policy frameworks and public service products.

Complementing this organizational perspective, eco-translatology has been applied to argue that destination image construction is fundamentally a process of adaptive textual and non-textual transformation across cultures: translation extends beyond language conversion to function as a bridge for cultural perception, where adaptive selection across linguistic, cultural, and communicative dimensions determines whether foreign visitors progress from merely seeing scenery to meaningfully understanding its significance [7]. International language service competence has further been conceptualized as comprising language competence, discourse competence, and technology competence, with evidence indicating that human expertise remains indispensable for high-order, creative tasks—including transcreation, management of culturally dense content, preservation of brand tonality, and deployment of creative rhetoric—even in the AI era. Collectively, these perspectives affirm that language services for inbound tourism constitute a triadic nexus: a public infrastructure, a commercial industry, and a cultural practice—none of which can be adequately sustained by any single actor in isolation.

2.2. Generative AI in Tourism, Translation, and Language Education

The rapid diffusion of large language models is reshaping tourism services across the entire value chain [8]. Systematic reviews identify applications in smart recommendation, intelligent guiding, demand forecasting, service robotics, and experience optimization, while highlighting persistent challenges in scenario adaptation, data governance, and human–machine collaboration. Generative AI has the potential to transform cultural

tourism from standardized mass production toward flexible, narrative-driven content creation—provided that structured cultural frameworks guide model outputs and human oversight mechanisms ensure authenticity and aesthetic quality. Empirical studies on AI-powered translation in tourism indicate significant improvements in travelers' cross-lingual communication and satisfaction; however, notable limitations remain in cultural mediation. Comparative evaluations show that leading large language models surpass conventional machine translation in fluency but demonstrate inconsistent performance in fidelity and cultural sensitivity when processing culture-rich tourism texts. Micro-level analyses further reveal that prompt engineering only partially mitigates these constraints, underscoring the enduring necessity of human cultural expertise within the translation process. On the operations side, large language model–based methods are already employed for daily tourist demand forecasting, reflecting AI's growing integration into destination management.

In language education, systematic reviews indicate accelerating integration of generative AI into higher-education foreign-language instruction. Documented benefits include personalized learning pathways, immediate feedback, expanded access, and enhanced communicative and collaborative competences; reported concerns encompass over-reliance, diminished opportunities for deep cognitive engagement, and risks to academic integrity—factors that necessitate pedagogical and curricular adaptation. Critically, research positions AI not as a replacement for language professionals but as an enabler: the value of human expertise increasingly centers on cultural interpretation, discourse strategy, and quality assurance—capabilities closely aligned with established competence frameworks. For inbound tourism, this suggests a functional alignment in which AI enhances accessibility at scale while university-trained specialists uphold cultural depth and service excellence. Recent implementations illustrate emerging capabilities: generative-AI–driven data analysis supports resort service optimization and responsiveness to inbound market dynamics; large language model–enabled personalization enriches urban tourism experiences; multilingual inbound tourism service platforms incorporating visual AI are being developed for foreign visitors; and cloud-based real-time translation solutions are deployed to reduce language barriers in tourism contexts. These cases affirm the technical viability of university-led service deployment while reinforcing the conclusion that technological implementation without robust cultural governance yields suboptimal outcomes [5].

2.3. Universities as Capability Suppliers in Regional Opening-Up

Higher education institutions are increasingly expected to serve regional development and national opening-up strategies. It has been observed that higher-education internationalization in China exhibits regional imbalance, with resources heavily concentrated in eastern megacities, while universities in central and western regions remain peripheral to global engagement and often lack internationalization strategies tailored to local conditions; deeper integration between universities and their regional contexts is therefore called for, along with opening-up initiatives aligned with local modernization goals. Empirical analysis of the airport hub economy in a major eastern city indicates that demand for narrowly specialized foreign-language graduates has declined sharply, whereas there is an acute shortage of innovative, interdisciplinary foreign-language professionals who combine industry knowledge, technological literacy, and cross-cultural communication competence—a structural gap particularly relevant to cities serving as tourism hubs. Research on multilingual service provision in key Silk Road regions further shows that proficiency in multiple languages—including less commonly taught languages of priority source markets—constitutes a strategic capability requiring systematic planning around both widely shared and mission-critical language sets; universities are uniquely positioned to cultivate and sustain such capabilities [9]. Collectively, these findings point to a pivotal shift: in the era of artificial intelligence, the distinctive contribution of universities to regional language services lies not in delivering basic language personnel, but in developing and maintaining the foundational corpora,

intelligent models, interoperability standards, and interdisciplinary talent essential for trustworthy, culturally grounded language technologies.

2.4. Research Gap

The literature converges on four propositions: language services are a decisive factor in converting visa-free policy traffic into tourism consumption; AI is transforming both the supply of and the demand for multilingual services in tourism, yet its cultural limitations reinforce the irreplaceable role of human expertise; universities possess the talent, knowledge, and data resources essential for regional opening-up, but their integration into city-level service systems remains insufficient; and collaborative multi-actor models are required to organize tourism translation and language services around user demand. However, existing studies treat these strands separately [10]. The organizational question—how universities, as a specific actor, deploy AI to deliver foreign-language services across the full tourist journey—and the causal mechanism linking such services to inbound tourism facilitation outcomes—remains unanswered. This gap motivates the analytical framework developed below.

3. The Chengdu Context: Momentum and Bottlenecks

3.1. Policy Momentum and Market Potential

Chengdu benefits from distinctive policy advantages and rich cultural resources [11]. Sichuan Province is included in the national transit visa-free policy, facilitating international travel and supporting efforts to boost inbound consumption. The city has established the development of an international consumption center city as a strategic priority and implemented targeted, time-bound initiatives to revitalize inbound tourism—a governance approach characterized by localized, experimental implementation. Building such centers requires professionals equipped with digital competencies, global perspectives, innovative thinking, and cross-contextual operational capabilities—competencies that higher education institutions are increasingly expected to cultivate.

Chengdu's cultural intellectual property portfolio commands broad international recognition: the giant panda as a globally resonant symbol of conservation and charm; the Sanxingdui and Jinsha archaeological sites as windows into the ancient Shu civilization; Sichuan opera, renowned for its expressive face-changing technique; and tea-house and hot-pot traditions that reflect a unique urban lifestyle. The city has advanced tangible international communication initiatives. The Sichuan International Communication Center operates the "PandaGuide" platform, which delivers multilingual services—including Chinese, English, Portuguese, French, and German—through a coordinated "1+N" framework. This system integrates provincial foreign affairs resources, employs retrieval-augmented generation (RAG) technology for intelligent, knowledge-grounded responses, and has produced over 200 practical guidance videos for international residents and visitors, complemented by offline salons and community engagement activities [12]. The 2025 Global Cross-Border Tourism (Sichuan) Conference hosted in Chengdu further underscores the city's commitment to embedding inbound tourism within the global tourism value chain. These cultural assets and operational experiments collectively form a robust foundation for developing a university-based AI-powered foreign language service system.

3.2. Practical Bottlenecks

Despite this momentum, three interlocking bottlenecks constrain Chengdu's inbound tourism facilitation. First, supply fragmentation [13]. Multilingual services are scattered across immigration and culture-tourism departments, scenic areas, transport operators, merchants, enterprises, and universities, with unclear responsibility assignments, inconsistent standards, and uneven quality—problems observed nationally and typically more pronounced in inland cities than in first-tier metropolises that have long maintained robust foreign-language service infrastructures. The result is a persistent gap between

policy intent and on-the-ground experience, particularly in small and medium service settings such as clinics, neighborhood markets, and public transport.

Second, the cultural translation gap. Existing services remain at the level of basic information translation; signage, menus, and guide texts often achieve literal accuracy while losing cultural connotation, and machine translation alone cannot adequately convey culture-rich content such as the cosmology embedded in Sanxingdui bronzes or the social aesthetics of traditional tea-house interactions. Unmediated AI output risks diluting the very cultural distinctiveness that motivates long-haul travel, while culturally insensitive communication may lead to misunderstanding.

Third, the talent–technology mismatch. Universities produce foreign-language graduates whose competencies do not align with scenario-based, technology-mediated service requirements; front-line tourism workers—including taxi drivers, shop assistants, hotel staff, and volunteers—lack systematic training in foreign languages and AI-assisted tools; and demand for single-language proficiency has significantly declined. Meanwhile, existing intelligent translation applications suffer from low adoption rates, insufficient adaptation to real-world service contexts, and weak integration between human operators and technological systems. These bottlenecks are interdependent: fragmentation raises the cost of quality assurance, the cultural gap limits the functional value of technology alone, and the talent mismatch impedes effective synergy between linguistic competence, cultural understanding, and technological capability. Together, they define the operational space where a university-based, AI-enhanced foreign-language service system can deliver targeted impact.

3.3. Why Universities: Chengdu's Comparative Advantage

Among candidate suppliers, universities offer Chengdu a distinctive bundle of advantages that neither government bureaus nor commercial platforms can replicate. Chengdu hosts one of China's largest groupings of higher-education institutions, with foreign-language programs covering English, Japanese, Korean, French, German, Spanish, and other less commonly taught languages, together with strong disciplines in tourism management, computer science, and communication—an interdisciplinary base aligned with the three-layer architecture of the service system. Universities can supply the service at marginal cost: student practicum and faculty engagement integrate teaching with service delivery, transforming budgetary allocations into educational investments. Their public accountability and cultural authority make them trustworthy stewards of cultural content and public data in ways that purely commercial actors are not. And their institutional continuity contrasts with project-based outsourcing: linguistic resources, technical standards, and trained personnel persist and accumulate, endowing the city with a durable language-infrastructure foundation rather than a series of time-limited initiatives. Cities such as Nanjing have already demonstrated the viability of aligning university foreign-language programs with hub-economy needs; Chengdu can advance this model by positioning universities as the organizational core for AI-enhanced language services supporting inbound tourism, rather than solely as a talent pipeline.

4. The Intrinsic Mechanism: A Supply–Scenario–Value Chain Coupling Framework

4.1. The Supply Architecture: The University AI Foreign-Language Service System

The university AI foreign-language service system is conceptualized as an integrated capability architecture comprising three mutually dependent layers. The resource layer includes multilingual corpora—such as tourism terminology, signage and public-service texts, cultural narratives, and frequently asked questions across source languages—as well as cultural knowledge graphs and scenario-specific data. These assets require sustained expert annotation and culturally informed judgment, capabilities uniquely supported by universities through faculty expertise, research initiatives, and student engagement [14]. The technology layer incorporates machine translation, speech recognition and synthesis, retrieval-augmented question answering, and domain-adapted large language models fine-tuned on Chengdu-specific knowledge, enabling cultural

resources to be delivered as scalable, real-time, on-demand services. The talent layer consists of "foreign language + AI" composite professionals—including students, faculty, and certified volunteers—who perform transcreation, cultural load management, corpus annotation, prompt engineering, and AI output review. The three layers correspond respectively to the corpora, tools, and people in the left-hand column of Figure 1; each is necessary but insufficient in isolation, and their synergistic integration constitutes the system's supply-side advantage over commercial platforms—which lack cultural depth and public accountability—and government agencies—which lack specialized linguistic and technical capacity.

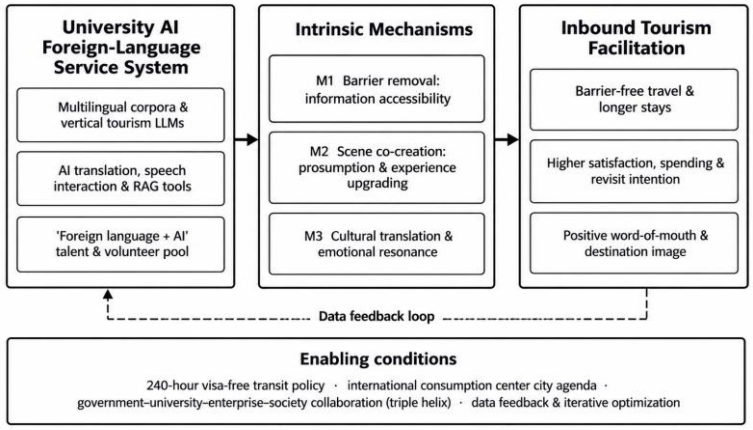


Figure 1. The Intrinsic Mechanism Framework: University AI Foreign-Language Services Empowering Inbound Tourism Facilitation in Chengdu.

4.2. Three Sequential Mechanisms

The system facilitates inbound tourism through three sequential, mutually reinforcing mechanisms that bridge supply-side capabilities with demand-side value across the tourist journey.

Mechanism 1 centers on barrier reduction via information accessibility. Foreign visitors' travel decisions and on-site behaviors are significantly influenced by the effort required to obtain and verify information. By delivering accurate, real-time, multilingual support across pre-trip planning, booking, navigation, payment, dining, and assistance scenarios, AI language services lower information search costs and mitigate uncertainty—shifting the destination perception from 'hard to understand' to 'easy to use'. Speech translation at entry points and service counters, multilingual signage aligned with unified technical standards, and AI-powered assistants handling routine inquiries reduce reliance on human interpreters and support autonomous traveler behavior—the preferred mode in today's inbound tourism market. This mechanism operates at the functional level of the tourist experience and aligns with the foundational assurance layer emphasized in national policy frameworks; its absence impedes progression to higher-order engagement, as tourists encountering difficulties with basic transactions rarely advance to cultural participation.

Mechanism 2 enables scene co-creation through prosumption. Research on scene-based economies indicates that consumption evolves when users actively contribute within thoughtfully designed environments: structured pathways linking scene development, participatory engagement, and demand enhancement; scene empowerment, collaborative interaction, and experiential enrichment; and scene value, co-creative input, and value amplification collectively shift consumption from functional adequacy toward quality, experience, and meaning. University AI language services advance this mechanism by equipping both tourists and local stakeholders—including hosts, merchants, and volunteers—with tools for collaborative content generation. Tourists contribute multilingual reviews and jointly identify language-accessible venues on shared

digital maps; student teams and visitors co-develop short videos and interpretive materials; merchants employ AI tools to describe offerings and respond to feedback. In this dynamic, tourists transition from passive recipients to active contributors, while local actors evolve from service deliverers to scene co-architects. Experience quality—not merely functional performance—becomes the primary determinant of willingness to pay, duration of stay, and spending intensity. Prosumption also yields a continuous flow of authentic multilingual content and behavioral data, enriching the system's training corpora and model refinement.

Mechanism 3 achieves cultural translation through emotional resonance. Inbound tourism increasingly functions as an emotion-driven economy, where choices follow affective alignment rather than purely rational evaluation, and where a cyclical process of stimulus, response, and reinforcement converts emotional satisfaction into repeat visits, advocacy, and broader domestic demand stimulation. Drawing on principles of eco-translatology, university AI foreign-language services fulfill a pivotal role—not through literal word-for-word rendering, but through adaptive cultural mediation. This entails transforming narratives around panda conservation, Sanxingdui bronze artifacts, traditional opera, and teahouse social customs into accessible, immersive, and personally meaningful experiences for international visitors. The university's distinctive contribution lies here: managing cultural complexity, calibrating discourse to diverse audience expectations, and integrating multimodal storytelling are high-level creative tasks where current large language models show inconsistent performance. When cultural content successfully evokes emotional resonance, it fosters identification, positive peer recommendations, and favorable destination image—the deepest tier of tourism facilitation and the strongest predictor of revisit intention and recommendation behavior. Empirical findings from stopover and heritage tourism contexts confirm that prior satisfaction and peer endorsement are decisive factors in destination selection.

4.3. Coupling Logic, Enabling Conditions, and Feedback

The three mechanisms operate sequentially and cumulatively rather than additively: accessibility serves as a necessary precondition for participation; participation generates the data and attention that fuel resonance; and resonance, in turn, stimulates demand for deeper access and re-visitation. This interdependence is conceptualized as the coupling of three chains—the supply chain (university AI foreign-language services), the scenario chain (pre-arrival, in-destination, and post-departure touchpoints), and the value chain (functional, experiential, and emotional value). Coupling implies that supply is structured around user scenarios rather than institutional convenience, and that value accumulates progressively across the tourist journey rather than being fully realized or exhausted at any single interaction point [7].

Three enabling conditions render this coupling operationally viable. First, demand and policy space: the implementation of the 240-hour visa-free policy and the development of international consumption center cities jointly generate both inbound tourist volume and institutional impetus for language infrastructure. Second, organizational coordination: collaborative engagement among government, enterprises, universities, and civil society integrates information, talent, and resources around actual tourist needs—thereby mitigating the fragmentation observed in current practice. Third, self-reinforcing dynamics: a governed data feedback loop captures tourist behavior, service interactions, and review inputs to iteratively update linguistic corpora, refine AI models, and enhance personnel training—endowing the system with destination-specific adaptive capacity absent in general-purpose AI platforms. Figure 1 summarizes the framework; two boundary conditions warrant attention: the framework assumes a minimum scale of inbound flow to justify fixed investment—which the visa-free policy now enables—and presumes sufficient governance capacity to ensure data security and cultural appropriateness, as elaborated in Section 5.4. For analytical clarity, the mechanism is formalized as three testable propositions. Proposition 1: greater information accessibility provided by university AI foreign-language services across high-frequency

scenarios reduces perceived transaction difficulty and increases the likelihood that visa-free transit visitors extend their stays and broaden consumption. Proposition 2: stronger prosumption affordances—including co-creation tools, feedback channels, and recognition mechanisms—enhance experience upgrading and willingness to pay, mediated by the tourist's transition from passive recipient to active participant. Proposition 3: higher-quality adaptive cultural translation in interpretation services strengthens emotional resonance and cultural identification, thereby reinforcing word-of-mouth promotion, destination image, and revisit intention. These propositions are sequentially nested—P2 presupposes P1, and P3 presupposes P2—yet each also exerts distinct, measurable effects, allowing the framework to accommodate tourists entering the journey at varying stages.

5. Realization Pathways

5.1. Full-Chain Scenario Embedding

The first pathway operationalizes the mechanism through the full tourist journey (Figure 2), aligning service delivery with the scenario chain identified in Section 4.3.

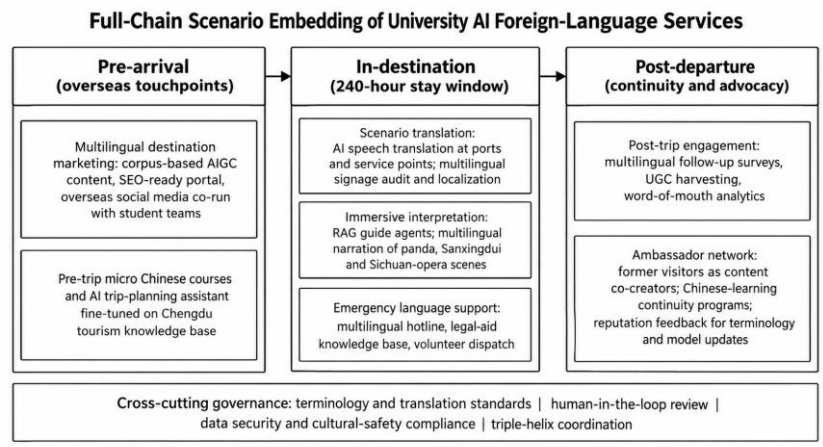


Figure 2. Full-chain Scenario Embedding of University AI Foreign-Language Services Across the Inbound Tourist Journey.

In the pre-arrival stage, universities can co-develop multilingual destination marketing initiatives with culture and tourism authorities: corpus-based AI-generated content production, search-engine-optimized multilingual portals, and overseas social media outreach managed by supervised student teams—replacing episodic, project-based publicity with continuously updated, audience-tailored communication. Pre-trip micro Chinese courses and AI-powered trip-planning assistants, fine-tuned on local knowledge bases, address information-acquisition and planning needs typical of this phase while supporting early cultural orientation to enhance the effectiveness of on-site interpretation.

In the in-destination stage—the core of the 240-hour stay window—the service portfolio should cover three tiers. At the basic-assurance tier, AI speech-translation terminals and multilingual signage audits at ports, scenic areas, hospitals, and transport nodes support barrier-free circulation, while multilingual assistance channels and accessible legal information resources provide timely support during urgent situations. At the interactive-experience tier, retrieval-augmented guide agents and AR-enabled multilingual narration enrich high-culture venues such as panda conservation bases, the Sanxingdui Museum, and Sichuan opera theaters, transforming static sightseeing into immersive, context-aware interpretation. At the deep-experience tier, theme-customized transcreation services—including tea art, culinary workshops, and intangible cultural heritage activities—facilitate culturally grounded micro-experiences that advance cultural consumption from passive observation to active understanding and participation.

In the post-departure stage, where systematic follow-up remains underdeveloped, universities can institutionalize sustained engagement through multilingual satisfaction assessments, user-generated content collection, sentiment-informed analytics, an ambassador network of former visitors for collaborative content development, and continuing Chinese language learning opportunities. These services help convert one-time transit tourists into repeat visitors and advocates, completing the experience–feedback–optimization cycle that strengthens organic promotion—the most influential factor in destination selection and extended stay decisions. Implementation should proceed in phases: a pilot year covering two or three signature scenarios—such as the airport arrival hall, a panda conservation base, and a historic district—followed by expansion guided by measured satisfaction and usage data. Performance evaluation should integrate service-side and outcome-side indicators: coverage (number of scenarios and languages served), quality (translation accuracy audits, human-review pass rates, signage compliance), engagement (usage volumes, co-created content counts, volunteer contributions), and impact (visitor satisfaction with language support, perceived ease of travel, length of stay, repeat-visit intention, and positive overseas social media mentions). Baseline measurement prior to pilot launch is essential—to establish performance benchmarks against conventional translation tools and to build an evidence foundation for resource allocation.

5.2. Chengdu-Oriented Multilingual Corpora and Vertical LLMs

The second pathway builds the data and model infrastructure on which everything else rests [1]. Guided by the principle that cultural authenticity must govern generative outputs, universities should lead the construction of a Chengdu tourism cultural gene map and story graph, covering panda ecology, ancient Shu civilization, opera and tea-house culture, cuisine, and urban lifestyle, with museum-level annotation standards and explicit provenance. On this foundation, vertical large language models and retrieval-augmented generation knowledge bases for inbound tourism should be developed and integrated into authoritative service terminals—following the "PandaGuide" precedent of combining authoritative multilingual resources with retrieval-augmented generation–based assistants.

Three design choices are critical. First, source-language configuration should be evidence-driven: rather than defaulting to English alone, corpora and services should prioritize the languages of Chengdu's dominant source markets, including less commonly taught languages, in line with multilingual-service planning principles; dynamic adjustment based on passenger-flow data can keep the portfolio aligned with demand. Second, human-in-the-loop governance must be embedded from the outset: professional review of high-stakes content (medical, legal, safety), cultural-safety screening, and bias correction, given documented risks of cultural flattening, hallucination, and algorithmic bias in large language model outputs. Third, data stewardship should remain with the public–university consortium: usage data and review corpora are strategic assets for iterative optimization, and their governance determines whether the feedback loop in Figure 1 strengthens public service or leaks value to general-purpose platforms.

5.3. Cultivating "Foreign Language + AI" Talent and Volunteer Networks

The third pathway re-engineers talent supply to ensure the human layer evolves in tandem with advances in resources and technology. Drawing on an integrated competence framework encompassing language proficiency, discourse analysis, and technological application, universities should redesign curricula around scenario-based tasks: tourism transcreation workshops, corpus construction and annotation practicum, AI-assisted interpreting exercises, and cross-cultural communication projects embedded in real-world municipal services. Such project-based learning simultaneously develops student competencies and delivers tangible community value, embodying the 'learning in service' principle widely endorsed by both educational research and industry practice [15].

Industry–university collaboration should be institutionalized through joint laboratories and practice bases established with culture and tourism authorities,

translation enterprises, scenic sites, and digital platforms, ensuring training content remains responsive to evolving operational contexts and that graduates possess immediate workplace readiness. A certified volunteer system—enrolling foreign-language students, returned overseas Chinese, international students, and faculty—can provide essential multilingual human support where AI falls short, especially in emotionally nuanced, high-stakes, or culturally sensitive interactions; robust certification protocols, standardized training frameworks, and formal recognition mechanisms—including academic service credits—are necessary to sustain participation beyond isolated engagements. Faculty development must advance concurrently: instructors' digital fluency and AI literacy fundamentally shape the upper limit of educational effectiveness, making systematic professional upskilling a prerequisite for curriculum innovation. Finally, incentive structures should formally acknowledge contributions to public service—such as corpus development, platform management, and volunteer training—within academic evaluation systems, aligning institutional performance metrics with regional societal responsibilities.

5.4. Collaborative Governance and Quality Assurance

The fourth pathway secures the institutional environment in which the first three can operate durably. A triple-helix coordination mechanism should clarify roles: government defines standards, opens application scenarios, and procures public services; enterprises operate platforms and commercialize viable products; universities supply talent, linguistic resources, research, and evaluation capacity; communities and tourists provide feedback and participatory input.

Quality assurance should rest on four pillars: unified terminology and translation standards for public signage and tourism texts, eliminating inconsistency that erodes trust; human-in-the-loop review of AI-generated content, proportionate to operational stakes; data security and personal information compliance across service platforms, with transparent consent and retention policies; and a performance evaluation system that links service quality to tourist satisfaction, word-of-mouth, length of stay, and consumption metrics rather than output volume alone. Chengdu's tradition of time-bound local measures offers a governance instrument: language-service pilots can be launched as time-limited policy sandboxes, evaluated against explicit indicators, and institutionalized or adjusted. Risk management should anticipate three failure modes—technological (model errors and hallucinations), cultural (insensitive or flattened communication), and organizational (coordination decay)—and assign each a clear mitigation owner within the coordination mechanism.

6. Discussion

This study makes theoretical contributions at three levels. Organizationally, it extends the triple-helix model from industrial innovation systems to urban public services, repositioning universities as the core capability supplier of inbound tourism language services rather than a peripheral participant; the extension is non-trivial because public-service innovation lacks the profit signal that coordinates industrial helices and must instead be coordinated by policy mandates, public procurement, and mission-driven university engagement. Mechanistically, it integrates prosumption theory and the emotion-economy perspective into language service research, proposing that the empowerment of AI foreign-language services follows a cumulative chain—from information accessibility through experiential co-creation to emotional-cultural identification; this chain explains why cities with similar visa-free endowments diverge in converting visitor traffic into consumption, and it specifies the mediating variables that future empirical work should measure. Technologically, it clarifies the division of responsibility between AI and human expertise: machines scale accessibility, while universities' irreplaceable contribution lies in cultural translation, discourse strategy, and quality governance.

Practically, the framework implies that inbound tourism facilitation should be treated as a language-infrastructure investment rather than a publicity expense [16]. Policy attention should shift from one-off campaigns to the sustained construction of corpora, models, talent, and governance; from English-centric services to evidence-based multilingual portfolios; and from arrival-stage visibility to post-departure continuity, where the largest service gap—and the largest word-of-mouth dividend—currently lies. For university administrators, the message is that foreign-language disciplines can and should reposition themselves as city-facing service infrastructures, embedding students and research in real-world scenarios. For other inland hub cities facing similar resource considerations, the Chengdu pathway suggests that universities can serve as the most cost-effective and sustainable entry point for AI-enabled language service capacity, provided that governance arrangements prevent fragmentation.

Several limitations qualify these conclusions. The framework is conceptual; its constructs—accessibility, co-creation, resonance—require operationalization and empirical testing through visitor surveys, service logs, and quasi-experimental evaluation of pilot initiatives. The analysis draws on policy and market evidence at the national scale, and Chengdu-specific micro-data on inbound visitor language needs remain scarce; future research should fill this gap with field studies. The role of source-market heterogeneity also deserves attention: the optimal language portfolio, narrative style, and even the relative weight of the three mechanisms may differ between Asian short-haul visitors and long-haul Western visitors, and the framework's propositions should be tested across segments [17]. Finally, the transferability of the pathway to cities with less developed university ecosystems or different source-market structures requires comparative study.

The framework also carries implications for theory development beyond tourism studies. By specifying how a public institution converts symbolic resources—such as language and culture—into service productivity through AI mediation, it contributes to the broader research agenda on new quality productive forces in service sectors: the 'new quality' here lies not in the technology per se but in the organizational innovation that couples technological capability with scenario demand and cultural expertise [5, 15]. Conversely, the framework cautions against technology-determinist interpretations of AI in public services: without the corpora, talent, and governance layers that universities supply, AI deployment in inbound tourism is likely to achieve accessibility without resonance—the translation without transformation.

7. Conclusion

This paper has examined how university-based AI foreign-language services support inbound tourism facilitation in Chengdu. It proposes a supply–scenario–value chain coupling framework, in which a university AI foreign-language service system—comprising multilingual corpora, AI tools, and composite talent—operates through three sequential mechanisms: barrier removal, scene co-creation, and cultural-emotional resonance, enabled by visa-free policy, triple-helix collaboration, and data feedback. Four realization pathways translate the framework into practice: full-chain scenario embedding across pre-arrival, in-destination, and post-departure stages; Chengdu-oriented corpora and vertical LLMs governed by cultural authenticity; "foreign language + AI" talent cultivation with certified volunteer networks; and collaborative governance with human-in-the-loop quality assurance. Future research should empirically test the framework through visitor surveys and service data, and explore its transferability to other inland destinations. As visa-free policies expand access to China, universities—through AI-amplified language services—can help cities like Chengdu achieve not only physical entry clearance but also deeper cultural connection.

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