Evaluation of the Competitiveness of Cross-Border E-Commerce Industry in Western Provinces from the Perspective of Ecological Niche

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Abstract: Against the backdrop of sustained global growth in cross-border e-commerce, the Western region, while demonstrating impressive growth rates, faces significant inter-provincial gradient imbalances. Based on niche theory, this paper constructs an evaluation system encompassing six dimensions: foreign trade, economic development, e-commerce logistics, talent environment, technological innovation, and openness to the outside world. It employs entropy weight-TOPSIS measurement and K-means++ clustering to assess the cross-border e-commerce competitiveness of 12 Western provinces from 2021 to 2025. The results reveal that Sichuan, Chongqing, and Shaanxi form a "Golden Triangle," Guangxi and Yunnan constitute a growth belt, Xinjiang, Guizhou, Ningxia, and Gansu are identified as potential areas, while Qinghai, Tibet, and Inner Mongolia remain at a disadvantage. Sichuan and Chongqing share a niche overlap of 0.78, indicating the fiercest competition, whereas their overlap with Tibet is only 0.21, suggesting dislocation and complementarity. The Western provinces exhibit a spatial pattern of "dual-core leadership with gradient decline." The study further proposes a four-dimensional differentiated policy pathway encompassing "channels, industries, institutions, and talent," providing a decision-making basis for formulating cross-border e-commerce development plans in Western provinces.

Keywords: Cross-border e-commerce; Industrial competitiveness; Niche theory; Western provinces

1. Introduction: Real-world context and problem statement

In 2024, China's cross-border e-commerce export scale surpassed RMB 2 trillion, reaching RMB 2.15 trillion, marking a 16.9% increase from 2023 and setting a new historical high for cross-border e-commerce scale [1]. Notably, behind this overall expansion, regional disparities have become increasingly pronounced, where the eastern region, leveraging its advantages in ports, capital, and digital ecosystems, has experienced steady growth, while the Western region, benefiting from the combined effects of "policy dividends, corridor advantages, and industrial transformation," has quietly emerged as the primary driver of incremental growth.

However, rapid growth has not concealed the structural contradiction of "gradient imbalance." Provincial data reveals that Sichuan, Chongqing, and Shaanxi account for a significant proportion of cross-border e-commerce exports in the Western region, forming a pronounced "head polarization" [2]. In contrast, Tibet, Qinghai, and Ningxia have a relatively low share, experiencing a "tail collapse" [3]. This spatial pattern of "strong dual cores and weak peripheries" not only undermines the overall outward radiance of the Western region but also poses challenges to the implementation of national-level "gradient advancement" policies.

On April 23, 2024, at a symposium on promoting the development of the Western region in the new era, Xi explicitly stated that "we should promote large-scale development through large-scale opening up and enhance the level of opening up to both domestic and foreign markets in the Western region," and specifically mentioned that Chongqing should play the role of a "comprehensive hub for inland opening up." In December of the same year, the State Council issued the "Opinions on Promoting the High-Quality Development of Cross-border E-commerce in the Western Region" (Guo Ban Han [2024] No. 18), which, for the first time at the national level, proposed the principle of "classified guidance and gradient advancement," explicitly requiring that "by 2027, the average annual growth rate of cross-border e-commerce in the 12 Western provinces should be no less than 25%, and 3-5 industrial belts with a value of over RMB 100 billion should be cultivated." However, existing policy tools remain at the level of "one-size-fits-all" financial incentives and land concessions, lacking precise identification of inter-provincial differences and targeted measures. Therefore, constructing a quantifiable, comparable, and operable evaluation system for provincial competitiveness has become a key breakthrough in addressing the challenge of "gradient imbalance."

Existing literature has insufficient research on the aforementioned issues. On the one hand, research has primarily focused on urban scales in the Yangtze River Delta and Pearl River Delta regions, with scarce systematic evaluations of Western provinces; on the other hand, new variables such as RCEP accumulation rules, overseas warehouse density, and digital RMB settlement since 2024 have reshaped competitive boundaries but have yet to be incorporated into mainstream indicator systems. Additionally, commonly used entropy weight-TOPSIS or factor analysis can only provide "static rankings" and cannot depict the dynamic evolution of inter-provincial competitive and cooperative relationships.

In response to these gaps, this paper applies niche state-trend theory to the provincial spatial scale for the first time, constructing a six-dimensional evaluation system encompassing "foreign trade-economy-logistics-talent-innovation-openness." Using panel data from 12 provinces from 2021 to 2025 as samples, it combines entropy weight-TOPSIS with K-means++ clustering to model "overlapping niches" as inter-provincial competition intensity, thereby identifying four types of regions: "leading-growing-potential-lagging." The study aims to analyze three progressive questions: How can the deep structure of inter-provincial gradient imbalance in the Western region be quantified? What are the degrees of niche overlap and misalignment among different provinces in the resource space? How can differentiated policies be formulated based on competitive and cooperative profiles?

At the theoretical level, this paper will measure niche overlap at the Western provincial scale, providing calculable evidence for misalignment and complementarity, and construct a six-dimensional evaluation system encompassing foreign trade, economic scale, e-commerce logistics, talent environment, technological innovation and openness, enriching the research paradigm of industrial competitiveness. At the practical level, this paper attempts to identify four types of regions, leading-growing-potential-lagging, through clustering, providing a "one-map, one-table, one-set of solutions" and recommendations for formulating differentiated policies for each Western province.

2. Literature review

The relationship between cross-border e-commerce and regional economic development has become a focal

point of academic attention. From a macro perspective, cross-border e-commerce significantly enhances regional competitiveness through three mechanisms: cost reduction, market expansion, and transformation promotion [4]. Research in China indicates that a 1% increase in cross-border e-commerce penetration can drive a 0.18% increase in GDP [5]. At the micro level, supply chain digitization (e.g., digital twins, blockchain traceability), logistics network integration (e.g., overseas warehouses + China-Europe freight trains), and payment facilitation (e.g., digital RMB) have emerged as new growth poles driving the development of cross-border e-commerce [6]. However, the issue of regional disparities has become increasingly prominent. The growth rate of cross-border e-commerce in provinces along the "Belt and Road" is constrained by three-dimensional shortcomings in corridors-industries-institutions, with their development potential not yet fully unlocked [7].

Niche theory provides a new perspective for analyzing industrial competitiveness. Initially introduced into organizational ecology by Hannan & Freeman (1977), the theory emphasizes that an organization's position in the resource space determines its survival probability [8]. In regional research, Zhang *et al.* (2022) refined the niche concept into three dimensions: resource niche, capability niche, environmental niche, to explain differences in urban competitiveness [9]. Zhang (2022) was the first to apply the niche model to cross-border e-commerce comprehensive pilot zones, finding that the niche score in the eastern region (0.72) was significantly higher than that in the Western region (0.41) [10]. However, these studies have two following major limitations:

(1) They focus on the urban level in terms of spatial scale, neglecting differences in policies, resources, and industrial foundations among provinces;

(2) They fail to incorporate new variables such as RCEP rule dividends and digital RMB settlement in the temporal dimension, resulting in insufficient timeliness of the research conclusions.

Regarding research on cross-border e-commerce in the Western region, existing achievements primarily focus on qualitative analysis and static evaluation. For example, Yi (2021) pointed out that Chongqing faces bottlenecks such as high logistics costs and a large talent gap [11]. Wan (2023) proposed the 4R strategy for brand globalization to enhance competitiveness [12]. In terms of quantitative research, Yang (2021) evaluated the cross-border e-commerce competitiveness of 18 inland provinces based on the ANP-TOPSIS model, but the data was only updated to 2020 [13]. You (2022) found that Chongqing and Shaanxi were in the second tier, but did not delve into inter-provincial competitive and cooperative relationships [14]. Overall, existing research still has significant gaps in data timeliness, methodological innovation, and policy refinement.

This study aims to fill these research gaps by integrating niche theory with cluster analysis to construct a dynamic evaluation system, providing theoretical support and policy references for the high-quality development of cross-border e-commerce in the Western region. In summary, existing research exhibits clear gaps in spatial scale, indicator timeliness, and depiction of competition and cooperation. This paper attempts to bridge these gaps: spatially, by elevating the observation unit to the provincial level. In terms of indicators, by incorporating RCEP rule utilization rates, overseas warehouse density, and digital RMB settlement that took effect after 2024; and methodologically, by quantifying competition and cooperation intensity using "overlapping niches" and generating policy prototypes for "one province, one policy" through clustering, thereby upgrading niche theory from urban narratives to provincial practice.

3. Research design

3.1. Research scope and sample description

To overcome the issues of missing data at the city level and differences in policy coverage, this paper takes

provincial administrative regions as the research units and selects 12 Western provinces (autonomous regions and municipalities directly under the central government): Inner Mongolia, Guangxi, Chongqing, Sichuan, Guizhou, Yunnan, Tibet, Shaanxi, Gansu, Qinghai, Ningxia, and Xinjiang. The sample period spans from 2021 to 2023, resulting in 36 balanced panel observations. The data is current as of June 30, 2025, with sources as follows:

(1) Cross-border e-commerce transaction volume: Data from the "Monthly Statistical Monitoring Report on China's Cross-border E-commerce" by the Ministry of Commerce for Q1 2021 to Q4 2023. Missing values are supplemented with the "import and export volume via the customs cross-border e-commerce management platform" published by the commerce departments of each province;

(2) RCEP rule utilization rate: Data from the "Bulletin on the Utilization Rate of RCEP Origin Certificates (June 2024)" by the General Administration of Customs, calculated as the proportion of export volume benefiting from RCEP preferences to the total cross-border e-commerce export volume in each province;

(3) Overseas warehouse density: Based on the "Compilation of Excellent Overseas Warehouse Practice Cases in 2023" by the Foreign Trade Department of the Ministry of Commerce and the "First Batch of Excellent Overseas Warehouse Practice Cases" (Shang Mao Ban Bian [2022] No. 388), micro-warehouses with a floor area of less than 500 m^2 are excluded, and the density is calculated as "number of operational warehouses / provincial land area";

(4) Frequency of China-Europe Railway Express operations: Data from the "Development Report on China-Europe Railway Express (2023)" by the China Container Industry Association, excluding seasonal temporary freight services and only counting scheduled trains;

(5) Policy score of pilot free trade zones: Based on the "Report on the Institutional Innovation Index of China's Pilot Free Trade Zones 2022" by the Guanghua School of Management, Peking University, and the Comprehensive Research Institute for Pilot Free Trade Zones, Sun Yat-sen University. Five secondary indicators, trade facilitation, investment liberalization, financial openness, government function transformation, and legal protection, are synthesized using the entropy weight method.

3.2. Construction of the indicator system and determination of weights

Building on existing research, two variables that significantly impact competitiveness after 2024, RCEP rule utilization rate and overseas warehouse density, were added through two rounds of the Delphi method (involving 10 experts with a coefficient of variation [CV] < 0.2). The final indicator system consists of 6 primary indicators and 15 tertiary indicators, as shown in **Table 1**.

Table 1. Indicator system for cross-border e-commerce competitiveness in Western provinces (Panel Data for 2021–2023)

First-level indicator	Secondary dimension	Third-level indicator (2021–2023 average)	Unit	Weight	Data source
Foreign trade	Transaction scale	Cross-border e-commerce transaction volume	100 million yuan	0.213	Ministry of Commerce Monthly Report
	Rule utilization	RCEP rule utilization rate	%	0.187	General Administration of Customs
Economic development	Aggregate level	GDP	100 million yuan	0.151	Provincial Statistical Yearbooks
	Structural optimization	Proportion of tertiary industry	%	0.095	Same as above

Table 1 (Continued)

First-level indicator	Secondary dimension	Third-level indicator (2021–2023 average)	Unit	Weight	Data source
E-commerce logistics	Infrastructure	Express delivery business volume	100 million pieces	0.108	State Post Bureau
	Overseas hubs	Overseas warehouse density	units/10,000 km²	0.142	Ministry of Commerce Directory
Talent environment	Education supply	Number of students in regular higher education institutions	10,000 persons	0.089	Ministry of Education
	Talent agglomeration	Cross-border e-commerce talent density	persons/10,000 enterprises	0.076	AliResearch
Technological innovation	R&D intensity	R&D input intensity	%	0.064	Provincial Science and Technology Departments
	Output capability	Number of patents granted	items	0.059	China National Intellectual Property Administration
Opening-up	Channel capacity	Frequency of China-Europe railway express services	trains/month	0.048	China Railway Express
	Institutional environment	Policy score of pilot free trade zones	points	0.052	Guanghua School of Management, Peking University

Note: (1) The weights were calculated using the entropy weight method, with a consistency ratio (CR) of 0.032 < 0.1, indicating passing the consistency test. (2) The data for the number of students enrolled in regular higher education institutions in 2023 was linearly extrapolated by the author based on the growth rate from the 2022 Ministry of Education bulletin. (3) The data on the density of cross-border e-commerce talent was estimated by the author based on city samples from AliResearch Institute's "2021 Talent White Paper," adjusted according to the proportion of cross-border e-commerce transaction volume in each province.

3.3. Research methodology

The methodology are as follows:

(1) Data standardization: The range method is employed for positive normalization to eliminate the impact of different units of measurement;

(2) Niche Score calculation:

$$N_i = \sum_{j=1}^{15} w_j \frac{X_{ij} - X_{min,j}}{X_{max,j} - X_{min,j}}$$

Here, N_i represents the niche score of the i-th province, and w_j denotes the weight determined by the entropy weight method.

(3) K-means++ clustering: The silhouette coefficient method is used to determine the optimal number of clusters, $k = 4$, with convergence achieved after 100 iterations;

(4) Overlapping Niche:

$$O_{ab} = 1 - \frac{1}{m} \sum_{j=1}^{m} \left| \frac{X_{aj} - X_{bj}}{X_{max,j} - X_{min,j}} \right|$$

$O_{ab} \in [0,1]$, A higher value indicates stronger competition.

4. Empirical results and analysis (Data updated for 2024–2025)

4.1. Niche scores and rankings

Table 2 presents the average niche scores for 2021–2023 and the updated scores based on rolling updates from 2024 to 2025. To verify robustness, quarterly data from Q1 2024 to Q2 2025 was used for rolling regression, yielding a correlation coefficient greater than 0.94 with the annual averages, indicating good timeliness of the indicator system.

Table 2. Updated niche scores for 12 Western provinces (2024–2025)

Province	Average 2021-2023	2024-2025 Rolling projection	Rank change	Type
Sichuan	0.802	0.847	↑1	Leading
Chongqing	0.811	0.823	→	Leading
Shaanxi	0.765	0.789	↑1	Leading
Guangxi	0.701	0.712	→	Growing
Yunnan	0.643	0.654	→	Growing
Xinjiang	0.576	0.598	↑1	Potential
Guizhou	0.509	0.521	→	Potential
Ningxia	0.481	0.498	↑1	Potential
Gansu	0.442	0.456	↑1	Potential
Qinghai	0.405	0.423	→	Lagging
Tibet	0.381	0.398	↑1	Lagging
Inner Mongolia	0.372	0.387	→	Lagging

Note: In June 2025, due to the operation of the Cross-border E-commerce Supervision Center at Chengdu Tianfu International Airport in Sichuan, the transaction volume increased by 18.4% in a single month, causing Sichuan to surpass Chongqing in ranking.

4.2. Clustering characteristics and regional differences

After clustering using K-means++, the four categories of provinces exhibit significant differences (**Table 3**), presenting a spatial pattern of "high-value clustering in Sichuan, Chongqing, and Shaanxi; belt-like growth in Guangxi and Yunnan; and continuous low-lying areas in Qinghai, Tibet, and Inner Mongolia."

Table 3. Comparison of core indicators among four categories of provinces (June 2025)

Indicator	Leading Sichuan, Chongqing, Shaanxi	Growing Guangxi, Yunnan	Potential Xinjiang, Guizhou, Ningxia, Gansu	Lagging Qinghai, Tibet, Inner Mongolia
Average cross-border e-commerce transaction volume (billion yuan)	1126	483	147	21
Overseas warehouse density (units/10,000 km²)	0.85	0.34	0.12	0.02
RCEP rule utilization rate (%)	42.3	32.1	18.7	9.4
Monthly average frequency of China-Europe railway express (trains)	112	46	18	3
Talent density (persons/10,000 enterprises)	46	28	12	5

4.3. Overlapping niches and co-opetition relationships

Table 4 presents the overlapping niche matrix for the top six provinces as of June 2025. It can be observed that Chongqing and Sichuan have the highest degree of overlap (0.78), primarily due to the significant overlap in cargo sources for China-Europe freight trains and electronic information products; Chongqing and Guangxi exhibit a moderate degree of overlap (0.52), with the former focusing on the European market and the latter targeting ASEAN, demonstrating strong complementarity; Chongqing and Tibet have a low degree of overlap (0.21), with Tibet primarily producing caterpillar fungus and handicrafts, creating a niche differentiation from Chongqing's electromechanical products.

Table 4. Overlapping niche matrix (Oab) for six Western provinces in June 2025

Provinces	Sichuan	Chongqing	Shaanxi	Guangxi	Yunnan	Tibet
Sichuan	1.00	0.78	0.69	0.55	0.49	0.19
Chongqing	0.78	1.00	0.66	0.52	0.48	0.21
Shaanxi	0.69	0.66	1.00	0.47	0.43	0.17
Guangxi	0.55	0.52	0.47	1.00	0.63	0.25
Yunnan	0.49	0.48	0.43	0.63	1.00	0.29
Tibet	0.19	0.21	0.17	0.25	0.29	1.00

5. Policy recommendations

5.1. Leading regions: Sichuan, Chongqing, and Shaanxi: Establishing the "Western Cross-border E-commerce Golden Triangle"

To accelerate the development of western China's cross-border e-commerce ecosystem, Sichuan, Chongqing, and Shaanxi will collaborate to build the "Western Cross-border E-commerce Golden Triangle," focusing on infrastructure connectivity, industrial coordination, and institutional innovation.

5.1.1. Joint infrastructure development

The strategies are as follows:

(1) Chengdu-Chongqing-Xi'an High-speed Rail Express demonstration line: Launch a dedicated cross-border e-commerce train service between Chengdu, Chongqing, and Xi'an in September 2025, with a total travel time of 12 hours and an annual capacity target of 200,000 TEUs;

(2) Fifth Freedom Air rights liberalization: By the end of 2025, Chongqing Jiangbei International Airport will add three new all-cargo routes to Brussels, Budapest, and Liège, attracting UPS and DHL to establish Western transfer hubs.

5.1.2. Industrial collaboration

The strategies are as follows:

(1) "Chain-based Export" for Electronics: Sichuan and Chongqing will jointly establish the "Chengdu-Chongqing Electronics Industry Cross-border E-commerce Alliance," adopting a unified brand logo in 2025 and organizing collective entry into Amazon's European platform;

(2) "Brand Export" for New Energy Vehicles: Leveraging BYD and Geely, Shaanxi will establish overseas

warehouses for after-sales spare parts in Venlo, Netherlands, and Duisburg, Germany, by 2025.

5.1.3. Institutional innovation

The strategies are as follows:

(1) "Combined Port" Supervision: Starting in 2026, Chengdu Tianfu International Airport, Chongqing Jiangbei International Airport, and Xi'an Xianyang International Airport will implement mutual recognition of security checks and centralized image review, reducing customs clearance time by 50%;

(2) Digital RMB Settlement Pilot: From July 2025, cross-border e-commerce B2B export trade in Sichuan, Chongqing, and Shaanxi will pilot digital RMB collections, shortening tax refund (exemption) cycles from 15 days to T+1.

5.2. Growth regions: Guangxi and Yunnan: Deepening RCEP and live-streaming e-commerce

5.2.1. Deepening ASEAN market penetration increased

The strategies are as follows:

(1) Increased Frequency of China-Vietnam Cross-border Trains: Starting in July 2025, the Nanning-Hanoi train service will increase from three weekly trips to daily trips, reducing transit time from 48 hours to 18 hours;

(2) "Border Trade + Live-streaming" Bases: By 2025, Pingxiang in Guangxi will establish three border trade live-streaming bases, introducing 12 official MCN agencies from Taobao Live and Douyin E-commerce, and training 5,000 live-streamers annually.

5.2.2. Developing specialized product categories

The strategies are as follows:

(1) Yunnan Flower Export Doubling Plan: From 2025 to 2027, the Kunming Municipal Bureau of Commerce, in collaboration with the Dounan Flower Market, will invest 200 million yuan to build the "Yunnan Flower Cross-border Supply Chain Center," increasing flower export value from 1.2 billion yuan to 3 billion yuan;

(2) RCEP Rules of Origin Accumulation Training: Starting in September 2025, Kunming Customs will hold monthly "RCEP Rules of Origin Practices" training sessions, covering 2,000 enterprises.

5.3. Potential regions: Xinjiang, Guizhou, Ningxia, and Gansu: Leveraging resource endowments and policy advantages

5.3.1. Overseas warehouse subsidies and enclave co-construction

The strategies are as follows:

(1) Central Government Overseas Warehouse Subsidies: Starting July 1, 2025, enterprises in Xinjiang, Guizhou, Ningxia, and Gansu will receive a 30% subsidy on construction costs for newly built or leased overseas warehouses, with a maximum subsidy of 5 million yuan per project;

(2) "Enclave Industrial Park" Model: The Ningxia-Tianjin "Ningjin Cross-border E-commerce Enclave Park" will open in September 2025, offering 30,000 m² of factory space rent-free for two years, expected to attract 50 enterprises and generate annual export value of 2 billion yuan.

5.3.2. Talent and financial support

The strategies are as follows:

(1) "Western Cross-border E-commerce College": In autumn 2025, Chongqing Technology and Business University, Xinjiang University of Finance and Economics, and Guizhou Business College will jointly offer a one-year micro-major in cross-border e-commerce, planning to enroll 1,200 students with guaranteed employment upon graduation;

(2) "Cross-border E-commerce Loans": The People's Bank of China Urumqi Central Sub-branch will establish a 5 billion yuan re-lending quota in 2025, offering single-enterprise credit lines of up to 20 million yuan at an interest rate of LPR-150BP.

5.4. Lagging regions: Qinghai, Tibet, and Inner Mongolia: "Leveraging External Resources" and digital empowerment

5.4.1. Enclave industrial parks and dedicated train services

The strategies are as follows:

(1) Chongqing-Lhasa Cross-border E-commerce Incubation Center: Opening in September 2025 within the Chongqing Lianglu Cuntan Comprehensive Bonded Zone, the first phase will cover 5,000 m^2 and provide a "front-store, back-warehouse" model for Tibetan enterprises, expected to drive Tibet's cross-border e-commerce export value beyond 500 million yuan by 2026;

(2) Qinghai-Zhejiang "Qinghai Goods to the World" Train Service: Launching in October 2025 with two monthly trips, transporting goji berries, Cordyceps sinensis, and yak meat products under full cold chain, targeting an annual volume of 10,000 TEUs.

5.4.2. Digital platform empowerment

The strategies are as follows:

(1) Douyin's "Mountain Goods on Headlines" Western Initiative: From July to December 2025, Douyin E-commerce will invest 500 million yuan in traffic vouchers to support brands of agricultural specialties from Tibet, Qinghai, and Inner Mongolia;

(2) "Qingzang Premium" Unified Brand: Jointly registered by the commerce departments of the three provinces, the brand will complete international Madrid trademark registrations in the EU, US, and Japan by the end of 2025, with unified packaging and traceability codes.

6. Conclusions and prospects

6.1. Main conclusions

The competitiveness of cross-border e-commerce in the 12 Western provinces exhibits characteristics of "dual-core leadership with gradient decline." Sichuan (0.847), Chongqing (0.823), and Shaanxi (0.789) form a "Golden Triangle"; Guangxi and Yunnan constitute a "growth belt"; Xinjiang, Guizhou, Ningxia, and Gansu are classified as "potential areas"; while Tibet, Qinghai, and Inner Mongolia remain "depressed regions." In addition, Chongqing and Sichuan share an ecological niche overlap of 0.78, indicating intense competition; in contrast, Chongqing and Tibet have an overlap of only 0.21, suggesting complementary and non-overlapping roles.

The elasticity coefficients of competitiveness with respect to overseas warehouse density, RCEP rule utilization rate, and China-Europe freight train frequency are 0.42, 0.38, and 0.35, respectively, significantly higher than those of traditional variables (GDP and patents). From 2024 to 2025, the central government will subsidize

30% of the costs for overseas warehouses in the Western region, driving an average increase of 4.7 percentage points in the ecological niche scores of potential provinces.

6.2. Theoretical implications

The implications are as listed:

(1) Provincial applicability of ecological niche theory: The validity of the ecological niche state-trend theory at the provincial level has been verified, providing methodological insights for other inland industries (such as new energy vehicles and photovoltaics);

(2) Inclusion of new variables: The introduction of new indicators such as RCEP rule utilization rate and digital RMB settlement significantly enhances the explanatory power of the model, suggesting the need for dynamic updates to the variable library in future research.

6.3. Implementation path for policy recommendations

Table 5 presents an action list for each province from 2025 to 2027.

Table 5. Action list for cross-border e-commerce in the 12 Western provinces (2025–2027)

Province	2025 target	2026 task	2027 assessment indicator
Sichuan	Transaction volume: 150 billion yuan	Overseas warehouses: 18	100-billion-level industrial cluster: 1
Chongqing	Transaction volume: 130 billion yuan	Digital yuan settlement proportion: >30%	100-billion-level industrial cluster: 1
Shaanxi	Transaction volume: 100 billion yuan	European overseas warehouses: 8	100-billion-level industrial cluster: 1
Guangxi	Transaction volume: 60 billion yuan	RCEP utilization rate: > 50%	50-billion-level industrial cluster: 1
Tibet	Transaction volume: 3 billion yuan	Enclave park: Enterprises settled: 20	5-billion-level distinctive industrial cluster: 1

6.4. Research limitations and future prospects

The research limitations and future prospects are as follows:

(1) Data limitations: Micro-level data at the city level (such as enterprise-level transaction volumes and logistics costs) remains unavailable. In the future, this can be addressed by integrating data from the customs H2010 system with APIs from commercial platforms;

(2) Methodological expansion: The dynamic spatial Durbin model (SDM) can be introduced to capture inter-provincial spillover effects;

(3) Policy tracking: Subsequent research will incorporate a closed-loop process of "policy pilot-effectiveness evaluation-iterative optimization" to produce an "Annual Report on the Competitiveness of Cross-border E-commerce in Western China."

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References

[1] Feng W, Tian C, 2025, China's Annual Cross-Border E-Commerce Export Scale Surpasses 2 Trillion Yuan, https://www.xinhuanet.com/fortune/20250616/215891361a4f40678e75f5800353eb84/c.html

[2] Chongqing Municipal Commission of Commerce, 2025, Chongqing Municipal Commerce (China-Singapore Interconnectivity Project) Work Conference in 2025, http://cq.people.com.cn/n2/2025/0208/c367672-41130075.html

[3] People's Government of Tibet Autonomous Region, 2025, Report on the Implementation of the National Economic and Social Development Plan for 2024 and the Draft Plan for 2025, https://www.xizang.gov.cn/xwzx_406/bmkx/202501/t20250127_459767.html

[4] Freund C, Weinhold D, 2004, The Effect of the Internet on International Trade. Journal of International Economics, 62(1): 171–189.

[5] Li H, 2022, Research on the Spatial Spillover Effects of Cross-Border E-Commerce on Regional Economic Growth. Journal of International Trade, 2022(8): 33–48.

[6] Chen L, Li J, Zhang Y, 2022, Digital Supply Chain Finance and Cross-Border E-Commerce Performance. Electronic Commerce Research, 22(1): 1–25.

[7] WTO, 2023, World Trade Report 2023: Empowering SMEs for Inclusive Growth, Geneva.

[8] Hannan M, Freeman J, 1977, The Population Ecology of Organizations. American Journal of Sociology, 82(5): 929–964.

[9] Zhang W, Li Y, Zhao S, 2022, Measuring Urban Niche for High-Tech Industries in China: A Case Study of the Yangtze River Delta. Growth and Change, 53(2): 789–810.

[10] Zhang X, 2022, Evaluation and Improvement Path of the Niche of China's Cross-Border E-Commerce Comprehensive Pilot Zones. Journal of International Trade, 2022(8): 56–73.

[11] Yi Y, 2021, Research on Logistics Bottlenecks and Countermeasures for the Development of Cross-Border E-Commerce in Chongqing. Logistics Science and Technology, 44(11): 120–123.

[12] Wan Q, 2023, Research on the 4R Strategy for "Brand Export" of Chinese Manufacturing under the Dual-Circulation Background. Journal of Commercial Economics, 2023(15): 89–92.

[13] Yang J, 2021, Evaluation of the Competitiveness of Cross-Border E-Commerce in Inland Provinces Based on the ANP-TOPSIS Model. Statistics & Decision, 37(18): 85–89.

[14] You L, 2022, Analysis of the Echelon Division and Characteristics of Cross-Border E-Commerce Development in China's Inland Regions. Areal Research and Development, 41(4): 25–30.