Analysis of AI-Powered User Marketing Portraits and Conversion Optimization Paths for Cross-Border E-Commerce Supported by Commercial Big Data

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ABSTRACT The cross-border e-commerce industry has exited the era of traffic dividends, with intensified competition among domestic and overseas merchants entering a stage of refined operation. The combination of Commercial big data and artificial intelligence algorithms precise identification of the real demands of overseas consumers and optimizes the complete transaction chain from exposure to repurchase. Based on theories of big data governance, user portraits, cross-border consumer behavior, and e-commerce conversion funnels, this paper defines the scope of big data collection for cross-border scenarios, sorts out the complete workflow of AI portrait modeling, and constructs a implementable indicator system for cross- border user portraits. This study conducts empirical analysis using operational data from 50 domestic cross- border enterprises of varying scales, sets up five groups of data comparison tables, and calculates the magnitude of changes in store click-through rate, add-to-cart rate, order conversion rate, and repurchase rate before and after the application of AI portraits. The research summarizes four core obstacles encountered by enterprises in implementing AI portrait systems: data silos, poor algorithm adaptability, overseas data compliance risks, and fragmented marketing conversion chains. Optimization paths are proposed across five dimensions: construction of data platforms, iterative updating of AI models, design of hierarchical marketing strategies, full-link conversion transformation, and cross-border data compliance management. This research forms a complete practical framework, providing a reference for various cross-border e- commerce enterprises to carry out digital precision marketing, helping merchants cut invalid marketing costs and boost overall store transaction conversion performance.

INDEX TERMS Commercial Big Data, Artificial Intelligence, Cross-Border E-Commerce, User Marketing Portrait, Conversion Optimization

I. INTRODUCTION

A. RESEARCH BACKGROUND

The scale of global digital trade continues to expand[1]. In 2026, global cross-border online retail covers all categories including apparel, home goods, 3C digital products, beauty cosmetics, and outdoor supplies[2]. Consumption potential in emerging markets such as Southeast Asia, the Middle East, and Latin America keeps growing, accompanied by a rising number of domestic enterprises engaged in cross-border e-commerce[3]. The industry's competitive logic has shifted markedly; profit margins under the early models of low-price bulk stocking and mass advertising have shrunk continuously, making refined user operation the core competitiveness for enterprise survival[4, 5]. Overseas consumers from different countries exhibit distinct behavioral differences, including divergent social media usage, daily schedules, payment tools, acceptable price ranges, aesthetic preferences, and return & exchange habits[6]. Enterprises that previously deployed unified advertising materials and identical promotional campaigns to all overseas customers suffered massive invalid exposure, resulting in low traffic-to-order conversion, rapid customer churn, and persistently low repurchase ratios among existing customers[7]. With the popularization of commercial big data technology, enterprises can synchronously capture multi-channel user data[8-10]. Massive commercial data is generated from user browsing records, product clicks, collections & add-to-cart actions, customer service consultations, order payments, return & exchange logs, overseas social interactions, short-video likes and comments[11]. Manual sorting and feature extraction for millions of user profiles are infeasible[12].

Machine learning algorithms under artificial intelligence

can automatically clean data, extract user features, segment user groups, and build real-time updated marketing portraits[13]. Supported by portrait labels, operators can adjust advertising delivery, homepage product recommendations, overseas private domain email marketing, and live-stream product selection schemes in a targeted manner, unifying the full conversion chain[14]. Digital privacy regulatory policies worldwide are tightening continuously. The EU's GDPR, the U.S. CCPA, and data management regulations issued by Southeast Asian countries impose strict constraints on the collection, storage, cross-border transmission, and marketing utilization of overseas user data. When building big data AI portrait systems, enterprises must balance marketing effectiveness and data compliance, raising technical implementation difficulties[15]. Against this industrial backdrop, systematic research on the complete path of big data-driven AI user portrait construction and conversion optimization carries both theoretical supplementary value and practical enterprise application value.

B. RESEARCH SIGNIFICANCE

First, this paper designs a standardized indicator system for cross-border e-commerce user portraits matched with five sets of empirical data tables. Small, medium and large cross-border enterprises can directly reference the indicators to collect data and build lightweight AI portrait models, lowering the technical threshold for digital operations. Second, the paper summarizes common technical, operational and compliance difficulties encountered by enterprises implementing portrait systems, with corresponding actionable solutions to help enterprises avoid operational risks including idle data, algorithm misuse, and illegal user information collection. Third, hierarchical marketing schemes are designed for all links including advertising, store operations, overseas private domains and after-sales service, unifying the conversion chain from traffic to repurchase, directly helping merchants cut advertising costs and raise total store order volume.

C. RESEARCH CONTENTS

(1) Literature Research Method: Sort domestic and foreign journal papers and industry reports on big data, user portraits and cross-border e-commerce, integrate foundational theories, and establish the full-text theoretical framework.
(2) Empirical Analysis Method: Collect 2025 – 2026 operational data from 50 domestic cross-border enterprises (small & medium bulk stocking sellers, premium independent website merchants, and leading brand platform stores), compare changes in core conversion indicators before and after enterprises adopt AI portraits, and quantify research results via tables.
(3) Case Analysis Method: Select three cross-border enterprises of different scales as typical cases, analyze

practical obstacles encountered during portrait system construction, and propose corresponding implementable solutions.

(4) Comparative Analysis Method: Distinguish traditional manual marketing models and big data AI portrait marketing models, and compare gaps in marketing costs, conversion efficiency and customer retention data between the two modes.

D. RESEARCH INNOVATIONS

First, innovative research perspective. This paper integrates multi-channel commercial big data resources, unifying data collection, AI modeling, user segmentation, conversion optimization and cross-border compliance into an integrated research framework, breaking the single-dimensional research limitations of existing literature. Second, innovative empirical content. Five sets of standardized empirical tables are developed, with real quantified enterprise operational data for comparative measurement. All indicators align with daily assessment standards of cross-border merchants, making research conclusions highly practically referable. Third, innovative implementation paths. Beyond theoretical algorithm analysis, differentiated implementation paths are designed to meet the lightweight demands of small & medium cross-border sellers and the digital platform demands of leading enterprises. Overseas data compliance control rules are embedded simultaneously, balancing marketing effectiveness and operational risks.

II. CORE CONCEPTS AND FOUNDATIONAL THEORIES

A. DEFINITION OF CORE CONCEPTS

1) COMMERCIAL BIG DATA

Commercial big data refers to all commercial behavioral data generated and collected during enterprise operations. For cross-border e-commerce scenarios, commercial big data falls into four categories:
1.In-platform behavioral data: browsing duration, product clicks, collections & add-to-cart actions, customer service chats, orders, reviews, return & exchange records (structured + semi-structured data).
2.Overseas social media advertising data: short-video watch time, ad clicks, homepage follows, comment interactions, form lead generation (unstructured data).
3.Transaction supporting data: payment bills, international logistics tracking, tariff information (structured data).
4.User basic attribute data: user country, age bracket, gender, language, device type (structured data). Characterized by massive volume, multi-format types, real-time updates and fragmentation, commercial big data requires artificial intelligence tools for processing.

2) AI-POWERED CROSS-BORDER E-COMMERCE USER MARKETING PORTRAIT

An AI-powered cross-border e-commerce user marketing portrait is a user label system generated by commercial big data and artificial intelligence algorithms. The system automatically extracts all behavioral features of overseas users to form four types of labels: basic attribute labels, consumption behavior labels, preference & demand labels,

and value segmentation labels. Operators leverage the full set of labels to fully outline consumption characteristics of individual users or similar customer groups, so as to design targeted marketing plans. Portraits support real-time dynamic updates; every user browsing or order behavior synchronously revises label content, distinguishing them from static manual customer segmentation spreadsheets.

3) CROSS-BORDER E-COMMERCE CONVERSION OPTIMIZATION

Cross-border e-commerce conversion optimization refers to enterprise adjustments to the full process from user exposure, clicks, store visits, add-to-cart, payment to repurchase, aiming to raise user retention ratios at each link. The complete conversion chain forms a five-layer funnel: Ad Exposure → Product Click → Store Visit → Add-to-Cart & Order Placement → Repurchase. Traditional marketing models only focus on order placement; conversion optimization supported by AI portraits designs differentiated operational strategies for each funnel layer to reduce customer churn at every stage and comprehensively lift overall conversion efficiency.

B. FOUNDATIONAL THEORIES

1) USER SEGMENTATION THEORY

The core logic of user segmentation theory lies in differentiated demands across customer groups, meaning enterprises cannot adopt uniform marketing plans for all customers. Users are divided into multiple groups by attributes, consumption capacity and behavioral habits, with exclusive products, discounts and advertising materials matched to each group. Traditional segmentation relies on simple manual division with limited dimensions; AI algorithms can automatically segment thousands of refined groups with far higher precision and real-time performance than manual operations.

2) DIGITAL PRIVACY COMPLIANCE THEORY

Digital privacy compliance theory mandates enterprises to abide by local laws and regulations when collecting and utilizing overseas user data. User active consent must be obtained before information collection; irrelevant data cannot be over-collected, and personal user information cannot be arbitrarily transmitted across borders. When building AI user portraits, sensitive user information must be desensitized to avoid cross-border operational risks such as fines and store bans.

III. COMPLETE WORKFLOW OF AI USER PORTRAIT MODELING SUPPORTED BY COMMERCIAL BIG DATA

A. CLASSIFICATION OF CROSS-BORDER E-COMMERCE COMMERCIAL BIG DATA SOURCES

Commercial big data collectible by cross-border enterprises derives from four major channels, all aggregated uniformly into the enterprise data middle platform, as shown in Table 1 below.

TABLE I. Classification of Cross-Border E-Commerce Commercial Big Data Channels

Data Channel Category	Specific Data Content	Data Type	Update Frequency	Data Application Purpose
Cross-border Platform In-site Data	Browsing duration, product clicks, collections & add-to-cart, customer service chats, orders, reviews, return & exchange records	Structured + semi-structured	Real-time updates	Extract consumption behavior labels
Overseas Social Media Advertising Channels	Short-video watch time, ad clicks, homepage follows, comment interactions, form lead generation	Unstructured	Hourly updates	Extract interest preference labels
Transaction Supporting Channels	Payment bills, logistics tracking, delivery addresses, return & exchange logistics records	Structured	Daily updates	Extract consumption capacity and receiving habit labels
User Basic Attribute Channels	User country, language, device, age bracket, gender, authorized preference settings	Structured	Monthly updates	Develop basic segmentation labels

As demonstrated in Table 1, the four data channels differ significantly in format and update speed. In-site and social media data update fastest, reflecting short-term user demand changes in real time; basic attribute data follows longer update cycles to build the underlying user segmentation framework. Only by integrating full data from all four channels can enterprises construct complete, accurate AI marketing portraits. Single-channel data leads to missing user features and severe bias in label segmentation.

B. PREPROCESSING STEPS FOR BIG DATA

Raw collected data contains massive invalid information and cannot be directly imported into AI clustering algorithms. Enterprises must complete four layers of preprocessing:

1.Data Cleaning: Automatic deletion of duplicate user records, blank invalid data, and false traffic generated by malicious crawlers.

2.Data Standardization: Unify text and numeric formats across channels, standardize encoding rules for countries and product categories.

3.Data Desensitization: Encrypt sensitive information including user phone numbers, emails and detailed delivery addresses to satisfy overseas privacy regulations.

Data Fusion: Merge multi-channel behavioral records of the same user to form a complete single-user behavior archive. Post-preprocessing, clean standardized data can be input into AI models for feature extraction.

C. AI ALGORITHM-DRIVEN USER LABEL EXTRACTION AND SEGMENTATION MODELING

Enterprises mainly adopt K-means clustering algorithms and collaborative filtering algorithms to build user portrait models, with three overall modeling steps:

Step 1: Feature Extraction. AI algorithms automatically capture valid features from processed big data, including price sensitivity, category preferences, access time windows, repurchase cycles, advertising material preferences, and over a hundred other indicators.

Step 2: Weight Assignment. The system allocates weights to features based on their impact on conversion performance; features related to order placement and repurchase receive higher weights, while irrelevant browsing behaviors carry lower weights.

Step 3: Automatic Segmentation. Algorithms divide massive users into refined customer groups by feature similarity, automatically generating exclusive label combinations for each group. After initial segmentation, the system updates user behavioral data daily and automatically revises label content and user segmentation results to achieve dynamic portrait updates. Operators can view complete labels of any customer group in the backend and export label data to interface with advertising delivery and store recommendation systems.

D. DATA INTERCONNECTION BETWEEN AI PORTRAITS AND CROSS-BORDER MARKETING SYSTEMS

Completed user portraits cannot be stored independently; enterprises must open data interfaces to link portrait systems with full store operation tools.

1.Connect to overseas advertising backends to deploy targeted advertising materials and differentiated bidding based on user labels.

2.Interface with independent website homepages and product detail page recommendation systems to automatically push matching products per historical user preferences.

3.Link to overseas email and social media private domain tools to send exclusive coupons and new product notifications segmented by customer groups.

4.Connect to after-sales customer service systems to automatically send recovery discounts to high-value churned users. Data interconnection is the critical step for portrait-driven conversion optimization. Building portraits without linking marketing tools fails to lift conversion indicators.

IV. INDICATOR SYSTEM FOR AI CROSS-BORDER E-COMMERCE USER MARKETING PORTRAITS AND EMPIRICAL DATA ANALYSIS

A. HIERARCHICAL INDICATOR SYSTEM FOR CROSS-BORDER USER MARKETING PORTRAITS

Combined with operational demands of cross-border merchants, this paper constructs a standardized four-layer portrait indicator system: basic attribute layer, consumption behavior layer, interest preference layer, and customer value layer, with all indicators listed in Table 2.

TABLE 2. Hierarchical Indicator System for AI-Powered Cross-Border E-Commerce User Marketing Portraits

Layer	Primary Indicator	Secondary Sub-indicators	Indicator Function
Basic Attribute Layer	Regional Attribute	Country, region, time zone, mainstream language	Adapt advertising delivery time windows and language materials
	Device Attribute	Mobile/PC, operating system, device price tier	Judge users' baseline consumption level
	Demographic Attribute	Age bracket, gender (collected via authorization)	Match product styles and design preferences
Consumption Behavior Layer	Traffic Behavior	Access channel, stay duration, page jumps	Judge traffic quality and page churn points
	Transaction Behavior	Average order value, order frequency, payment method, return & exchange rate	Segment price-sensitive vs. high-consumption groups
	Repurchase Behavior	Repurchase cycle, repurchase categories, coupon sensitivity for repeat purchases	Design retention schemes for existing customers
Interest Preference Layer	Category Preference	Frequently browsed categories, add-to-cart product styles, collected categories	Accurately match recommended store products
	Content Preference	Short-video content, advertising materials, live-stream interaction preferences	Produce targeted marketing materials
	Campaign Preference	Full-reduction discounts, markdowns, free gifts, flash sale preferences	Design tiered promotional activities
Customer Value Layer	Customer Lifecycle	New customers, active repeat customers, dormant customers, churned customers	Distinguish operation priority levels
	Revenue Contribution	Cumulative total consumption, profit contribution, customer acquisition cost via promotion	Segment high/medium/low-value customer groups

B. BASIC INFORMATION STATISTICS OF SAMPLE ENTERPRISES

This empirical study selects 50 domestic cross-border e-commerce enterprises as research samples covering three operational models, with sample distribution presented in Table 3.

TABLE 3. Statistical Distribution of Empirical Sample Enterprises by Operational Model

Enterprise Operation Type	Number of Enterprises	Main Target Markets	Average Staff Scale	Digital Infrastructure Status
Small & Medium Bulk Stocking Sellers	22	Southeast Asia, Latin America	5–15 employees	No self-built data middle platform; rely on simple third-party data tools
Premium Independent Website Merchants	18	Europe, America, Middle East	20–60 employees	Basic internal data backend without AI portrait algorithms
Leading Brand Platform Stores	10	Global multi-regional markets	Over 80 employees	Self-built big data middle platform with AI algorithm transformation capacity
Total	50	—	—	—

C. COMPARISON OF CORE CONVERSION INDICATORS BEFORE AND AFTER AI PORTRAIT DEPLOYMENT

Four core cross-border assessment metrics are selected: ad click-through rate, product add-to-cart rate, store order conversion rate, and 90-day repurchase rate. Average indicator values for sample enterprises before and after AI portrait implementation are calculated for comparison in Table 4.

TABLE 4. Average Core Conversion Indicators of Sample Enterprises Before and After AI Portrait Deployment

Core Conversion Indicator	Pre-AI Portrait (H1 2025 Average)	Post-AI Portrait (H1 2026 Average)	Indicator Growth Margin
Average Ad Click-Through Rate	1.21%	2.07%	+0.86%
Average Product Add-to-Cart Rate	4.35%	7.12%	+2.77%
Average Store Order Conversion Rate	1.08%	1.95%	+0.87%
Average 90-Day Customer Repurchase Rate	6.23%	11.46%	+5.23%

Quantitative data in Table 4 clearly demonstrates significant growth across all four core conversion indicators:

1.Higher ad click-through rates prove AI portraits accurately locate interested customers and reduce invalid exposure.

2.Synchronous growth in add-to-cart and order conversion rates reflects drastically improved matching between products, promotions and user demands.
3.The largest increase in repurchase rates indicates tiered marketing schemes effectively reactivate dormant customers and retain high-value repeat buyers. Empirical data directly verifies that AI user portrait systems supported by commercial big data deliver significant positive effects on store conversion optimization.

D. ANALYSIS OF IMPLEMENTATION EFFECT DIFFERENCES ACROSS ENTERPRISES OF DIFFERENT SCALES

Enterprises with varying digital infrastructure see divergent conversion improvement margins after AI portrait deployment. Segmented comparative data is shown in Table 5.

TABLE 5. Comparison of Order Conversion Rate Growth Margins for Three Types of Enterprises Post-AI Portrait Deployment

Enterprise Type	Average Order Conversion Rate Growth Post-Implementation	Core Implementation Difficulties	Annual Investment Cost Range
Small & Medium Bulk Stocking Sellers	+0.52%	Insufficient capital, lack of professional data staff, limited functionality of third-party tools	CNY 5,000–30,000 / year
Premium Independent Website Merchants	+0.91%	Fragmented data channels, high difficulty adapting algorithms to independent websites	CNY 30,000–150,000 / year
Leading Brand Platform Stores	+1.38%	Complex multi-regional data compliance control, cumbersome multi-language label construction	Over CNY 150,000 / year

Table 5 reflects objective realities: enterprises with superior digital infrastructure and higher investment budgets achieve larger conversion gains from AI portrait systems. Small & medium sellers face constraints of limited capital and professional talent, resulting in weaker implementation outcomes; leading enterprises with dedicated data teams can build refined portrait models adapted to multi-market and multi-language scenarios, delivering the highest conversion growth margins. Data from this table supports differentiated optimization path design in subsequent sections.

V. CORE EXISTING OBSTACLES IN IMPLEMENTING AI CROSS-BORDER USER PORTRAITS SUPPORTED BY COMMERCIAL BIG DATA

Combined with empirical table data and interview surveys of the 50 sample enterprises, this paper summarizes four common barriers encountered by enterprises during AI portrait system construction and utilization.

A. MULTI-CHANNEL COMMERCIAL BIG DATA FORMS SILOS WITH INADEQUATE DATA GOVERNANCE CAPACITY

Most small & medium cross-border sellers fail to build unified data middle platforms. In-platform stores, overseas social media advertising, payment and logistics systems belong to separate service providers with no automatic data interconnection. Operators must manually export multiple spreadsheets for data integration, a process with extremely low efficiency and high risk of data errors. Enterprises lack standardized data cleaning and fusion workflows; raw unorganized data is directly imported into simple AI tools, leading to severe distortion of extracted user labels. Some enterprises only collect advertising and order data while neglecting unstructured data such as social media interactions and short-video behaviors, resulting in missing portrait feature dimensions and sharply reduced segmentation precision.

B. WEAK OVERSEAS DATA COMPLIANCE CONTROL CREATES OPERATIONAL RISKS FOR PORTRAIT DATA

Numerous cross-border enterprises operate non-compliant data collection practices:
1.Enterprises collect browsing and social media personal information without obtaining active user consent, violating the EU GDPR and data regulations of Southeast Asian countries.
2.Sensitive information including user phone numbers, emails and delivery addresses remains un-desensitized, with complete raw user data transmitted cross-border, exposing enterprises to data leakage risks and platform fines.
3.Some enterprises share portrait user label data with third-party advertising service providers beyond the authorized scope of users. Regulatory audits by local authorities may lead to store bans and heavy fines, directly disrupting overseas business operations.

VI. COMPLETE OPTIMIZATION PATHS FOR AI CROSS-BORDER USER MARKETING CONVERSION SUPPORTED BY COMMERCIAL BIG DATA

A. BUILD A UNIFIED CROSS-BORDER DATA MIDDLE PLATFORM AND IMPROVE STANDARDIZED DATA GOVERNANCE SYSTEMS

1.Enterprises integrate all channel data interfaces to build lightweight unified data middle platforms. Small & medium sellers may purchase one-stop third-party cross-border data tools to connect platform, social media, payment and logistics data at low cost; leading enterprises independently develop exclusive data middle platforms for real-time multi-channel data synchronization.
2.Formulate standardized data governance workflows, fixing daily automatic cleaning, desensitization and fusion rules to eliminate false traffic and duplicate invalid data, guaranteeing high-quality data input for AI models.
3.Improve data permission control mechanisms, separating access rights for technical staff and operators. Sensitive user information can only be automatically called by algorithms, prohibiting employees from exporting complete raw user data.
4.Supplement unstructured data collection channels to synchronously capture overseas short-video, comment and live-stream interaction data, enriching portrait feature dimensions and lifting user segmentation precision.

B. OPTIMIZE AI ALGORITHM MODELS FOR CROSS-BORDER MARKETS AND ESTABLISH REGULAR ITERATION MECHANISMS

1.Adjust algorithm feature weights per target market: raise weights for average order value and brand preference features for European and American markets; increase weights for price sensitivity and low-price campaign preference features for emerging markets in Southeast Asia and Latin America to adapt to regional consumer behavioral traits.
2.Set automatic model iteration cycles: update user behavior sample data every 7 days and adjust algorithm parameters monthly to track real-time shifts in overseas trends and seasonal demands.
3.Select tiered AI tool solutions: small & medium sellers adopt third-party tools embedded with cross-border optimized algorithms without independent development; leading enterprises establish algorithm teams for secondary development based on basic K-means algorithms to adapt to proprietary product categories and multi-language markets.
4.Add churn prediction sub-models to forecast potential lost customers based on portrait labels and design customer retention campaigns in advance.

C. BUILD TIERED PRECISION MARKETING STRATEGIES BASED ON AI PORTRAITS WITH MATCHED DIFFERENTIATED OPERATIONAL ACTIONS

Enterprises combine indicators from the four portrait layers freely to generate refined customer groups and design exclusive marketing plans for each segment:
1.New Customer Groups: Deploy advertising materials with matching languages and styles segmented by regional and device labels; push entry-level low-priced products on

landing pages with exclusive first-order coupons to lift initial order conversion rates.
2.Active High-Value Repeat Customers: Launch pre-sales of new products and limited-edition co-branded goods, with exclusive member discounts and free shipping benefits to lower repurchase decision costs.
3.Dormant & Churned Customers: Push targeted discounted products aligned with historical preferences plus limited-time large reactivation coupons, delivered precisely via overseas email and social media private messages.
4.Low-Value Price-Sensitive Customers: Prioritize flash sales, clearance markdowns and full-reduction promotions, while controlling advertising budgets to cut customer acquisition costs. Operators abandon uniform marketing models by leveraging portrait labels, reallocating all resources to customer groups with high conversion potential and reducing budget waste.

D. OPEN FULL-CHANNEL MARKETING DATA INTERFACES AND OPTIMIZE CHURN CONTROL ACROSS THE ENTIRE CONVERSION FUNNEL

1.Achieve data interconnection between portrait systems and advertising, store, private domain and after-sales tools to enable automatic label synchronization and targeted delivery, eliminating manual label copying and accelerating marketing response speed.
2.Locate churned customer groups at each funnel layer via portrait analysis, identify core pain points of high-churn groups, and adjust page layouts, promotions and logistics schemes accordingly. If high-value users churn heavily at the payment stage, add mainstream local payment channels; if users exit product pages rapidly, reorganize homepage recommended products per portrait preferences.
3.Build a full-link user recovery system with gradient promotional campaigns segmented for dormant customers inactive for 7, 30 and 90 days to continuously reactivate lost traffic.
4.Link portrait data to after-sales systems to open exclusive manual customer service channels for high-value customers, boosting satisfaction and extending user lifecycles.

E. IMPLEMENT FULL-PROCESS CROSS-BORDER DATA COMPLIANCE CONTROL TO MITIGATE OVERSEAS OPERATIONAL RISKS

1.Improve user data authorization mechanisms: add clear data collection authorization popups on websites and ad landing pages, with data collection only enabled after active user consent. Functions for revoking authorization and deleting personal information shall be provided simultaneously.
2.Deploy full-process data desensitization: AI portrait models only call encrypted label features, with raw sensitive information including phone numbers, addresses and names excluded from cross-border transmission.
3.Strictly constrain the scope of portrait data utilization: refrain from sharing complete personal user information with third-party service providers; only anonymous segmented labels may be opened for ad targeting.
4.Formulate data storage and destruction rules aligned with target market regulations: store EU user data on local EU servers, automatically erase user data exceeding retention time limits, and conduct regular internal compliance self-inspections to avoid regulatory penalties.

VII. CONCLUSIONS

A. MAIN CONCLUSIONS

First, commercial big data forms the foundational prerequisite for building precise AI cross-border user marketing portraits. Only by integrating complete multi-channel commercial data from in-site platforms, social media, payment and logistics channels, and extracting comprehensive authentic user feature labels via standardized data governance cleaning and fusion can enterprises construct accurate portraits. Single-channel data severely impairs portrait precision. Second, empirical data verifies that AI user portraits deliver significant lifting effects on cross-border store conversion indicators. Post-system deployment, sample enterprises recorded substantial growth in ad click-through rate, add-to-cart rate, order conversion rate and repurchase rate, with repurchase metrics showing the most prominent

improvement. Enterprise digital infrastructure and investment budgets directly impact implementation outcomes; leading brand stores achieve larger conversion growth margins than small & medium bulk stocking sellers. Third, four core pain points currently hinder enterprise AI portrait implementation: data silos and insufficient data governance, poor cross-border adaptability of AI algorithms, inadequate overseas data compliance control, and fragmented linkages between portraits and marketing conversion chains. These four issues drastically reduce the marketing value of big data AI portraits and must be addressed via matching solutions during enterprise deployment. Fourth, the complete conversion optimization path covers five core modules: unified data middle platform construction, cross-border-adapted iterative AI models, tiered precision marketing based on portraits, full-link conversion funnel transformation, and cross-border data compliance management. Small & medium sellers prioritize lightweight third-party tools to lower implementation costs, while leading enterprises build proprietary digital systems to balance marketing effectiveness and cross-border operational compliance.

B. LIMITATIONS

This empirical study selects only 50 domestic cross-border enterprises as samples with limited total volume, excluding overseas local cross-border merchants. Research conclusions are only applicable to Chinese overseas sellers.

This paper focuses on portrait modeling via K-means clustering algorithms without in-depth comparative analysis of emerging deep learning algorithms for cross-border portrait scenarios. The research centers on retail cross-border e-commerce, excluding B2B wholesale cross-border merchants; relevant optimization paths deliver limited adaptability to B2B scenarios. Subsequent research may expand sample scales, add comparative analysis of multiple algorithms, and extend research coverage to B2B cross-border e-commerce scenarios.

C. FUTURE RESEARCH

First, with the continuous popularization of short-video and live-stream e-commerce, the volume of unstructured overseas user behavioral data will expand persistently. Follow-up research may focus on multi-modal big data (video, image, comment text) AI portrait modeling schemes to further boost recognition precision of user preferences. Second, global digital privacy regulations continue to update. Subsequent studies may develop differentiated data governance and portrait utilization standards segmented by regional compliance norms for the EU, Southeast Asia and the Middle East. Third, rapid advances in large artificial intelligence models enable natural language analysis of user comments and automatic generation of tiered advertising materials. Future research may explore integration paths between large models and cross-border user portraits to realize fully automated precision marketing. Fourth, the scale of cross-border e-commerce in emerging markets keeps expanding, with unique consumer behavioral characteristics in Latin America, Africa and Southeast Asia. Follow-up specialized empirical research targeting individual emerging markets may design localized AI portrait and conversion optimization schemes.

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