

Research on Cross border E-commerce Brand Internationalization Distributed Architecture and Cloud Computing Collaborative Strategy Empowered by Generative Artificial Intelligence

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Abstract: The research background focuses on the increasing demand for internationalization of global cross-border e-commerce brands. Traditional brand building models face challenges due to their difficulty in adapting to differentiated and high value-added market requirements, while generative artificial intelligence and cloud computing technologies provide new momentum for them. Previous literature has pointed out that cross-border e-commerce brand building faces problems such as brand homogenization, unclear positioning, and low marketing efficiency. At the same time, distributed architecture design lacks flexibility, and cloud computing collaboration strategies face challenges such as uneven resource scheduling and data silos. Traditional research often focuses on optimizing a single link and lacks deep collaboration mechanisms between generative AI, distributed architecture, and cloud computing. This study used a questionnaire survey to identify key indicators of brand building, combined with expert scoring method to construct an AHP indicator model for empirical analysis, and drew on top enterprise cases to propose optimization paths. The research results found that intelligent generation of brand content and precise marketing can be achieved through generative AI empowerment. Combined with distributed architecture, system scalability can be improved. By utilizing cloud computing collaboration strategies, resource scheduling and data sharing can be optimized, thus constructing an international distributed architecture for cross-border e-commerce brands empowered by generative AI. Cloud computing collaboration strategies are designed to achieve efficient resource allocation and data exchange, improving brand building efficiency and international competitiveness. Specific contributions include a brand content intelligent generation framework based on generative AI, a distributed architecture elastic extension module, a cloud computing intelligent resource scheduling algorithm, and a brand internationalization evaluation index system. The conclusion emphasizes that the research needs to deepen the theoretical framework of brand building and corporate strategy, and expand the sample size of case studies to enhance universality

1 Introduction

The research background focuses on the increasing demand for internationalization of global cross-border e-commerce brands. Traditional brand building models are difficult to adapt to the requirements of differentiated and high value-added markets. Generative artificial intelligence and cloud computing technology provide new momentum for the internationalization of cross-border e-commerce brands. In previous literature, cross-border e-commerce brand building has been plagued by issues such as brand homogenization, unclear positioning, and low marketing efficiency. Distributed architecture design lacks flexibility, and cloud computing collaboration strategies face challenges such as uneven resource scheduling and data silos. Traditional research often focuses on optimizing a single link and lacks deep collaboration mechanisms between generative AI, distributed architecture, and cloud computing. The motivation for work stems from addressing the aforementioned pain points, empowering brand content intelligent generation and precise marketing through generative AI, enhancing system scalability through distributed architecture, and optimizing resource scheduling and data sharing through cloud computing collaboration strategies. The goal of this paper is to build a distributed architecture for cross-border e-commerce brand internationalization empowered by generative AI, design cloud computing collaboration strategies to achieve efficient resource allocation and data exchange, and enhance brand building efficiency and international competitiveness. The main contributions include: proposing a brand content intelligent generation framework based on generative AI, achieving rapid customization of personalized marketing materials; Design an elastic expansion module under a distributed architecture that supports dynamic adaptation of brand operations across multiple regions and platforms; Develop cloud computing collaboration strategies, reduce operating costs and improve service response speed through intelligent resource scheduling algorithms; Build a brand internationalization evaluation index system to quantify the impact of the synergy between generative AI and cloud computing on brand value. The research content is organized around the above innovative points, forming a complete closed loop from brand content generation to distributed architecture deployment and then to cloud computing collaborative optimization, promoting the transformation of cross-border e-commerce brand construction from extensive growth to intelligent and refined, in line with the industrial upgrading trend driven by generative AI and cloud computing.

2 Correlation theory

2.1 Core Concepts and Theoretical Framework of Cross border E-commerce and Brand Building

Cross border e-commerce [1] refers to an international commercial activity in which trading entities belonging to different customs territories digitize the display, negotiation, and transaction processes of traditional import and export trade through e-commerce methods, and rely on cross-border logistics or overseas warehouse direct delivery to complete product delivery. It has the characteristics of globalization, information interactivity, paperless, multi variability, transparency, and immediacy. Its classification dimensions are diverse: according to the logistics direction, it can be divided into export cross-border e-commerce (domestic goods sold overseas) and import cross-border e-commerce (overseas goods sold domestically); According to the transaction mode, it can be divided into B2B (large single volume, few batches), B2C (small single volume, many batches), and C2C (niche, complex); According to the operation mode, it can be divided into third-party platforms (with a wide audience, complex rules, and fierce competition) and independent websites (with high user stickiness and high customer acquisition costs). Among them, B2B and B2C are the

most basic models, with B2B accounting for about 90% of the total transaction amount and B2C accounting for about 10%. Cross border e-commerce enterprises have the characteristics of non materialization, temporal and spatial freedom, convenience, diversity, and low cost: non materialization reflects the transaction attributes of online platforms, does not require physical factories, and relies on stable supply chains and logistics; The freedom of time and space allows enterprises to provide customer service at any time, and site selection focuses more on cost rather than transportation distance; Convenience improves efficiency through electronic payments and fast capital turnover; Diversity meets the demand for diverse products in segmented markets; The cost advantage comes from the price competitiveness brought by the absence of storefront rent, low personnel inventory costs, and economies of scale. Brand building[2] was pioneered by David Ogilvy and defined by the American Marketing Association as a broad symbol that distinguishes similar competitors. Moon and Millison see it as a link between customers and sellers, while Philip Kotler emphasizes its essence as an intangible asset of the enterprise - transmitting brand knowledge systems to consumers through marketing strategies to influence decision-making. Brand attributes are divided into internal (product function, service guarantee) and external (name, logo, impression). The construction process needs to visualize the product and service features and promote them to the market, promote consumer acceptance and achieve sales goals, and have three values: increasing information efficiency, reducing risks, and creating image benefits. The core elements include brand strategy, positioning, association, cognition, value, and differentiation, which need to be optimized from multiple dimensions such as asset maintenance, marketing promotion, image building, and competitiveness enhancement, and dynamically adjusted according to the characteristics of segmented markets and target customers.

2.2 Core theoretical framework for cross-border e-commerce brand building

The brand positioning theory [3] was first proposed by Jack Trout, emphasizing the unique value position in the target customer's mind through product design, service, and image shaping. Its core steps include defining segmented markets, selecting market strategies, and implementing positioning. Its role is reflected in conveying product information, providing purchase reasons, and creating experiential value. The brand value theory starts from the perspectives of labor value, neoclassical values, and stakeholders, and believes that brand value originates from the conceptual system formed by the interaction between merchants and customers. It includes both the material and cultural values obtained by enterprises through brand monopoly, as well as the functional and emotional values obtained by consumers. Its utility is manifested in reducing drainage costs, improving conversion and repurchase rates, and creating advantages in customer unit price and profit space. Brand marketing theory is guided by consumer demand and uses the 4Ps (product, price, channel, promotion)[4] and 4C (demand, cost, convenience, communication) [5] theories to achieve brand value dissemination. The strategy covers brand personality shaping, multi-channel communication, and promotion strategy optimization, aiming to establish consumer resonance and expand brand image. The theory of enterprise strategy [6] was developed by scholars such as Ansoff and H. Tavel, emphasizing that strategy is the core planning for the survival and development of enterprises, involving overall strategy (direction outline), competitive strategy (differentiation/cost leadership/centralization, etc.), and functional strategy (quality, manpower, marketing, etc.). It requires environmental analysis, goal setting, direction clarification, and implementation step planning to complete strategic construction, ultimately promoting the balance between short-term development and long-term maintenance of enterprises.

3 Research method

3.1 Challenges in the Evolution of Global Cross border E-commerce Brand Building

The construction of global cross-border e-commerce brands can be divided into four stages of development: the budding stage marked by the launch of international e-commerce platforms, the incomplete industrial chain, enterprises mostly adopting the "white label" model, and the initial emergence of independent brand awareness; The imitation period is accompanied by a surge in platforms and the influx of small and medium-sized sellers, causing the industry to fall into price wars and homogeneous competition. Infringement phenomena occur frequently, and policy regulations promoting brand transformation have become an inevitable choice; The personalized period benefits from the improvement of the logistics payment system and favorable policies. Production oriented enterprises upgrade from OEM/ODM[7] to independent brands, and the platform branding requirements and consumer personalized needs jointly accelerate the pace of brand building; During the internationalization period, the industry has entered a mature stage, and digital technology has been fully enabled. Emerging enterprises have deeply cultivated the market segment through the Internet platform, and created international brands with high-quality and professional images. The trend of brand localization and diversification is significant. The number of international registered trademarks has increased. Brand value and competitiveness have achieved leapfrog improvement. Labels such as "design", "innovation" and "quality" have gradually occupied the minds of overseas consumers. Currently, the conditions for brands to go global are becoming increasingly mature, with a mature manufacturing system and diverse product categories providing high-quality product supply for brand building. The coordinated operation of various links in the industrial chain forms an efficient ecosystem, supporting the foundation for brands to go global; Overseas consumers' attention to brands has increased, social media has become an important marketing platform, and new models such as internet celebrity marketing and live streaming sales have emerged, driving the trend of integrated marketing. However, brand building still faces challenges: the number of internationally renowned brands does not match their economic status, brand positioning is vague, localization is insufficient, marketing methods are lagging, resulting in low user stickiness, and a shortage of compound talents restricts development; The uneven quality of products affects brand image, insufficient technological content leads to weak brand strength, and the lack of international certification weakens the foundation of brand trust. Brand owners need to shift from "traffic logic" to "brand logic", achieve transformation through precise positioning, innovative marketing, and talent cultivation, while improving product quality and technological content, obtaining international certifications to enhance trust, and promoting the comprehensive improvement of brand value and competitiveness.

3.2 The three core pillars of cross-border e-commerce brand growth

Cross border e-commerce companies have achieved rapid growth and established a good reputation in the US market through clear market positioning and product strategies. The current situation of its brand building is manifested as: strict product quality control, commitment to "one bad, three compensations", multiple single products ranking in the top 20 of Amazon search popularity, forming a reliable brand image; Outstanding ability in new product development, able to quickly respond to market demand (such as the launch of sports equipment with heart and lung monitoring function during the epidemic, which became popular), and high brand innovation; Standardized brand management, registered 4 local trademarks in the United States to avoid infringement risks, stood out in the wave of Amazon store closures, and achieved sales of over 64 million yuan in 2021, with a growth rate of 74.15%.

In terms of brand building strategy, enterprises promote brand effect release and market share expansion through measures such as extending product matrix[8] (covering categories such as sportswear and luggage, forming synergies), registering brand trademarks to strengthen asset protection, actively marketing and promoting (including platform advertising, promotional activities, customer visits, and social media marketing), optimizing channel layout (expanding to platforms such as Wish and eBay, increasing social media exposure), etc., achieving healthy growth in sales expenses and net profit margin, and continuously deepening brand logic to enhance value and competitiveness.

3.3 Analysis of the Core Issues and Causes of Brand Building in Cross border E-commerce Enterprises

Cross border e-commerce enterprises face multiple challenges in the process of brand building: in terms of talent, there is a shortage of compound talents, employees need to balance multiple aspects of work, and the low threshold for industry entrepreneurship leads to a high rate of talent loss, exacerbating human resource costs and efficiency issues; At the operational level, independent brands have high R&D investment and long conversion cycles, facing price wars of counterfeit products squeezing profit margins and significant risks of cash flow pressure; In terms of operational efficiency, excessive reliance on a single platform (such as Amazon) leads to weak channel synergy, traditional advertising costs increase while conversion rates decrease, and there is insufficient investment in emerging social media marketing; In terms of customer maintenance, diversified information touchpoints increase the difficulty of precise marketing, traditional foreign trade personnel find it difficult to adapt to private traffic operations on social media, and insufficient digital level restricts customer segmentation and personalized service capabilities. The root cause of the problem lies in the prominent contradiction in talent supply (scarcity of high-level composite talents), low proportion of R&D investment (about 2% resulting in insufficient product differentiation), limited brand operation capabilities (weak adaptability to channel expansion and emerging marketing methods), and traditional customer management methods (lagging levels of digitization and intelligence). It is necessary to optimize talent structure, balance R&D investment, expand multi platform layout, and enhance digital management capabilities to solve development bottlenecks.

4 Results and discussion

4.1 Core mechanism of blockchain digital health platform

The Analytic Hierarchy Process (AHP)[9], as a multi criteria decision-making method that combines qualitative and quantitative analysis, provides scientific modeling support for complex decision-making through four steps. In the research on the optimization path of brand building in cross-border e-commerce enterprises, the indicator source adopts a triple method: through literature analysis, nearly 60 relevant studies are sorted out, and 6 primary indicators and 18 secondary indicators are extracted, including brand development and design, brand positioning, brand value, brand marketing, brand building talents, and brand distribution; Using a questionnaire survey method to cover 20 similar enterprises, 162 valid questionnaires were collected. The respondents were aged between 26 and 45 years old (68.03%), with a main working experience of 3-10 years (58.02%), covering multi-level positions from senior management to employees in the enterprise; Combining the Delphi method to invite experts to score the importance of indicators on a scale of 1-9, construct a judgment matrix $A=a_{ij}$ (where a_{ij} represents the importance of indicator i relative to indicator j , with values of 1, 3, 5, 7, 9 or their reciprocal), and normalize it using the sum product

method:

$$b_{ij} = \frac{a_{ij}}{\sum_{k=1}^n a_{kj}}$$

$$W_i = \frac{\sum_{j=1}^n b_{ij}}{n} \text{ (Formula 1)}$$

Finally determine the weight ranking of each indicator. To verify the consistency of the judgment matrix, calculate the maximum eigenvalue

$$\lambda_{max} = \sum_{i=1}^n \frac{(AW)_i}{nw_i} \text{ (Formula 2)}$$

and calculate the consistency index

$$CI = \frac{\lambda_{max} - n}{n - 1} \text{ (Formula 3)}$$

And the consistency ratio $CR = CRI$ (RI is a random consistency index that varies with the order n of the matrix), when $CR < 0.1$, the consistency of the matrix is acceptable. By quantitatively evaluating the impact of different factors on brand building, providing data support for optimizing strategies, and achieving a transition from "experience driven" to "data-driven" brand building decisions.

4.2 Model experiment

The target layer focuses on optimizing the brand building path of cross-border e-commerce enterprises. The criteria layer is divided into six primary indicators: brand design and development, brand positioning, brand value, brand marketing, brand talent, and brand distribution. The scheme layer includes 18 secondary indicators and a specific model system. Among them, brand design and development cover product appearance and functional design, category development, brand name and logo; Brand positioning includes market positioning, customer profile, and market demand; Brand value involves brand cognition, brand identity, and brand differentiation; Brand marketing includes marketing methods, marketing channels, and marketing concepts; Brand talent involves talent cultivation, talent absorption, and talent accumulation; Brand distribution includes convenient purchasing, affordable prices, and after-sales service. By using the Analytic Hierarchy Process (AHP), a 6th order judgment matrix was constructed for 6 primary indicators. The weights of each indicator were calculated using the sum product method: brand value 24.22%, brand positioning 21.35%, brand marketing 20.31%, brand talent 14.32%, brand distribution 11.46%, and brand design and development 8.33%. The consistency test showed that the CR value was $0.0118 < 0.1$, which passed the consistency test. The weights and final ranking of each secondary indicator are shown in Table 1

Table 1 Brand Elements Eigenvector and Weight Distribution

Project	Eigenvector	Weight Value
Brand Design & Development	0.5343	8.3333%
Brand Positioning	1.2812	21.3541%
Brand Value	1.4531	24.2187%
Brand Marketing	1.2187	20.3125%
Brand Talent	0.8593	14.3229%
Brand Distribution	0.6875	11.4583%

The top four primary indicators with the highest impact are brand value, brand positioning, brand marketing, and brand talent; The first eight secondary indicators are brand differentiation, market positioning, marketing methods, marketing channels, brand identity, market demand, talent acquisition, and talent cultivation. Visually present the weight distribution of each indicator. (As

shown in Table 2)

Table 2 Simplified Brand Building Metrics

Primary Indicator	Primary Weight	Secondary Indicator	Secondary Weight	Final Weight
Brand Design & Development	0.0833	Product Appearance & Function	0.3769	0.0314
Brand Design & Development	0.0833	Category Development	0.2901	0.0242
Brand Design & Development	0.0833	Name & Logo	0.3330	0.0277
Brand Positioning	0.2135	Market Positioning	0.4891	0.1044
Brand Positioning	0.2135	Customer Portrait	0.1630	0.0348
Brand Positioning	0.2135	Market Demand	0.3478	0.0743
Brand Value	0.2422	Brand Awareness	0.1048	0.0254
Brand Value	0.2422	Brand Identity	0.3495	0.0846
Brand Value	0.2422	Brand Differentiation	0.5457	0.1322
Brand Marketing	0.2031	Marketing Approach	0.4210	0.0855
Brand Marketing	0.2031	Marketing Channel	0.4172	0.0847
Brand Marketing	0.2031	Marketing Concept	0.1618	0.0329
Talent Development	0.1432	Talent Cultivation	0.3944	0.0565
Talent Development	0.1432	Talent Acquisition	0.4647	0.0665
Talent Development	0.1432	Talent Retention	0.1409	0.0202
Brand Distribution	0.1146	Purchase Convenience	0.2674	0.0306
Brand Distribution	0.1146	Price Affordability	0.4352	0.0499
Brand Distribution	0.1146	After-sales Service	0.2974	0.0341

Judgment matrix and analysis of each secondary indicator. For example, the weights of the three secondary indicators under brand design and development are 37.69% for product appearance and functionality, 29.01% for category development, and 33.30% for name and logo; The weights of the three secondary indicators under brand positioning are market positioning 48.91%, customer profile 16.30%, and market demand 34.78%. This model indicates that the brand building of cross-border e-commerce enterprises needs to start from shaping brand differentiation and creating brand identity to enhance brand value; Establish a scientific brand positioning by clarifying market positioning and meeting market demand; By utilizing appropriate marketing methods and channels, we can enhance the effectiveness of brand marketing; Relying on talent absorption and cultivation to optimize the composite talent structure of cross-border e-commerce and brand building.

4.3 Effect analysis

For enterprises, in the context of the rapid development of cross-border e-commerce industry, they need to draw experience from the brand development process of mature enterprises such as Anker and Shein. Currently, small and medium-sized cross-border e-commerce enterprises are facing shortcomings in terms of funding, talent, scale, financing, and digitalization, manifested in unclear business models, weak market competitiveness, and low digitalization levels. To achieve this, three major thinking transformations need to be realized: shifting from a sales mindset to a brand mindset, deepening vertical segmentation, improving research and development design capabilities, and utilizing new marketing models such as independent websites to accumulate private domain traffic and strengthen brand professionalism; Transitioning from extensive development to refined operation, guided by customer needs, implementing differentiated operations in consumer experience, channel marketing, value co creation, and concept dissemination to enhance customer conversion and retention; Transitioning from traditional management to digital applications, utilizing big data to analyze user behavior, cloud computing to support full chain digital operations, artificial intelligence to improve logistics efficiency and marketing conversion rates, blockchain to achieve logistics monitoring and payment optimization, thereby improving decision-making efficiency at all stages and achieving cost reduction and efficiency improvement. The specific optimization path includes: enhancing brand value to strengthen recognition, optimizing user experience through quality management, international certification, and digital technology; Clarify brand positioning to meet market demand, explore target customers through competitive environment analysis, and highlight brand differences; Integrating marketing channels to enhance brand influence, combining interactive channels such as social media, influencer marketing, and live streaming with traditional channels, and attempting to build an independent website to accumulate private domain traffic; Gathering brand talents to meet development needs, cultivating compound talents through school enterprise cooperation, improving welfare benefits to retain core talents, and attracting global talents to achieve localized operations. These measures will help X company achieve a transformation from short-term sales orientation to long-term brand value accumulation in the process of brand building, ultimately enhancing market competitiveness and brand influence.

5 Conclusion

This article is based on the perspective of optimizing cross-border e-commerce brand building, using theories such as brand positioning, brand value, brand marketing, and corporate strategy to systematically analyze the macro environment and overall status of cross-border e-commerce enterprise brand building. Identify key indicators that affect corporate brand building through questionnaire surveys, construct an AHP indicator model using expert scoring method for empirical analysis, and draw on successful cases of top companies such as Anker and Shein to propose targeted optimization paths. Specifically, it includes: enhancing brand value to strengthen recognition - designing and developing high-quality products with reliable quality to establish a good brand image, strengthening brand innovation to shape differentiation and achieve high value-added transformation, applying digital information technology to optimize the experience of front-end, logistics, after-sales and other links; Clarify brand positioning to meet market demand - fully analyze the competitive environment, explore target customers and segmented markets, and firmly implement differentiated brand strategies to enhance competitiveness; Integrate marketing channels to enhance influence - carry out global integrated marketing to attract active customer groups, build and operate independent websites to accumulate private domain traffic and improve user stickiness; Gathering brand talents to meet development needs - carrying out school enterprise cooperation to

cultivate compound talents with both theoretical and practical experience, improving welfare benefits to retain talents, and attracting and localizing global talents. In terms of research prospects, brands have a long history of going to sea, and take advantage of the development of the Internet to welcome new opportunities. During the epidemic, the cross-border e-commerce industry experienced disruptive changes, with sales growing against the trend, demonstrating the potential for international development. The brand service market is gradually forming a complete and highly market-oriented industrial ecology, and the capital boom is sweeping across upstream and downstream industries, presenting a trend of refinement, diversification, and personalization in development. Marketing methods have shifted from "product" and "category" to "social", with internet celebrity marketing[10], short videos, and live streaming sales becoming new trends; The customer acquisition method is to vertically create independent websites through segmented fields, and the DTC brand is entering a period of dividends; The operation mode tends to be localized, and the brand's overseas expansion accelerates the efficient operation of overseas localization; Products and services are gradually abandoning plagiarism and imitation, and effective customer demand based on segmented markets has become the basis for business operations, placing higher demands on supply chain control capabilities. The research shortcomings and future directions are reflected in the need to deepen literature research and theoretical framework sorting, especially in brand building, corporate strategy and related academic achievements, which need to be further understood and integrated to form a complete research system; The selection of cases has limitations. Currently, small and medium-sized cross-border e-commerce enterprises are the research objects, and their business data and structure are relatively single, which affects the universality of research results. In the future, it is necessary to expand the sample range and conduct more comprehensive and in-depth academic research on the brand building of cross-border e-commerce enterprises.

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