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The Growth Flywheel of Digital Supply Chain Enabling Cross-Border E-Commerce - The Case of SHEIN

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ABSTRACT
In the rapid development of the global digital economy, cross-border e-commerce has become an important part of international trade. The traditional cross-border e-commerce model often exists slow response speed, high inventory costs, low matching degree of user demand and other pain points. However, the company represented by SHEIN has achieved an average annual compound growth rate of over 100% with the help of digital supply chain. This paper analyzes SHEIN's closed-loop growth flywheel model centered on "user recruitment - data decision-making - supply chain response - experience optimization" through case studies. It also looks into the future and explores what the industry can learn from each other.

KEYWORDS
Digital supply chain; Growth flywheel; SHEIN; Cross-border e-commerce; Flexible supply chain

1 Background and significance of the study

Against the backdrop of the rapid development of the global digital economy, cross-border e-commerce has become an important part of international trade. According to China's General Administration of Customs, China's cross-border e-commerce import and export scale reached 2.38 trillion yuan in 2023, a year-on-year growth of 15.6%, of which exports accounted for 68.6%. At present, the traditional cross-border e-commerce model faces problems such as slow response speed, high inventory costs and low matching of user needs. However, the new generation of cross-border e-commerce enterprises represented by SHEIN has achieved an average annual compound growth rate of over 100% by reconstructing its business model through a digital supply chain. Its successful experience provides important inspiration for the operation and future model among the industry.

The digital supply chain has transformed from a linear collaboration to a dynamic and intelligent network by integrating technologies such as Internet of Things, big data analysis and artificial intelligence, etc. SHEIN has built a unique growth flywheel model based on the digital supply chain system, the core of which lies in the formation of a closed-loop mechanism by means of data-driven design, flexible production synergy and real-time logistic scheduling. This model breaks through the response bottleneck of the traditional supply chain, shortens the new product development cycle to 7 days, and increases the inventory turnover rate to 12-15 times/year, which significantly enhances SHEIN's market competitiveness. Most of the existing studies focus on a single technology application or local optimization, but lack a systematic exploration of the synergistic mechanism between digital supply chain and growth flywheel. This paper reveals the intrinsic connection between the two through case studies, providing theoretical references and practical paths for cross-border e-commerce enterprises.

2 Literature Review and Theoretical Framework

2.1 Evolution of cross-border e-commerce

The concept of cross-border e-commerce originated from the e-commerce wave in the 1990s, and the concept of "e-commerce" was first proposed byIBM in 1996, which promoted the digitalization of global trade. Early research by Zwass (1996) focused on the structural design of e-commerce and the optimization of payment systems, and with the practical exploration of the European Union market, Gomez-Herrera et al. (2014) pointed out the importance of logistics coordination and payment standardization for the development of regional cross-border e-commerce. The popularity of mobile Internet and social media has given rise to new business models, and Turban et al. (2015) emphasize the key role of social media in consumer interaction and brand communication. In recent years, Tapscott et al. (2016) and Lv (2021) have shown that the application of blockchain and AI technology further improves cross-border logistics efficiency.

Domestic research started after 2010, E Libin and Huang Yongshang (2014) defined cross-border e-commerce as a "new way of international trade", but pointed out that the policy lag restricts its development. Through empirical

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analysis, Zhang Xiaheng and Ma Tianshan (2015) found that high logistics costs and inefficient customs clearance are the main obstacles, and suggested the adoption of overseas warehouse mode. Gao Xiang and Jia Liangting (2016) identified key factors of supply chain risk based on structural equation modeling, including online marketing, payment, customs clearance, logistics and credit risk. During the Xin Guan epidemic, Chen Tinggui et al. (2022) verified the facilitating effect of the "double-cycle" policy on cross-border e-commerce B2B through a system dynamics model, emphasizing the importance of internal and external supply chain synergy.

2.2 Enabling mechanisms for digitized supply chains

The development of digital supply chain can be traced back to the transformation of information technology at the beginning of the 21st century, and early studies by Rai et al. (2012) focused on the impact of inter-firm IT capacity allocation on relationship value.Gubbi et al. (2013) proposed the application of IoT architecture in logistics tracking, which is defined as a real-time data platform with a focus on the customer by the U.S. Institute for Digital Supply Chain (2017). Zhao Xisan (2017) pointed out that the digital economy promotes the transformation and upgrading of the manufacturing industry by optimizing supply chain efficiency, and Zhang Mingchao et al. (2018) revealed the synergistic mechanism of data-driven and intelligent customization based on the perspective of supply chain duality. During the epidemic, the research focus shifted to resilience building and technology integration, Ivanov et al. (2019) proposed a digital twin model for risk simulation, and Liu, Zhiyong, and Li, Zipei (2020) designed a blockchain cross-border supply chain framework to enhance transparency. Li Qi et al. (2021) empirically found that supply chain digitization significantly improves firm performance by enhancing upstream and downstream integration, and entrepreneurship plays a positive moderating role in this process.

2.3 Application and expansion of the growth flywheel theory

The growth flywheel theory originates from the positive feedback loop of system dynamics, and the incremental revenue model proposed by Brian Arthur (1996) emphasizes the mutual promotion relationship between technology, network effect and user scale; Porter (2001) points out that the Internet technology can strengthen the synergistic effect of the value chain, and Collins (2006) systematizes the flywheel effect. Collins (2006) systematized the "flywheel effect" and argued that enterprises need to break through the growth tipping point by continuously promoting customer experience and operational efficiency. The rise of the platform economy pushes the theory to expand to the bilateral market, and the bilateral market theory constructed by Rochet and Tirole (2003) reveals the mutual promotion mechanism between the users and the supply side.Adner and Kapoor (2010) discuss the value creation in the innovation ecosystem, and Chen Weiru and Yu Zhuoxuan (2013) put forward the design of the mechanism of the platform ecosystem. In the field of fast fashion, Tokatli (2014) finds that agile supply chain, rapid new release and consumer feedback form a closed loop of growth through the case study of Zara, and Chen Yihua et al. (2021) point out that digital empowerment can reorganize the elements of manufacturing resources.

3 SHEIN's growth flywheel building mechanism

3.1 Business model deconstruction

SHEIN's business model is centered on "data-driven design, flexible supply chain and social marketing", forming a closed-loop structure of "user recruitment-data decision-making-supply chain response-experience optimization". optimization". The success of this model is not only reflected in the high-frequency of new products and the best price/performance ratio, but also in the low-cost customer acquisition brought about by the social fission effect. shein has built a set of dynamic and synergistic growth mechanisms by accurately capturing user demand, rapidly responding to market changes and optimizing user experience.

The first link is the user pulling strategy, which is the starting point of SHEIN's business model. By cooperating with small and large netizens around the world, SHEIN has formed viral spread through exclusive topics on platforms such as TikTok, and the related topics have been played more than 33 billion times. At the same time, SHEIN incentivizes users to share through a three-tier distribution system, where users receive a 10%-15% commission for sharing links, forming a spontaneous distribution network. In addition, a limited-time promotion strategy was launched in conjunction with holidays to further stimulate impulse spending.

The next step is the real-time data decision-making system, which is the core driver of SHEIN's business model. By crawling social media buzzwords and analyzing user behavior, SHEIN can accurately capture consumer preferences in order to quickly respond to market demand. SHEIN adopts a "small order, quick return" model, testing the market response through a small batch of the first order, and then deciding whether to replenish or change the model based on

real-time sales data. Moreover, its purely online sales approach allows for low-cost evaluation with pictures. For example, after putting up a dress, SHEIN observes the number of views and clicks on the pictures on the official website of the product and decides on the sales style. The combination of this model reduces the inventory backlog rate to 5%, well below the industry average of 30%. And based on dynamic pricing algorithms, SHEIN is able to adjust product prices in real time, adjusting prices based on the first day of product sales data to improve profit margins.

Supply chain responsiveness is the underlying support of SHEIN's business model. The third link is the "internalized digital supply chain system" created by SHEIN. Through the Internet of Things, big data and other technologies, it realizes the collaborative management of the whole chain within the enterprise. This system includes the "small order quick response" in the second link, as well as the digital empowerment of suppliers and the global logistics and warehousing network. shein integrates more than 4,000 small and medium-sized factories in the Panyu area, forming an agile and extensive production network. That is, the first order is produced in 100-200 pieces, and the order is returned within 7 days according to the sales data, which improves the annual inventory turnover rate. And also set up four dimensions of KPIs, which are rush picking and shipping timely rate, stocking and shipping timely rate, defective rate, and the success rate of new products, and carry out the final elimination system for the supply factories.SHEIN shortens the billing period to 7 days, and 30 days at the latest, and also provides suppliers with the ERP system and intelligent scheduling tools to achieve real-time synchronization of order, production, and quality inspection data, and shortens the response cycle of the order to 1 week. In addition SHEIN has invested a lot of money in the technological transformation of factories, such as integrating the intelligent sorting and intelligent manufacturing functions of Zhaoqing Intelligent Industrial Park, and has set up three kinds of warehouses around the world, i. e., the domestic central warehouse, the overseas transit warehouse, and the overseas operation warehouse, to shorten the delivery timeframe to 3-7 days.

Finally, the optimization of user experience is the ultimate closure of SHEIN's business model. SHEIN's user profiling system makes personalized recommendations based on customers' browsing and purchasing behaviors, and the built-in community function of its app allows users to share their outfits and communicate with each other, which increases their conversion rate by 20%. And on the logistics end, it has achieved an average delivery time of 7 days for global orders, supports real-time parcel tracking and a worry-free return policy, and the user re-purchase rate exceeds the industry average re-purchase rate, reaching 45%. This efficient fulfillment power significantly improves its user satisfaction and stickiness.

3.2 Synergies in the growth flywheel

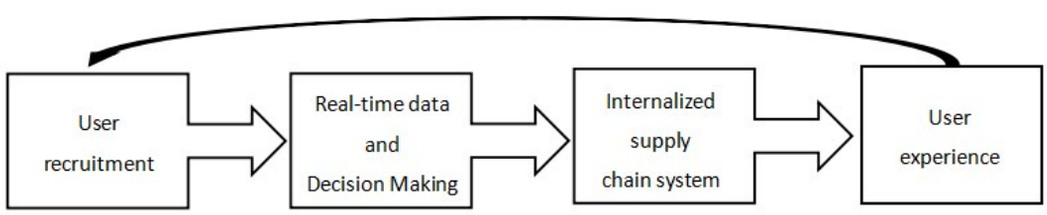

Figure 1 SHEIN Growth Flywheel Model

This closed-loop synergy of "user-data-supply chain-experience" constitutes Shein's unique growth flywheel mechanism. The expansion of user scale directly brings exponential growth of data volume, while richer data further improves the accuracy of demand prediction and makes the supply chain response more accurate and efficient. Sales growth drives the scale effect of the supply chain, and unit costs continue to fall, thus strengthening price competitiveness. The ability to quickly add new products enhances user stickiness, while the social fission effect continues to expand brand influence through spontaneous user communication. This self-reinforcing positive cycle has enabled SHEIN to achieve a GMV of $45 billion in 2023, with average monthly user visits exceeding 200 million, making it the fastest-growing fast fashion brand in the world.

4 Comparative Analysis and Industry Insight

4.1 Differences between SHEIN and traditional cross-border e-commerce

Compared with traditional cross-border e-commerce platforms, SHEIN's supply chain model has realized a paradigm shift from "economy of scale" to "economy of speed". While Amazon and other platforms rely on large-scale inventory and standardized production to reduce costs, SHEIN reduces the risk of inventory backlogs through a small-order, quick-response model. The real-time data-driven decision-making mechanism makes SHEIN much more responsive to market changes, with Zara taking 21 days to complete the design and put it on the shelves, while SHEIN takes only 7 days. The

social fission strategy has completely subverted the traditional advertising logic and greatly compressed the cost of customer acquisition.

The advantages of this model are especially evident in the cost structure, as SHEIN reduces purchasing costs by "internalizing the supply chain" and compresses inventory costs by "pre-sale + on-demand production". More importantly, SHEIN's community-based operation strategy has significantly increased user engagement, with a 45% repurchase rate, significantly higher than the average of 30% in the fast fashion industry.

Table 1 Comparison of core differences in growth flywheels between SHEIN and Amazon

Comparison dimension	SHEIN	Amazon
Core driver	Digital supply chain Socialized marketing	Platform effect Economies of scale
Supply Chain Model	Small order, quick response Flexibility of supply chains	Mass production Merchant pre-stock
Cost structure	Low inventory costs Optimization of logistics costs	High inventory costs Dependence on economies of scale
User Acquisition Method	Socialized marketing User fission	Platform traffic Prime membership
User adhesion	Personalized recommendation Social interaction	Prime membership Algorithm recommendations
Market responsivenes	Real-time data Quickly adjust merchandising strategies	Historical data Slower response

Data sources: SHEIN annual report, Amazon earnings report, Deloitte industry report (2024)

Compared to traditional cross-border e-commerce giant Amazon, Shein demonstrates significant advantages in supply chain efficiency, cost structure and user acquisition methods. For example, Shein's annual inventory turnover rate reaches 12-15 times, higher than Amazon's 8-10 times; its average delivery time is only 5-7 days, compared to Amazon's 7-14 days. These figures show that Shein's digitalized supply chain and growth flywheel model give it a strong competitive advantage.

Table 2 Comparison of SHEIN and Amazon specific data

Comparison dimension	SHEIN	Amazon
Speed of New Arrivals	New 2000+ models per day, 5-7 days design-to-shelf cycle	1-2 new releases per month, 2-3 months design-to-shelf cycle
Logistics efficiency	Average delivery time 5-7 days (central warehouse, transit warehouse, operational warehouse + real-time scheduling)	Average delivery time 7-14 days (FBA warehousing)
Annual Inventory Turnover	12-15 times	8-10 times
User Scale	Approx. 150 million monthly active users	Approx. 300 million monthly active users
Repurchase rate	60% +	/
Customer unit price	Approx. 20 USD	Approx. 35 USD
Annual Transaction Volume (2023)	Approx. 45 billion dollars	Approx. $500 billion (global e-commerce business)
Annual Growth Rate of Transaction Volume (2023)	Approx. 55.2%	Approx. 28.2%

Data sources: SHEIN annual report, Amazon earnings report, Deloitte industry report (2024)

4.2 Industry Insights and Challenges

The success of SHEIN provides three key insights for the cross-border e-commerce industry. First, technology integration must break through single-point innovation and deeply embed big data, IoT and blockchain technologies into the whole supply chain. Second, the construction of flexible supply chain needs to realize the dynamic allocation of resources through ecological cooperation, rather than relying solely on its own assets. Finally, social marketing should shift from traffic thinking to value thinking, focusing on the long-term asset-based operation of user-generated content.

However, this model also faces a triple challenge. The contradiction between the fast-fashion model and environmental protection demands is becoming more and more prominent, geopolitical risk poses a threat to globalized operations, and algorithm-driven precision marketing may raise concerns about user privacy. To address these challenges, SHEIN has initiated systemic changes: investing in a photovoltaic plant to achieve carbon neutrality, shortening the delivery cycle through localized operations, and attempting to replicate a regional supply chain system in Brazil, Turkey,

and elsewhere. These initiatives show that SHEIN is transforming from "efficiency-first" to "value-first".

5 Conclusion and Outlook

Taking SHEIN as an example, this study thoroughly explores how digital supply chain empowers the growth flywheel mechanism of cross-border e-commerce. By analyzing SHEIN's business model, supply chain synergy effect, and comparison with traditional cross-border e-commerce companies, the study reveals the core role of digital supply chain in enhancing market responsiveness, optimizing cost structure, and enhancing user stickiness. The study not only provides theoretical references for cross-border e-commerce enterprises, but also practical insights into the future development direction of the industry.

By integrating the Internet of Things, big data analysis and artificial intelligence, the digital supply chain breaks the linear collaboration mode of the traditional supply chain and builds a dynamic intelligent network. Relying on this technological system, SHEIN has formed a closed-loop mechanism of "user recruitment - data decision-making - supply chain response - experience optimization". SHEIN relies on this technology system to form a closed-loop mechanism of "user recruitment-data decision-making-supply chain response-experience optimization". This mechanism significantly improves the speed of market response, and forms a self-reinforcing positive cycle through the data growth brought by the expansion of user scale, accurate data-driven prediction, fast response of supply chain and continuous optimization of user experience, thus enhancing the market competitiveness. However, the sustainability of the fast fashion model, geopolitical risks and technological ethical issues remain major challenges for the industry.

Looking ahead, technology integration and supply chain resilience will become an important direction for research, and how SMEs can realize digital transformation of the supply chain under resource-constrained conditions is also a key issue to promote the overall upgrading of the industry. In addition, the impact of cross-cultural consumer behavior differences on social marketing strategies deserves in-depth study. Differences in consumer preferences, social media habits and cultural backgrounds in different markets will directly affect the globalization operation strategies of brands. By accurately analyzing these differences, companies can formulate more targeted marketing programs to enhance the competitiveness of their brands in multicultural environments. The in-depth exploration of these research directions will not only further deepen the understanding of digital supply chain and cross-border e-commerce, but also provide new theoretical support and practical guidance for the sustainable development of the industry.

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