

Live Streaming in Cross-Border E-Commerce: A SICAS-Based Analysis of Consumer Behavior in a Small Enterprise

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Abstract: This study investigates the role of live streaming-as an emerging digital information system-in cross-border e-commerce through a case study of a Chinese-operated small enterprise based in Japan. Drawing on the SICAS (Sense-Interest & Interactive-Connect & Communicate-Action-Share) consumer behavior model, I analyze the firm's operational workflow and conduct a quantitative analysis of transactional data using Python to profile consumer purchasing patterns. The findings reveal that live streaming significantly enhances product presentation through real-time interactivity and sustained seller-customer communication. Moreover, the integration of Key Opinion Leaders (KOLs) into live sales events fosters stronger consumer loyalty. However, challenges persist, particularly in post-purchase service delivery due to international logistics complexities and limited capacity for customer acquisition beyond existing networks. This research advances the understanding mobile-era consumer behavior in digital cross-border contexts and provides actionable insights for small enterprises leveraging live commerce platforms in global markets.

1. Introduction

Cross-border e-commerce has long served as a key channel for international trade, but it has recently been transformed by the integration of live streaming-a dynamic, interactive digital format that enables real-time product demonstration, instant feedback, and immersive consumer engagement. This innovation has gained remarkable momentum in China: in 2020, the live commerce market reached USD 147.26 billion, reflecting a year-on-year growth of 121.5% [1]. By 2021, live streaming had become a dominant force during major shopping festivals, with platforms like Taobao Live generating over RMB 130 billion in gross merchandise value (GMV) during Double 11 alone [2].

As an emerging information system embedded within social commerce ecosystems, live streaming offers cross-border retailers-especially small and medium enterprises (SMEs)-a low-cost yet high-engagement channel to showcase foreign products, build trust, and convert digital attention into measurable economic outcomes, even in the absence of physical presence.

While live commerce has been widely studied in domestic settings, its role in cross-border contexts-particularly among resource-constrained SMEs operating across regulatory and cultural boundaries-remains underexamined. To address this gap, this study focuses on a Chinese-operated

SME based in Japan and leverages transaction and platform interaction data from a three-month window spanning one month before and two months after the launch of its live streaming initiative. By comparing key performance and behavioral metrics across this period, we identify the primary drivers of consumer engagement and purchasing decisions. Using quantitative analysis, I map these patterns onto the SICAS model (Sense–Interest & Interactive–Connect & Communicate–Action–Share), thereby elucidating how live streaming reshapes consumer behavior and operational dynamics in cross-border e-commerce for SMEs navigating global markets through digital platforms.

2. Literature Review

Cross-border e-commerce (CBEC) enables consumers to purchase goods from foreign sellers via digital platforms, effectively transcending geographical barriers [3]. However, this model introduces heightened uncertainty compared to domestic e-commerce—stemming from unfamiliarity with overseas products, sellers, and regulatory environments [4] [5] [6]. Reducing such uncertainty is critical for fostering trust and purchase intention in CBEC contexts. In this regard, trust is not only shaped by platform design but also by alternative quality cues—such as influencer endorsements and transparent fulfillment policies—which help mitigate perceived risk in cross-border transactions [7].

Live commerce—a real-time, interactive format combining entertainment and sales—has emerged as a potent mechanism to mitigate these risks. Drawing on Rogers’ (2010) Diffusion of Innovations theory, live streaming enhances relative advantage (e.g., instant Q&A), compatibility (with mobile shopping habits), trialability (via live demonstrations), and observability (through shared viewer experiences), thereby accelerating consumer adoption [8]. Moreover, its interactive nature aligns with the concept of IT affordances: features such as visibility (product close-ups), Meta voicing (real-time comments), and guidance (host recommendations) directly shape purchase intentions in social commerce settings [9] [10].

Crucially, the live environment often triggers impulsive responses. Visual and social stimuli—such as limited-time offers or real-time audience reactions—activate emotional arousal, leading to immediate purchase actions, as explained by the stimulus-organism-response (SOR) framework [11].

A key enabler of trust in this context is the Key Opinion Leader (KOL). Unlike traditional advertising, KOLs leverage parasocial relationships and perceived authenticity to influence cross-border purchase decisions [12] [13]. Their endorsements serve as credible signals that offset information asymmetry, particularly when consumers lack direct experience with foreign brands. This process is further amplified by social learning: consumers observe others’ interactions and purchases during live sessions, reducing uncertainty through vicarious experience [14].

Furthermore, the rise of live streaming reflects broader shifts in retail toward experiential and real-time engagement. Under the “new retail” paradigm, consumer behavior is increasingly shaped by seamless integration of online interaction, community participation, and instant fulfillment—factors that live commerce uniquely embodies [15].

Despite growing interest in live commerce, most studies focus on domestic markets. The unique dynamics of cross-border live streaming—where cultural distance, logistics delays, and platform fragmentation amplify uncertainty—remain underexplored. Existing frameworks like AIDMA or AISAS inadequately capture the iterative, community-driven nature of live interactions. In contrast, the SICAS model (Sense–Interest & Interactive–Connect & Communicate–Action–Share) better reflects the cyclical engagement patterns observed in live streaming, where sharing and re-engagement continuously feed back into awareness and purchase [16]. This study thus adopts SICAS as its analytical lens to examine how live streaming reshapes consumer behavior in a resource-constrained cross-border SME setting.

3. Material and Methods

3.1 Material

3.1.1 Fieldwork overview

This study is based on sales data from a Chinese-operated small and medium enterprise (SME) located in Osaka, Japan. The analytical period spans November, 2020, to January, 2021, covering one month before and two months after the launch of live streaming. This design enables a comparative analysis of consumer behavior across pre- and post-intervention phases.

The SME launched its cross-border e-commerce business on October 28th, 2020, using the WeChat Mini Program as its primary sales platform. Live streaming commerce was introduced on December 7th, 2020 -approximately five weeks after market entry-marking the key intervention point for this study.

When the enterprise intended to sell via live streaming, the pre-sale product list was completed one day in advance. Following consultation with Key Opinion Leaders (KOLs, the KOLs who called ‘Da V (big VIPs’) in China, have over three million followers on Chinese social media Sina Weibo) who were invited by the SME, the final sell list was determined. Three hours before live streaming commenced, a selection of items was listed on the online store and the link was established. The WeChat group sent a notice to consumers who could subscribe to it.

All transactions were automatically recorded in the firm’s ERP system, generating a timestamped sales log. Orders were processed within 24 hours (after the cancellation window closed), with fulfillment typically handed over to an international logistics provider within four business days. Post-purchase, consumers were encouraged to share their experiences on social media and could earn loyalty points for doing so.

This live streaming way is that combines e-commerce platforms with social media. Most KOLs already have a large number of followers on their accounts at other social media. Therefore, there is no need to further launch the live streaming function on the e-commerce platform. The standard procedure involves first inviting high-follower KOLs to host live broadcasts on social media. Subsequently, the audience is guided to click on shopping links, which redirect them to an e-commerce app or website to complete the purchase.

3.1.2 Procedure for data analysis

In this study, all raw data was automatically generated by an ERP management system (“Online Store manager”) and extracted from two primary tables: the order table and the logistics table. The order table contains, purchase time, product category, unit price, sales volume, total sales amount, and delivery address. The logistics table contains, recipient address, national identification number (used solely for demographic inference under anonymized processing), and dispatch timestamp.

The order data is grouped and aggregated by the groupby of the pandas lib in Python. The analysis begins by acquiring commodity category data. The core step involves parsing delivery addresses with the open-source cpca library to extract geographic distribution (province/city) data. To determine the suitable correlation method, following outlier removal, the analysis culminates in calculating the P-value and Spearman’s rank correlation coefficient to quantify and interpret the data correlations.

Because the epidemic has affected the inability of goods to be sent on time and the consolidation of the same consumer's orders, there is a big difference between the total number of logistics data and the order data. There used Python's datetime lib to extract birthday information from the sixth to fourteenth digits of the ID card number in the logistics table. At the same time, the gender information is extracted from the last digit or the penultimate digit of the ID card. In this way, the age and gender

distribution of consumers are obtained.

3.2 Conceptual Framework: The SICAS Model

Traditional consumer behavior models-such as the AIDA model proposed by Lewis (1898)-were developed prior to the rise of social media and emphasize a linear, one-way flow of information from marketer to consumer [17]. In 2005, Dentsu Inc. of Japan introduced the AISAS model; subsequently, with the further evolution of the internet, newer frameworks such as SIPS emerged. However, in the context of live streaming commerce-characterized by real-time interaction, co-creation, and user-generated sharing-these models still fall short in adequately capturing the cyclical and participatory nature of contemporary consumer behavior.

The SICAS model, proposed by the Data Center of China Internet (DCCI), offers a more suitable framework for analyzing consumer behavior in social commerce environments. It conceptualizes the journey as five interconnected stages: Sense, Interest & Interactive, Connect & Communicate, Action, and Share. Unlike earlier models, SICAS explicitly incorporates bidirectional communication and post-purchase dissemination as integral components of the conversion funnel.

Notably, the SICAS model includes the Action stage-a critical differentiator from the Dentsu's SIPS model (Sympathize-Identify-Participate-Share), which omits actual purchase behavior and thus cannot adequately link engagement to sales outcomes in commercial contexts (Table 1) .

In cross-border live streaming, this model is particularly relevant:

Sense: Consumers are exposed to products through KOL broadcasts, social feeds, or group notifications.

Interest & Interactive: Real-time Q&A, polls, and comments foster immediate engagement during the stream.

Connect & Communicate: Post-interaction, consumers may join brand communities (e.g., WeChat groups) for ongoing dialogue.

Action: Purchase occurs via embedded links, often within minutes of product demonstration.

Share: Satisfied buyers voluntarily share unboxing experiences or reviews on social media, generating organic reach.

Table 1. The Change of Consumer Behavior Model

Model	Stages					
AIDA, 1898	Attention	Interest	Memory	Action	-	
AISCS, 2005	Attention	Interest		Search	Action	Share
SIPS, 2011	Sympathize		Identify	Participate		Share& Spread
SICAS, 2011	Sense	Interest & Interactive		Connect & Communicate	Action	Share

3.3 Methods

For analyzing the influencing factors of consumer behavior, the dimensional structure of retail consumer behavior must be divided. Based on consumer perceptions, the SICAS model regards consumer behavior from five dimensions (Table 2), including achieving linkage with consumption (inducing consumers) and creating products and services needs for consumers (inspiring interest). This paper will measure consumer behavior in these five areas where data permit and attempt to find the influencing factors for each measurable stage.

Table 2. The Stage of Consumer Behavior Based on the SICAS Model

SICAS	Stage
Sense	Inducing consumers
Interest and Interactive	Inspiring interest
Connect and Communicate	Persuading to purchase
Action	Ordering to purchase
Share*	Feedback reviews

The Share stage-encompassing voluntary user behaviors such as posting reviews, sharing experiences, or referring friends on social media-cannot be measured, as the ERP system does not capture any post-purchase dissemination metrics, nor is there integration with external social platforms.

Therefore, based on the SICAS model, the aim of this research is to survey the online consumer population of the company. The analysis focuses on two research questions:

Does live streaming play a role in the promotion of cross-border e-commerce for small-scale enterprises?

What exactly is directing consumption? Does the price still affect sales?

4. Results

Based on the SICAS model, the enterprise created an online platform for retailer and consumer to sense each other and to connect them at any time and in any place, network wide.

As shown in Figure 1, daily sales remained low in November 2020 (pre-live streaming). After December 2020, by utilizing live streaming twice weekly by the KOL, the visibility of the online store was enhanced, which resulted in rapid sales growth. In the days where there was live streaming by the KOL, the average daily turnover was approximately 10,700 USD. At the same time, there was a significant difference between sales on non-live days and on live streaming days.

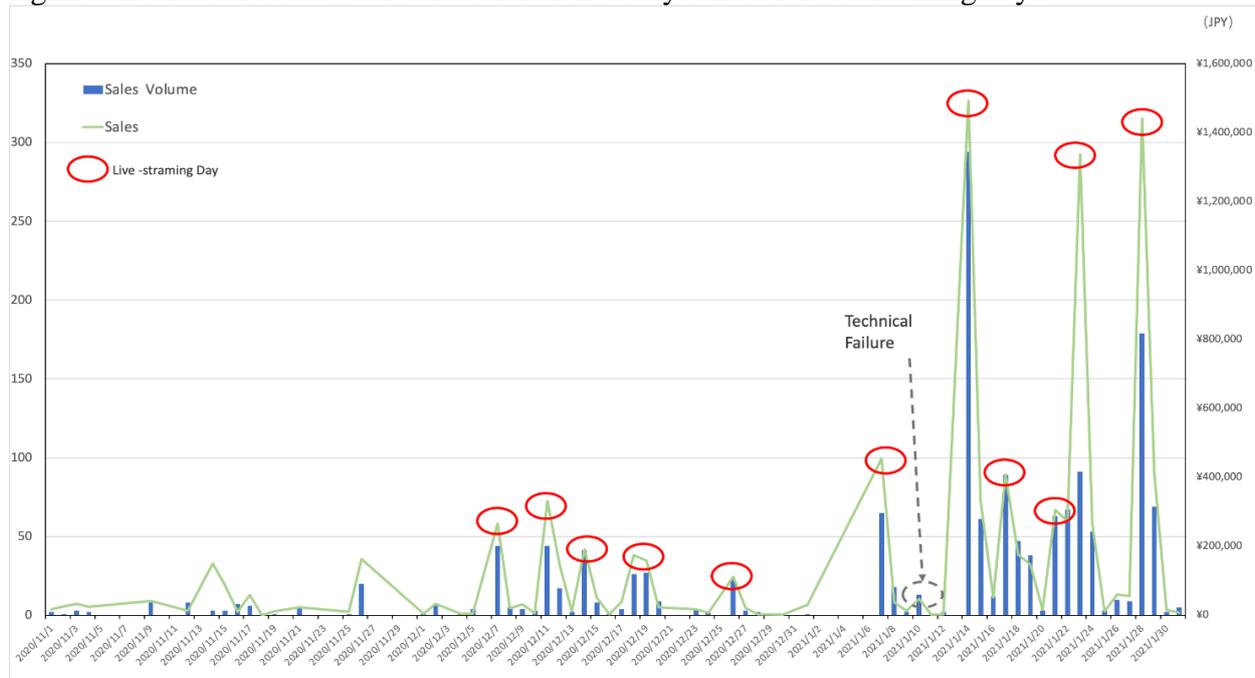


Figure 1. Daily Sales and Sales Volume (November 2020 – January 2021)

In addition, live streaming sales are not stable, as demonstrated by the data from January 2021 in

particular. This is because every sale is not the same item. Therefore, sole reliance on KOLs for attracting customers does not directly lead to sale conversions. Sensing consumer induction and choosing which products to sell are key factors for increasing sales.

From the perspective of categories (Figure 2), alcoholic beverages, personal care, health food, and accessories accounted for 81% of total sales. However, sales of alcoholic beverages were special in comparison to other products. It was close to the Lunar New Year, and special offers were available, so consumers purchased alcoholic beverages in quite large quantities. In addition, the alcoholic beverage that was sold was Japanese whisky and certain types of Japanese whisky are difficult to find in China. Pushing information about products consumers were interested in via the WeChat group and setting up selling points enabled the rapid inspiration of consumer interest. Alcoholic beverages went on sale in January and were set as selling points, which intuitively reflects this.

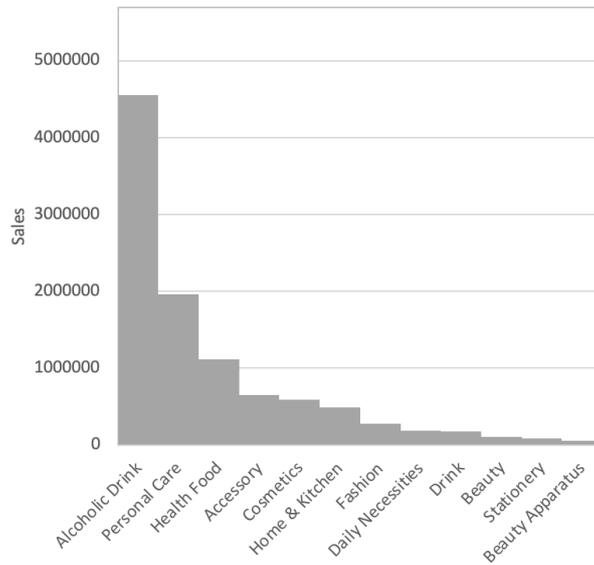


Figure 2. Perspective of Categories

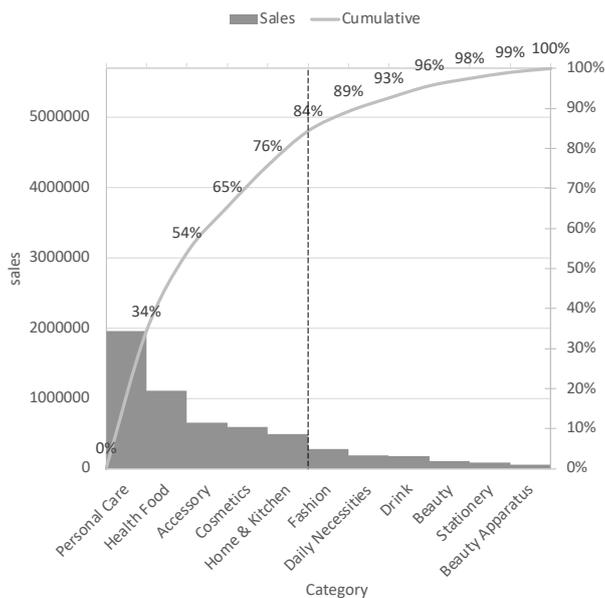


Figure 3. Sales Pareto Chart

Table 3. Descriptive Statistics for Sales Volume and Price (n = 227)

	Quantity	Price (USD)
Mean	6.81057269	724.769761
Median	3	308.75
Standard Deviation	20.6914602	1265.24265
Kurtosis	114.734198	33.5349831
Skewness	9.82885161	5.19468347
Minimum	1	27.55
Maximum	267	10575.4
Sum	1546	164522.736

So, after removed the data on alcoholic beverages, according to the cumulative percentage chart (Figure 3), the top three product categories (Personal Care, Health Food, and Accessory) account for 65% of total sales, and the top five product categories account for 84% of total sales.

Based on the descriptive statistical values of sales and sales volume (Table 3), it appears that the quantity and price data are highly variable and skewed to the right, with a few very large values that are skewing the data. Further analysis, need to examine the distribution of the data or investigating outliers.

Figure 4 visualizes several outliers in the data, corresponding to special promotions and high-value orders. Descriptive statistics (Table 3) reveal that both price and sales volume are highly right-skewed (skewness = 5.19 for price; 9.83 for quantity) with extreme kurtosis, indicating a non-normal distribution dominated by a few large values.

Given these characteristics, Spearman's rank correlation—a non-parametric measure robust to outliers and monotonic but non-linear relationships—was used to assess the association between price and sales volume.

As shown in Table 4, a weak but statistically significant negative correlation was observed ($\rho = -0.134$, $p = 0.042$), suggesting that higher-priced items tend to sell in slightly lower quantities. However, the small magnitude of the correlation coefficient implies that price alone explains only a limited portion of sales variation; other factors such as product category, live streaming timing, or product scarcity likely play more substantial roles.

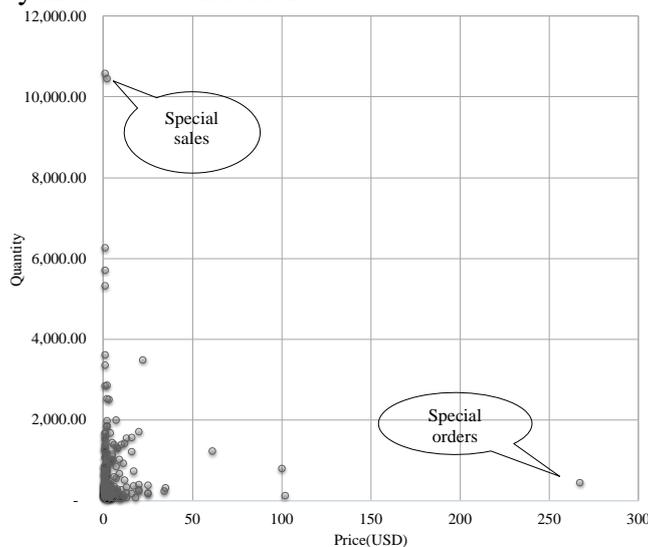


Figure 4. Scatter Plot (price (USD) vs sales volume)

Table 4. Spearman’s Rank Correlation between Price and Sales Volume

	Price	Sales volume
Price	1.0000	-0.1339*
Sales volume	-0.1339*	1.0000

* $p < 0.05$

Geographically, customer orders originated from 28 provinces across China. The top five cities by order volume were Shanghai, Shenzhen, Shantou, Wuhan, and Guiyang. Based on the Yicai City Index, orders from first-tier and new first-tier cities accounted for 42% of the total, while those from second- and third-tier cities represented 35% (Figure 5). This demonstrates that the customer base extends beyond major metropolitan centers.

Figure 6 presents the estimated age distribution of customers based on anonymized identification data. The majority of purchasers appear to fall within the 30–50 age range, with relatively fewer in their 20s. No pronounced gender disparity was observed in the transactional sample. Although the collaborating KOLs primarily attract a middle-aged audience, this study does not empirically examine the alignment between influencer follower demographics and actual customer profiles.

Figure 7 is a graph showing consumer purchase frequency. From 571 samples, it was found that almost 20% of consumers purchased more than twice. On average, each person made 1.32 purchases during 12 live stream selling sessions. There was one consumer that made eight purchases in two months.

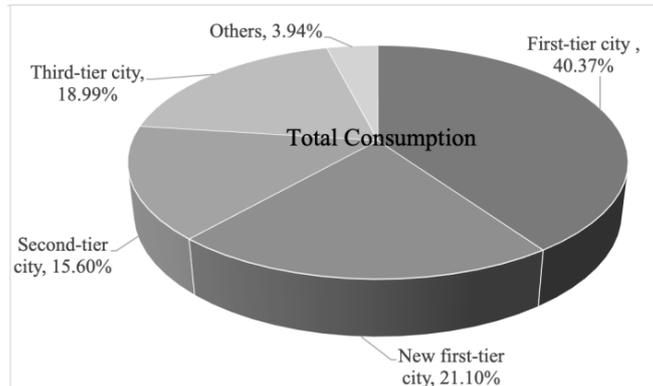


Figure 5. Distribution of City-Tier Classification

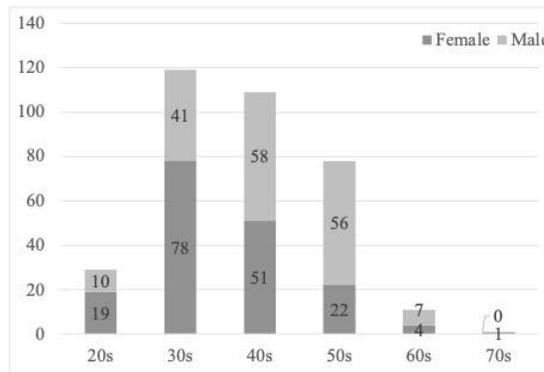


Figure 6. Distribution of Age and Gender

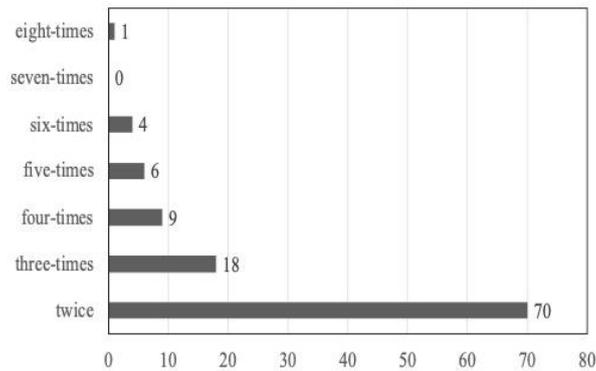


Figure 7. Purchase Frequency

5. Discussion

Although the data were collected in early 2021—a period often associated with pandemic-related market anomalies—the behavioral mechanisms identified in this study reflect enduring features of live commerce rather than transient crisis responses. Specifically, this study examines the role of KOL live streaming in cross-border e-commerce through a case analysis of a small and medium-sized enterprise (SME). The findings demonstrate that live streaming significantly enhanced sales visibility and drove short-term revenue growth, particularly when aligned with consumer interest in Japanese products. On live streaming days, average daily turnover reached approximately USD 10,700—substantially higher than on non-live days—supporting the view that live commerce serves as an effective channel for cross-border SMEs to bridge information gaps and stimulate purchasing decisions.

Product category analysis reveals that personal care, health food, and accessories formed the core of demand, collectively accounting for 65% of total sales after excluding exceptional items. Notably, alcoholic beverages—primarily rare Japanese whiskies—generated disproportionately high sales in January, likely driven by their scarcity in the Chinese market and perceived investment value rather than routine consumption. This highlights how product scarcity and cultural desirability can amplify live streaming effectiveness. Meanwhile, the strong performance of health-related categories aligns with broader societal trends toward wellness and quality of life, suggesting that cross-border retailers may benefit from prioritizing these segments in future assortments.

The weak negative correlation between price and sales volume ($\rho = -0.134$, $p = 0.042$) indicates that while higher-priced items tend to sell in slightly lower quantities, price alone is not a dominant driver of sales variation. Instead, success appears contingent on strategic product selection, timing of promotions, and KOL credibility—factors that shape consumer trust and urgency during live sessions.

Geographically, orders originated from 28 provinces, with first-tier and new first-tier cities representing 42% of total orders, while second- and third-tier cities contributed 35%. This broad geographic footprint suggests that cross-border live commerce is not confined to affluent metropolitan centers but has also penetrated mid-tier urban markets—a finding consistent with the platform’s accessibility via WeChat and mobile payment integration.

Beyond spatial reach, the customer profile also diverges from typical expectations. Although cross-border e-commerce in China is often characterized by a young, female-dominated consumer base—especially in wellness-related categories—this case reveals a customer profile concentrated in the 30–50 age range with no significant gender imbalance. This pattern likely stems from the middle-aged audience of the collaborating KOLs, underscoring how influencer choice can shape market reach beyond conventional demographics.

Furthermore, approximately 20% of customers made repeat purchases during the study period,

with an average of 1.32 orders per customer across 12 live sessions. This recurring engagement reflects the potential of live streaming to foster customer retention through real-time interaction and community building (e.g., WeChat groups).

Notably, when in instances of fulfillment discrepancies-such as misdelivered packages-several customers voluntarily coordinated via WeChat to forward items to the correct recipients, often without seeking refunds or compensation. This high level of customer tolerance and proactive assistance suggests that consumers felt empowered and valued-a phenomenon linked to effective channel integration in Chinese retail contexts [18]. This behavior suggests a relational dynamic beyond transactional exchange, likely nurtured by consistent KOL presence, transparent communication, and the affordances of closed-loop social-commerce ecosystems.

While post-purchase sharing behaviors-such as social media reviews or referrals-are central to the “Share” stage of the SICAS model, they were not captured in transactional data. Nevertheless, the observed repurchase rate implies a degree of satisfaction that may indirectly facilitate word-of-mouth diffusion.

Operationally, the company strengthened the “Action” phase by guaranteeing shipment within four working days, thereby reducing purchase anxiety and enhancing trust in cross-border fulfillment. Combined with KOL-led demonstrations and limited-time offers, this created a closed-loop experience: consumers sensed product value, connected through live interaction, acted on impulse or need, and potentially shared experiences afterward-though the latter remains an area for future validation.

In sum, this study illustrates how SMEs can leverage live streaming -as an integrated digital information system- to operationalize the SICAS framework in cross-border contexts. Success hinges less on celebrity endorsement alone and more on synergy between product strategy, consumer insight, logistics reliability, and platform affordances that collectively mitigate uncertainty and foster trust in global digital markets.

6. Conclusion

In an era of information overload and abundant choice, consumers increasingly struggle with decision fatigue-even in routine purchases. KOL-led live streaming has emerged as a powerful mechanism to simplify this process by offering trusted, real-time product curation. This study examined the role of live streaming in cross-border e-commerce through transactional data from a small and medium-sized enterprise (SME) selling Japanese products to Chinese consumers between November 2020 and January 2021. Grounded in the SICAS consumer behavior model, the analysis yields five key conclusions:

First, KOL live streaming significantly boosts sales performance. With biweekly broadcasts, average daily revenue on live streaming days reached approximately USD 10,700-substantially higher than on non-live days-demonstrating its effectiveness as a sales catalyst in cross-border contexts.

Second, product strategy is central to success. Personal care, health food, and accessories accounted for 65% of total sales (after excluding exceptional items), reflecting strong demand for wellness-oriented goods. Notably, limited-edition Japanese whisky generated disproportionately high sales due to its scarcity and perceived collectible value, highlighting how cultural desirability and exclusivity can amplify conversion during live sessions.

Third, price plays a minor role in purchase decisions. A weak but statistically significant negative correlation was observed between price and sales volume ($\rho = -0.134$, $p = 0.042$), suggesting that consumers prioritize product relevance, KOL credibility, and promotional urgency over cost alone.

Fourth, the customer base spans diverse geographic markets. Orders originated from 28 provinces

across China, with first-tier and new first-tier cities representing 42% of total orders, while second- and third-tier cities collectively contributed 35%. This broad reach indicates that cross-border live commerce is not confined to affluent urban centers but has penetrated mid-tier markets through accessible digital platforms like WeChat.

Fifth, live streaming fosters customer retention. Approximately 20% of customers made repeat purchases during the study period, with an average of 1.32 orders per customer across 12 live sessions. This recurring engagement underscores the value of real-time interaction and community building (e.g., via WeChat groups) in cultivating loyalty.

These findings are synthesized within the SICAS framework (Table 5) to illustrate how operational practices map onto consumer journey stages:

Table 5. Influencing Factors of Consumer Behavior Based on SICAS Model

SICAS Stage	Key Factor	Empirical/Observational Basis
Sense	Product origin (Japanese goods), platform visibility	Category sales dominance, pre/post-live sales contrast
Interest	Community-driven promotion, scarcity-based selling points	Spike in whisky sales, WeChat group activity
Connect	KOL live streaming, real-time Q&A	Significant sales uplift on live days
Action	Mobile payment integration, logistics commitment	High completion rate, minimal complaints
Share	Product quality, responsive service	Repeat purchase behavior (indirect proxy)

Sense: Online store visibility and alignment with interest in Japanese products;

Interest: Targeted promotion of high-demand or scarce items through sales communities;

Connect: KOL-led live sessions enabling interactive, trust-based communication;

Action: Seamless payment (WeChat Pay) and fulfillment promise (shipping within four working days);

Share: While post-purchase sharing behaviors were not directly measured, the high repurchase rate suggests underlying satisfaction that may facilitate organic word-of-mouth-a limitation acknowledged in this study

Despite its promise, cross-border live commerce persistent challenges-particularly for resource-constrained SMEs. Nevertheless, ongoing institutional support -such as China’s policy emphasis on cross-border e-commerce development and regional trade agreements promoting digital customs procedures, and the Regional Comprehensive Economic Partnership (RCEP), effective January 2022, includes provisions to digitize trade, reduce tariffs, and accelerate customs clearance -may further lower entry barriers for small enterprises in global markets.

In sum, the success of cross-border live streaming hinges not on celebrity endorsement alone, but on the integration of product insight, trust architecture, digital infrastructure, and operational reliability. Critically, the emergence of customer-initiated support behaviors-such as voluntarily resolving delivery errors-suggests that live streaming can foster not just transactions, but genuine relational equity. This aligns with the notion that integrated digital touchpoints empower consumers and cultivate a sense of co-membership in the brand community [18]. Future research should incorporate social media analytics to directly observe the “Share” stage, thereby completing the empirical validation of the SICAS loop in live commerce ecosystems.

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