Inducing Shoppers' Impulsive Buying Tendency in Live-Streaming: Integrating Signaling Theory with Social Exchange Theory

Xi Luo
Lecturer
School of Business School,
Sunway University,
Sunway City, Selangor, Malaysia.
Email: clorislx79656@gmail.com
ORCID: 0000-0003-3393-1154

Jun-Hwa Cheah (Corresponding Author)
Associate Professor
Norwich Business School
University of East Anglia
Earlham Rd, Norwich NR4 7TJ, United Kingdom
ORCID: 0000-0001-8440-9564
Email: jackycheahjh@gmail.com

Xin-Jean Lim
Senior Lecturer
Centre of Value Creation and Human Well-being, Faculty of Economics and Management Universiti Kebangsaan Malaysia, Bangi, Selangor, Malaysia.
ORCID: 0000-0002-6794-3607
Email: lim.xinjean@yahoo.com

T. Ramayah[1234567]
[1]School of Management, Universiti Sains Malaysia (USM)
[2]Department of Information Technology & Management, Daffodil International University, Bangladesh (DIU)
[3]Department of Management, Sunway University Business School (SUBS)
[4]Azman Hashim International Business School, Universiti Teknologi Malaysia (UTM)
[5]Applied Science Private University (ASU), Amman, Jordan
[6]University Center for Research & Development (UCRD), Chandigarh University (CU), India
[7]Faculty Of Business, Economics and Social Development, Universiti Malaysia Terengganu (UMT), Malaysia
E-mail: ramayah@usm.my

Yogesh K. Dwivedi[12]

[1]Digital Futures for Sustainable Business & Society Research Group, School of Management, Room 323, Swansea University, Bay Campus, Fabian Bay, Swansea, SA1 8EN, Wales, UK.
[2]Department of Management, Symbiosis Institute of Business Management, Pune & Symbiosis International (Deemed University), Pune, Maharashtra, India.
Email: y.k.dwivedi@swansea.ac.uk

Abstract

Purpose – The increasing popularity of live-streaming commerce has provided a new opportunity for e-retailers to boost sales. This study integrated signaling theory and social exchange theory to investigate how streamer- and product-centered signals influence customers' likelihood of making an impulsive purchase in the live-streaming commerce context.

Design/methodology/approach – An online survey was designed and distributed to the target respondents in China using purposive sampling. A total of 735 valid responses were analyzed with partial least square structural equation modeling (PLS-SEM).

Findings – Both streamer-centered signals, i.e., streamer credibility and streamer interaction quality, were discovered to significantly influence product-centered signal, i.e., product information quality. Additionally, streamer interaction quality was found to have a significant impact on streamer credibility. Furthermore, it was observed that customer engagement played a significant mediating role in the relationship between product information quality and impulsive buying tendency. Moreover, the paths between product information quality and customer engagement, as well as the connection between engagement and impulsive buying tendency, were found to be moderated by guanxi orientation.

Originality/value – Despite the prevalence of impulsive purchases in live-streaming commerce, few studies have empirically investigated the impact of streamer and product signals on influencing customers' impulsive purchase decisions. Consequently, to the best of our knowledge, this study distinguishes itself by offering empirical insights into how streamers use reciprocating relationship mechanisms to communicate signals that facilitate impulsive purchase decisions.

Keywords: Live-streaming commerce; Signaling theory; Social exchange theory; Customer engagement; Impulsive buying tendency; PLS-SEM.

Paper type Research paper

1. Introduction

Live-streaming commerce (LSC) is a new form of e-commerce platform, which works by establishing a temporary virtual community shared by streamers and customers in real-time (Luo *et al*., 2023). Its increasing popularity has prompted e-retailers to leverage live-streaming for product promotion, with an anticipated 20.3% annual growth in the global live-streaming market from $1.03 billion in 2021 to $1.23 billion in 2022 (The Business Research Company, 2023). According to an industry report, LSC holds substantial potential in stimulating impulsive buying, as 66.2% of customers reported making impulsive purchases, largely

influenced by streamers' recommendations in LSC (iiMedia, 2021). Streamers play a pivotal role in this unique shopping environment, surpassing the impact of traditional marketing messages, as the immediacy and interactive nature of LSC enhances the streamer's role in guiding customers to make impulsive purchase decisions (Yang *et al*., 2023a; Miranda *et al*., 2024). Understanding these dynamics is essential for businesses and marketers to leverage LSC fully as a channel for impulsive buying behavior (Yan *et al*., 2022).

Existing studies in the field of LSC have predominantly focused on a few specific areas, leaving gaps in the exploration of other relevant factors that may potentially trigger impulsive buying within LSC. For example, most studies have applied stimulus-organism-response theory (SOR) to examine external stimuli such as technical characteristics of the platform (e.g., presence, immersion, media richness), marketing stimuli (e.g., sales promotions, scarcity, product popularity), and customer motivations (e.g., hedonic/utilitarian value, flow, entertainment) in driving impulsive buying through customer internal states (e.g., emotional or cognitive reactions) (Lin *et al*., 2023; Parsad *et al*., 2021). However, given the importance of the awareness effect of recommendations and the unique nature of LSC in stimulating individuals' impulsive consumption, there is an urgent need to understand the role of streamer recommendations as a primary signal in triggering impulsive purchases (Lu and Chen, 2021; Luo *et al*., 2024).

In light of this, the present study integrates signaling theory with social exchange theory (SET) to develop a comprehensive model aimed at exploring the factors influencing impulsive buying tendencies across various domains. Responding to Lo *et al*.'s (2022) call for investigating effective streamer criteria in impulsive buying, this study examines the role of streamers in transmitting information and explores how the exchange of information between streamers and customers can lead to high levels of engagement with the LSC, ultimately fostering impulsive buying tendencies. On the other hand, product signals are identified as another crucial factor (Chen *et al*., 2019). This concept is motivated by the assertion that the product information not only serves as the primary signal for customers to evaluate the functionality and quality of a product but also acts as a filtering mechanism within the first few minutes to determine whether it is worthwhile to continue watching the LSC (Yang *et al*., 2023b; Liu *et al*., 2023). Generally, LSC content that provides customers with informative and exceptional details is more likely to evoke positive perceptions, thereby expediting the customer's decision-making process (Lo *et al*., 2022; Shamim and Islam, 2022). Hence, the research model of this study draws attention to how multi-layered influence can further trigger impulsive buying. Specifically, the former content (i.e., streamer signals) aims to enhance

positive perceptions of the streamer, including both streamer interaction quality and streamer credibility. Meanwhile, the latter content (i.e., product signals) focuses on communicating positive attributes of the product (Mavlanova *et al*., 2016), which can be assessed using product information quality.

Considering the social nature of LSC, which prioritizes the establishment of social relationships, this study extends the applicability of SET to examine customer engagement as an internal mechanism that fosters impulsive buying tendencies. By immersing customers in the dynamic content of LSC, engaged customers are more likely to encounter decision points, such as product recommendations with limited-time offers (Chen *et al*., 2022a). Consequently, streamers can seamlessly integrate impulsive buying opportunities into the customer experience itself (Luo *et al*., 2024). This intermediary role, grounded in SET, highlights the significance of reciprocal relationships in transforming customers from passive information receivers to active information-seekers. This offers a nuanced understanding of how engaged customers actively explore latent needs and make impulsive purchase decisions (Hollebeek, 2011; Hollebeek *et al*., 2021). Therefore, it is crucial for our study to consider the mediating role of customer engagement in triggering impulsive buying.

Given that this study is conducted in China, the concept of guanxi, which represents Chinese social networks, holds significant importance in transactional outcomes (Su *et al*., 2021). Prior research has indicated that customers with a guanxi orientation prioritize reciprocity (Wang *et al*., 2014) and inherently trust those with established guanxi connections (Luo, 1997; Ding *et al*., 2017). Aligned with SET, guanxi orientation contributes to positive moderation effects on individual attitudes and behavior (Cropanzano *et al*., 2017). The nature of LSC fosters communities around shared interests, which aligns with guanxi's emphasis on social harmony and conformity to group norms (Wu *et al*., 2021). The inherent trust stemming from guanxi reduces the need for detailed information evaluation in LSC, thereby heightening susceptibility to impulsive buying based on streamer recommendations (Zhang *et al*., 2019b). Therefore, our study delves into the nuanced role of guanxi orientation as a moderator, exploring how it distinctly influences the signaling process, leading to impulsive buying tendencies through heightened social exchange.

Based on the abovementioned, this study aims to provide streamers with some implications, particularly about creating a more engaging environment by using information signals to motivate impulsive buying tendencies. Next, the literature review will be presented in section 2, followed by the development of the conceptual model and the hypotheses

development in section 3. Next, in sections 4 and 5, we will discuss the methodology and results. Finally, we conclude the main findings and implications in section 6.

2. Theoretical foundations

The study draws on both signaling theory and SET as informing theories to study customer impulsive buying tendency in LSC (Przepiorka and Berger, 2017; Chen *et al*., 2019; Tóth *et al*., 2022). Within these theoretical realms, we highlight how streamers and customers looking to form relationships evaluate their exchanges' estimated benefits and costs using available signals. Both theoretical bases integrated well to explain online social exchange and to solve information asymmetry between customers and streamers.

2.1 Signaling theory

Signaling theory, originating from information economics studies, addresses situations characterized by asymmetric information, where two parties possess varying levels of information (Spence, 1974; Connelly *et al*., 2011). Existing literature on signaling theory underscores those signals, which disclose relevant and valuable product information from one party to another and significantly reduce uncertainty and facilitate a purchase or exchange (e.g., Lu and Chen, 2021; Wells *et al*., 2011). Beyond product signals, research suggests that strategically employed hidden signals by signalers play a pivotal role in emotional and unplanned buying situations (Chen *et al*., 2019; Przepiorka and Berger, 2017). In line with the aims of this study, signaling theory is adopted to discern potential hidden signals and explore their interplay with product signals in triggering impulsive purchases.

Within the LSC context, signals emerge as a pivotal determinant in triggering impulsive purchase decisions (Shamim and Islam, 2022). This significance arises from LSC's facilitation of product discovery through pre-curated presentations by streamers, fostering exploratory and less-focused buying behavior, leading to unplanned purchases (Fu and Hsu, 2023; Liu *et al*., 2023). Given the constraints of limited time and cognitive resources in decision-making processes, signaling serves as a rapid cue for processing information, aiding customers in making impulsive decisions (Miranda *et al*., 2024; Chen *et al*., 2019). Therefore, it is imperative for streamers to strategically invest in signals to convey valuable information, diminish uncertainty, and facilitate impulsive purchases (Connelly *et al*., 2011).

Previous research has shown that signals related to product- and seller-quality are vital in alleviating uncertainties in online selling, thereby promoting impulsive purchases (Chen *et al*., 2016). With the paradigm shift introduced by LSC, the study recognizes the transformative

role of streamers' credibility and real-time interactions in creating an authentic shopping environment, effectively reducing uncertainties, and prompting impulsive purchases (Fu and Hsu, 2023; Miranda *et al*., 2024). Building upon Chen *et al*.'s (2019) typology for quality signals, this study categorized the signals conveyed by streamers into *streamer-centered signals* and *product-centered signals.*

2.1.1 Streamer-centered signals

Streamer-centered signals, conveyed through non-product-centered content, aim to enhance positive perceptions of the streamer (Mavlanova *et al*., 2016; Lu and Chen, 2021). Previous research has shown unobservable streamer reputation and service quality serve as hidden signals (Zhang *et al*., 2020), heuristically affecting judgments about product quality, thereby reducing uncertainty and prompting impulsive purchases (Wang and Scheinbaum, 2018; Yang *et al*., 2023a). Hence, in this study, *streamer credibility* and *streamer interaction quality* are regarded as streamer-centered signals.

Streamer credibility refers to the positive characteristics of streamers that lead to customers' accepting the veracity of their messages (Ohanian, 1990). It is an important evaluation criterion of product information quality, especially in online selling (Ismagilova *et al*., 2020). In the LSC context, streamer credibility is determined by two subdimensions: expertise (streamers' relevant knowledge, experience, and skills) and trustworthiness. (streamers' honesty, credibility, and integrity) (Hovland and Weiss, 1951). On one hand, *streamer interaction quality* refers to customers' perceptions of the interaction quality with streamers in live-streaming shopping (Zhang *et al*., 2020; Tseng *et al*., 2021). Unlike the physical scene, the interaction of the live-streaming shopping scene relies on the effectiveness of technology (Etemad-Sajadi, 2016; Yan *et al*., 2022). Thus, this study conceptualized streamer interaction quality based on three subdimensions, i.e., real-time interaction, responsiveness, and empathy. *Real-time interaction* refers to the real-time communication between the streamer and customer; *Responsiveness* refers to how streamers respond to customers' questions and inquiries in a timely and accurate manner*; Empathy* relates to streamers' caring and individualized attention to customers (Zhang *et al*., 2020; Zhang *et al*., 2022).

2.1.2 Product-centered signal

Product-centered signals reveal direct information about the recommended product and mainly focus on conveying positive attributes of the product (Eppler, 2006). Within the context of LSC,

it refers to customers' perception of product information quality, which is often evaluated based on how well it aligns with their expectations and fulfils their needs (Zhang *et al*., 2020).

Adapting to the LSC context, this study conceptualized product information quality using three subdimensions: believability, usefulness, and vividness (Zhang *et al*., 2020). *Believability* refers to the authenticity and credibility of the product information conveyed by the streamer. Customers assess whether the information presented by the streamer is trustworthy and reliable. *Usefulness* pertains to customers' perception of how valuable the new information provided by the streamer is in enhancing their understanding of the product. Customers assess whether the information presented by the streamer is practical and relevant to their decision-making process. *Vividness* refers to the sensory richness of the information presented by the streamer. It encompasses the extent to which the streamer utilizes various sensory channels (e.g., visual, and auditory) to stimulate customers' senses and provide a more immersive and engaging experience. This may include activities such as product demonstrations or in-person examinations that offer a more tangible and vivid representation of the product. Taken together, these dimensions of product information quality capture customers' evaluations of the authenticity, usefulness, and sensory stimulation provided by the streamers in the LSC context.

2.2 Social Exchange Theory (SET)

Social Exchange Theory (SET) proposes that interpersonal relationships occur when one party exchanges something valuable with the other party. This exchange can involve *economic resources* or *social resources* such as information, support, and influence (Cropanzano and Mitchell, 2005). Previous research has examined the impact of economic rewards (e.g., coupons) on review posting intentions, attitudes, and usage intentions (e.g., Shiau and Luo, 2012; Tang *et al*., 2016). Additionally, studies have explored how social exchanges, such as information and support, influence brand engagement, customer perception, trust, and purchase intention (Phan *et al*., 2020; Tóth *et al*., 2022).

Within the existing literature, SET is mainly used to investigate three aspects: *the initiation of reciprocal actions* (e.g., providing information support), *the process of reciprocity* (e.g., the formation of relationships between parties), and *reciprocating responses* (e.g., attitudinal and behavioral outcomes). Additionally, positive reciprocity belief has been studied as a moderator in these contexts (Cropanzano *et al*., 2017). In the context of LSC, first, understanding SET is crucial in comprehending how the exchange of information serves as *an initiating action* that triggers reciprocal exchanges between streamers and customers (Zhang *et*

al., 2020). For example, when customers find the information shared by streamers to be valuable, credible, and vivid, this triggers positive emotions like confidence and excitement, motivating them to invest in building an emotional connection with the streamer (Hollebeek *et al*., 2019). Given the interactive nature of customer engagement, SET is an appropriate theory to explain customer engagement as a reciprocating relationship mechanism between streamers and customers, which leads to positive behavioral outcomes (Hollebeek, 2011; Rather and Sharma, 2019).

Second, customer engagement can be seen as a social exchange (*reciprocating process*) between customers and streamers. Customers invest their time and attention with the expectation of gaining social and personal benefits like information, entertainment, a sense of community, and emotional satisfaction (Hollebeek, 2011; Rather and Sharma, 2019). Consequently, impulsive buying is the reciprocating response when those expectations align with the product recommendations presented in LSC (Chen and Yao, 2018; Chen *et al*., 2022a). Besides, when customers find the information provided by a streamer to be actionable and helpful, they will invest more effort (e.g., discussions and sharing experiences). This *reciprocating process* can indirectly influence impulsive buying by creating a sense of community and emotional satisfaction (Ou *et al*., 2022). Moreover, when customers find the streamer's information valuable and credible, customers' social resources invested during interaction (e.g., through co-creation, sharing of product-centered experiences, etc.) can further enhance impulsive buying tendencies (Hollebeek *et al*., 2019; Danniswara *et al*., 2020).

Third, *positive reciprocity beliefs*, as discussed in Cropanzano *et al*.'s (2017) review of SET, may act as a potential moderator that influences individuals' attitudes and behaviors. Guanxi orientation, as a form of positive reciprocity belief deeply rooted in Chinese culture, moderates individuals' attitudes and behaviors by fostering trust, reciprocity, emotional connections, and enhanced persuasion (Ding *et al*., 2017; Su *et al*., 2021). Building on the literature, this study utilizes SET to predict guanxi orientation's positive moderation effects on customer engagement and their impulsive purchase decisions.

2.3 Impulsive Buying Tendency

Impulse buying typically occurs in the spur of the moment, often prompted by stimuli encountered during the shopping experience (Beatty and Ferrell, 1998). In contrast, planned buying is a more deliberate process involving careful consideration before purchase. In live-streaming commerce, impulse buying is triggered by unique environmental cues such as limited broadcast time, real-time interaction with persuasive streamers, and their vicarious product

demonstrations, which create urgency and connection with shoppers (Lo *et al*., 2022; Luo *et al*., 2024). This notion contrasts with traditional e-commerce, where shoppers consider product alternatives for planned purchases. Subsequently, they must meticulously evaluate and analyze information before making a decision (Wang *et al*., 2024). While both involve cognitive processes, they differ in processing depth and cognitive effort (Chen *et al*., 2019). In the LSC context, we define "impulsive buying tendency" as the buying behavior which occurs when customers enter a broadcasting room and unexpectedly develop a strong desire to buy after watching a broadcast (Lu and Chen, 2021).

Impulse buying is typically classified into four categories: pure, reminder, planned, and suggestive (Stern, 1962), which has served as a foundational framework for research in this area (Beatty and Ferrell, 1998; Rook, 1987). This classification also applies to most buying behavior observed on LSC platforms (Xu *et al*., 2020). For instance, when customers aimlessly watch streamers' real-time product demonstrations and decide to purchase, it falls under the category of pure impulsive buying. If they recall a shortcoming or a prior experience while watching the broadcast and make a purchase, it is considered a reminder of impulsive buying. Suggestive impulsive buying occurs when customers purchase a new product based on streamers' recommendations, such as suggesting different occasions for product use. Finally, when customers watch streamers' product demonstrations with a shopping list but make purchases based on coupons or promotions, it can be categorized as planned impulse buying (Xu *et al*., 2020; Chan *et al*., 2017).

In the existing literature, some studies suggest that impulse buying tendency is a kind of personality trait of individuals (Verplanken and Herabadi, 2001), a leaning entrenched (Parsad *et al*, 2021). This trait reflects their general inclination to make unplanned purchases driven by emotions or other psychological factors. It is imperative to acknowledge that unplanned purchases can be influenced by the interplay of a wide range of situational, environmental, and contextual factors (Chen *et al*., 2019; Fu and Hsu, 2023). Based on our definition of impulsive buying (four types of impulsive buying proposed by Stern, 1962) in the LSC context, streamer recommendations can result in customers' impulsive purchases. This entails a sudden, strong, and enduring desire to purchase immediately when frequently exposed to information and interactions with streamers (Chen *et al*., 2016; Yang *et al*., 2023b).

However, most studies mainly examined the effects of content quality on regular purchases because it mainly involves cognitive evaluation (e.g., Gao *et al*., 2021; Liu *et al*., 2022). ignoring that information quality in LSC is more customer-centric (responsiveness and personal attention) and visualized (vs. product-centric textual description), thus customers'

responses encompass not just cognitive reactions but also emotional, behavioral, and social reactions, all of which contribute to the activation of impulsive buying tendencies. Lastly, similar to the argument posited by Lee and Kacen (2008), information available inside a store will have a greater overall impact on an impulse purchase than a planned purchase. Thus, if streamer recommendation was only available during the broadcast, it became a more important factor in impulse buying than in the regular buying context.

3. Research model and hypotheses

Based on the signaling theory and the SET, this study explores the intricate dynamics between streamers and customers in the context of reciprocal relationship mechanisms and impulsive purchase decisions in LSC. Additionally, we employ guanxi orientation as a potential moderator that may alter the relationship between the proposed factors. Prior research in the online marketing domain found that customers' online purchase decisions may vary based on their demographic profiles such as gender, education, and income (Chen *et al*., 2022b), and their past shopping experiences (i.e., usage duration and purchase frequency) (Mallapragada *et al*., 2016). Thus, this study included these as control variables to avoid any spurious effects on impulsive buying tendency. Figure 1 depicts the proposed conceptual framework.

[Insert Figure 1 here]

3.1 Signals and customer relationship mechanism

In the LSC context, streamer interaction quality helps customers to better evaluate streamer credibility. Real-time and interactive communication aids customers in identifying the service personnel featured on-screen (Wongkitrungrueng and Assarut, 2020). Additionally, frequent interactions between the streamer and customers can lead to increased familiarity (Chung and Cho, 2017) and the cultivation of a trustworthy relationship (Guo *et al*., 2021). Consequently, this allows customers to establish a better assessment of the level of trustworthiness and expertise of streamers (Onofrei *et al*., 2022). On the other hand, by benefiting from the existence of bullet-screen comments (i.e., real-time reviews posted by customers), streamers can provide timely responses to customers' questions and provide individual attention to different customers (Kang *et al*., 2020). As a result, streamers' better understanding of customer needs enhances their relationship with customers and evidences their credibility (Gong and Li, 2019). Drawing upon these arguments, we hypothesize that the better the streamer's interaction quality, the higher the perceived streamer credibility.

H1: Streamer interaction quality positively affects streamer credibility.

According to signaling theory, streamer credibility serves as a streamer-centered signal that reduces customers' uncertainty about the product and positively influences customer's evaluation of product information quality (Mavlanova *et al*., 2016; Naujoks and Benkenstein, 2020; Chung *et al*., 2020). Information from credible sources is perceived to be a more valid and persuasive heuristic cue (Wang and Scheinbaum, 2018), which positively influences individual beliefs, opinions, and attitudes (Yan *et al*., 2022). Studies proved that streamers' expertise and trustworthiness positively influence customers' perceived usefulness of information (Ma, 2021; Guo and Sun, 2022). Moreover, customers' trust in streamers is more likely to transfer to the product endorsed (Leite and Baptista, 2022; Chung and Cho, 2017). In live-streaming shopping, when customers perceive streamers as highly credible, they will certainly have more confidence in the quality of the information content (Kang and Namkung, 2019; Chen *et al*., 2022b). Besides, streamers are often considered experts who are more familiar with products and experienced in providing shopping guidance (Zafar *et al*., 2021). Therefore, we propose streamer credibility may strongly shape the quality of information. The following is proposed:

H2: Streamer credibility positively affects product information quality.

Relying on both the real-time and visibility characteristics of live-streaming, customers receive quick and effective responses from streamers without the barriers of time and space (Wang *et al*., 2022; Zhang *et al*., 2020). By interacting with a streamer in real-time, customers can fully understand the product details (e.g., place of origin, quality, and price) (Xue *et al*., 2020). Meanwhile, the interactive product presentation feature also improves customers' sense of experience (Singh *et al*., 2021; Yang *et al*., 2023a) and provides them with vivid product information (Guo and Sun, 2022). In addition, a personalized feature found in the LSC platform allows the streamers to provide customers with a better shopping experience and highly improved communication efficiency (Zhang *et al*., 2022). Grounded on the signaling theory, streamer interaction quality is a seller-quality related signal, which can directly influence product-quality related signal (Mavlanova *et al*., 2016; Özpolat and Jank, 2015). Therefore, streamer interaction quality not only influences the convenience and pertinence of

communication but also improves the quality of information obtained. We, hence, hypothesize the following:

H3: Streamer interaction quality positively affects product information quality.

According to the signaling theory, symmetric information exchange between the online service provider and the customer generates positive outcomes (Connelly *et al*., 2011). For example, high-quality information provides customers with a greater shopping experience, enhancing their positive attitudes and, eventually, their engagement intentions with streamers (Wang and Huang, 2023). Most importantly, customers tend to consider the benefits and risks in deciding whether or not to engage with the streamer (Nammir *et al*., 2012). In LSC platforms, streamer provides vivid and useful information content by demonstrating product details (e.g., product materials, workmanship, and size) in front of the screen or sharing their knowledge and personal experience (Wang *et al*., 2022). As a result, customers' uncertainty about product fit will be reduced (Al-Adwan *et al*., 2022), and they are more likely to interact positively with streamers (Hu and Chaudhry, 2020; So *et al*., 2021b). Based on the principle of social exchange, customers reciprocate with the streamer when they are able to gain benefits, hence they will develop an increased likelihood to reciprocate with engagement behaviors such as liking, sharing, subscribing, and commenting (Oh *et al*., 2017). Therefore, when the information provided by streamer is of high quality, it would drive customer engagement. Thus, we hypothesize the link between product information quality and customer engagement:

H4: Product information quality positively influences customer engagement.

3.2 Customer relationship mechanism and impulsive buying tendency

Customer engagement is the psychological state of mind in which customers are engaged subconsciously, resulting in frequent interactions beyond transactional motives in a focal service relationship (Brodie *et al*., 2019). This term can be decomposed into four components: cognitive, affective, behavioral, and social engagement (Vivek *et al*., 2014; Hollebeek, 2019). *Affective engagement* refers to customers' emotional bond with the streamer. *Behavioral engagement* is a series of interactive behaviors such as likes, shares, and comments. *Cognitive engagement* relates to customers' mental apprehension resulting from observation, learning, and communication. Finally, *social engagement* highlights social and interactive

characteristics such as co-creation and sharing values between streamers and customers (Vivek *et al*., 2014; Dessart *et al*., 2016).

Previous studies have examined that positive customer engagement significantly influences consumption behaviors and decision-making (Pansari and Kumar, 2017; Alvarez-Milán *et al*., 2018). When cognitively engaged in live-streaming shopping, customers develop a better understanding of the recommended product, enabling them to feel a sense of gratification and form positive evaluations of impulse buying tendency (Xu *et al*., 2020). Besides, emotionally engaged customers are more likely to conduct hedonic buying (Nandha *et al*., 2017). For example, in Shen and Khalifa's (2012) research, customers who are highly aroused in a pleasant online shopping environment tend to spend more time and effort on product exploration, which further induces impulsive purchase tendency. Moreover, customer engagement increases the intimacy between streamers and customers (Chen *et al*., 2019; Luo *et al*., 2024), meanwhile, reduces customers' uncertainty and consumption concerns, thus positively influencing their impulsive consumption intentions (Lo *et al*., 2022). Based on SET, when customers gain benefits from this relationship (i.e., positive emotion, intimacy, reduction of uncertainty), they are more likely to exhibit positive emotions and impulsive buying tendency. Therefore, customer engagement acts as a force that influences customers' impulsive buying tendency. We hypothesize that:

H5: Customer engagement positively affects impulsive buying tendency.

3.3 Mediation effect of customer engagement

Customer engagement is a psychological state in the service experience process (Brodie *et al*., 2019), and most scholars have used customer engagement as a mediator between customer perceptions and behavioral intentions (Rather and Sharma, 2019; Hollebeek, 2011; So *et al*., 2021a). Prior research evidenced that the influence of informational signals on impulsive buying tendency can be further elaborated by incorporating a psychological mechanism (Chen and Yao, 2018; Zhang *et al*., 2019a; Shamim and Islam, 2022). In live-streaming shopping, browsing information presented by the streamer may trigger customers' emotional reactions, e.g., emotional connection, which also indirectly influences impulsive buying (Verhagen and Dolen, 2011; Parboteeah *et al*., 2009). Besides, engaging in high-quality information exchange can also drive social benefits to customers by increasing their confidence to make immediate purchase decisions and choose trusted and credible streamers (Danniswara *et al*., 2020; Luo *et al*., 2024).

As a mediating variable, customer engagement regulates changes in impulsive buying tendency. Vivek *et al*. (2014) have mentioned that a high degree of engagement makes customers believe that the product recommended has all the merits and makes the purchase more satisfying. As a result, customers' positive emotions from satisfaction can easily trigger impulsive buying tendency (Widagdo and Roz, 2021). Meanwhile, cognitive engagement allows the viewers to believe that the product has high value and is worth buying (Kumar *et al*., 2023). Therefore, we propose the following hypothesis:

H6: Customer engagement mediates the relationship between product information quality and impulsive buying tendency.

3.4 Moderation effects of guanxi orientation

Guanxi is a personalized relationship based on mutual interests and benefits, achieved through the exchange of favors between two parties (Luo, 1997). This concept revolves around the principle of reciprocity, where individuals engage in mutual give-and-take to strengthen relationships. In online business contexts, especially LSC, guanxi often involves a broader scope of connections due to the vast reach of digital platforms. The interactions in question are often more transactional-focused, emphasizing the exchange of products, discounts, and promotions (Zhang and Zhang, 2014; Parsad *et al*., 2021). Individuals with a strong guanxi orientation tend to have stronger exchange ideologies and pay closer attention to social interactions in order to establish close ties with those around them (Guo *et al*., 2021).

Grounded in SET, previous research has highlighted the role of the reciprocal norm of guanxi in moderating individual attitudes and behaviors (Cropanzano *et al*., 2017; Su *et al*., 2021; Ding *et al*., 2017). For instance, in the context of online shopping, individuals who benefit mutually through information sharing tend to develop positive attitudes toward engagement (Shiau and Luo, 2012). Communication within virtual communities can be seen as a form of social exchange, where voluntary actions between parties are often based on a cost-benefit approach (Dong *et al*., 2017; Gharib *et al*., 2020). In the context of LSC, customers with a higher guanxi orientation may actively engage with streamers to establish shopping convenience, believing that streamers can provide valuable and important information based on the assurance of reciprocity. During their interaction, customers and streamers can communicate, share experiences, and learn from each other (Li *et al*., 2020; Ou *et al*., 2022). Consequently, customers with a strong guanxi orientation are more likely to sustain their

engagement in live-streaming shopping when they receive valuable, high-quality information from the streamer (Barnes *et al*., 2011; Su *et al*., 2021).

Furthermore, existing research indicates that individuals with a high guanxi orientation tend to develop mutual trust with their counterparts, facilitating decision-making in online transactions (Leung *et al*., 2020; Lin *et al*., 2018). This aligns with SET, individuals with a strong guanxi orientation highly value reciprocal relationships (Wang *et al*., 2014; Ding *et al*., 2017). In the context of impulsive purchases, the favorable treatment and personalized attention associated with guanxi foster a sense of obligation, positively moderating impulsive buying through reciprocal favor exchange (Zhang *et al*., 2019b; Zhang *et al*., 2020). Moreover, guanxi orientation is a reciprocity belief based on mutual benefits. Thus, when customers engage in the flow shopping experience created by streamers, guanxi-oriented customers are more likely to trust the streamer (Zhang *et al*., 2019b; Su *et al*., 2021). Consequently, they are more inclined to reduce the cognitive deliberation process and make impulsive purchases (Wu *et al*., 2021). Based on these considerations, we propose the following hypotheses:

H7a: When customers are more guanxi-oriented, the relationship between product information quality and customer engagement is stronger.

H7b: When customers are more guanxi-oriented, the relationship between customer engagement and impulsive buying tendency is stronger.

4. Methodology

4.1 Data collection procedures

During data collection, the designed questionnaires were distributed using purposive sampling – a non-probability sampling procedure – through a professional online survey service website (see https://www.wjx.cn/). The purposive sampling method was employed in this study due to the unavailability of a complete sampling frame in the given context. This approach assists in selecting valid samples and helps minimize non-response bias (Rowley, 2014). It is worth noting that both Lin *et al*. (2023) and Tong *et al*. (2022) have utilized a similar method when examining customers' impulse buying behavior in the live-streaming context. Furthermore, LSC has proven particularly effective in targeting the millennial generation, referring to customers born between 1981 and 2000, who form a significant customer group (Taobao Live and Chinese Academy of Social Sciences, 2022). Therefore, this generation represents an important and intriguing market segment for streamers who explore the LSC context. To ensure the suitability of potential respondents (i.e., Millennial live-streaming

shoppers), three pre-screening questions were included as selection criteria for our sampling technique. The first question inquired whether respondents were born between 1981 and 2000. The second question assessed whether they had subscribed to at least one social media platform that integrates live-streaming functions, such as Taobao or Douyin. The third question focused on whether they had engaged in any live-streaming shopping experiences within the last two months. Respondents who did not meet these pre-screening criteria were excluded from the study. To ensure more accurate responses, we provided a brief introduction with a shopping scenario aimed at recalling respondents' memories of their live-streaming shopping experiences.

A total of 960 responses were collected, after excluding incomplete and straight-line answers, 735 valid responses were finally confirmed. Table 1 exhibits the demographic information of the participants. Of all the respondents, the majority of them were female (54.15%), bachelor's degree holders (40.82%) with monthly income of RMB5,001 to RMB8,000 (39.46%). Additionally, they had purchased three times in the current two months (32.79%) and their usage duration was 1 to 2 years (30.07%).

[Insert Table 1 here]

4.2 Measures

All constructs' measurement items were adapted based on previous literature, with minor adaptations for the LSC context. As the survey was conducted in China, while all items in the survey were originally designed in English, thus we adopted the forward-back translation to ensure the accuracy of the translation (Brislin, 1970). Next, all items were assessed by a panel of eight experts comprising five marketing professors and three experienced live-streaming Millennial shoppers. They were requested to examine whether the statements in the questionnaire reflect the constructs being measured. Before the questionnaires were distributed, we conducted a preliminary test (pre-test) with 40 live-streaming Millennial shoppers. The results show that Cronbach's α coefficients of all questionnaire items in exploratory factor analysis are larger than 0.7 in the pre-test, thus all proposed items of each construct are valid and reliable (Hair *et al*., 2020).

The items of product information quality and streamer interaction quality were adopted from Zhang *et al*. (2020). Streamer credibility was measured with the scale established by Ohanian (1990). Four dimensions of customer engagement were measured: affective, behavioral, cognitive, and social, based on the scale modified by Dessart *et al*. (2016) and Vivik *et al*. (2014). Guanxi orientation was measured with the scale developed by Ding *et al*. (2017).

Finally, the scale of impulsive buying tendency adopted the measurement items established by Beatty and Ferrell (1998) (see Appendix A).

5. Data Analysis

5.1 Choice of data estimation technique

Firstly, SPSS v.29 was used for the assessment of respondents' demographic profiles and test of common method bias. Secondly, partial least squares structural equation modeling (PLS-SEM) using SmartPLS v.4 (Cheah *et al*., 2024) was employed in the study to maximize the variance explained in the latent dependent variables and has been widely employed in information system fields (Song *et al*., 2021; Lim *et al*., 2022). Specifically, we used PLS-SEM for three reasons. First, the technique is suitable for testing models of theory building and testing (Shiau *et al*., 2019), which fits well with this study's goal of integrating both signaling theory and social exchange theory. Second, there are many past studies proven that PLS-SEM is best suited for testing complex variables, i.e., higher-order constructs (Becker *et al*., 2023) (i.e., streamer interaction quality, streamer credibility, product information quality, and customer engagement are conceptualized as a reflective-formative type of higher-order constructs). This analysis approach is found to outperform when assessing a research model that involves many constructs and complex relationships (i.e., with mediation and moderation effects) (Cheah *et al*., 2021). Finally, this technique is causal-predictive, which has achieved the best balance between explanation and prediction (Shmueli *et al*., 2019).

5.2 Common method bias (CMB)

Given the cross-sectional approach used in the study design, CMB may be a potential concern. To assess CMB, we adopted two different CMB assessments. First, we adopted Harman's single-factor test, and the results showed that the variance explained by the first factor was 23.779% (<40%), which suggests there is no CMB (Fuller *et al*., 2016). Second, the full collinearity (FC) test showed that the variance inflation factor (VIF) values were between 1.014 and 1.368 (below 3.33; see Table 2), suggesting CMB does not present a severe issue in this study (Kock, 2015).

5.3 Measurement model

To assess the measurement model, Hair *et al*. (2020) suggested using a confirmatory composite analysis (CCA) approach. As shown in Table 2, all metrics for the internal consistency reliability (Cronbach's alpha, ρ_A, and CR) were above the acceptable value of 0.7, which

satisfied the reliability requirement (Hair *et al*., 2020). Next, convergent validity was achieved as items' loading was higher than the threshold of 0.708 and AVE was greater than 0.50 (See Table 2, Hair *et al*., 2020). The final step of measurement model assessment is to evaluate the constructs' discriminant validity using the heterotrait-monotrait ratio of correlations (HTMT). As presented in Table 3, the HTMT scores of all constructs were lower than the conservative threshold value of 0.85, confirming discriminant validity among all the constructs used in this study (Hair *et al*., 2020).

[Insert Table 2 here]

[Insert Table 3 here]

5.4 Higher-order construct (HOC)

This study employed a disjoint two-stage approach to assessing four higher-order constructs (HOCs): product information quality, streamer interaction quality, streamer credibility, and customer engagement (see Becker *et al*., 2023). First, convergent validity was tested using redundancy analysis with a global single-item. As shown in Table 4, the path coefficient (i.e., convergent validity) of four HOCs, i.e., product information quality (0.704), streamer interaction quality (0.768), streamer credibility (0.738), and customer engagement (0.886) were greater than the threshold value of 0.70, thus confirming the validity of all HOCs (Cheah *et al*., 2018; Hair *et al*., 2020). Next, the VIF values of all LOCs were between 1.063 and 1.215 (<3.33) (Hair *et al*., 2020). Thus, multicollinearity is not an issue in this path model. Finally, all LOCs achieved statistically significant results with weight values between 0.126 and 0.635.

[Insert Table 4 here]

5.5 Model fit

To assess the model fit, we used both the standardized root mean square residual (SRMR) and the normed fit index (NFI). The results showed that the SRMR values for both the saturated and estimated models were 0.041 and 0.068, respectively, which were below the threshold of 0.08 (Hu and Bentler, 1999), indicating a good model fit. In addition, both the saturated and estimated models had an NFI value of 0.966 and 0.942, respectively, indicating a good fit as the value exceeds the threshold of 0.90 (Hu and Bentler, 1999). Therefore, the results suggest that the proposed model, which integrates signaling theory and SET, is well-suited to explain impulsive buying tendencies in LSC.

5.6 Structural model

The assessment of the structural model started by evaluating the collinearity between the predictors. As shown in Table 5, the VIF values of all the combination paths were between 1.000 and 1.413 (<3.33, see Hair *et al*., 2020), indicating that collinearity is not at a critical level. Next, the bootstrapping technique with 10,000 subsamples was used to test the significance of the relationships between the constructs (Hair *et al*., 2020). Table 5 shows that streamer interaction quality (β=0.541; p<0.01) positively influenced streamer credibility, supporting H1. Besides, both streamer credibility (β=0.328; p<0.01) and streamer interaction quality (β=0.393; p<0.01) had positive relationships with product information quality, providing support for H2 and H3. Regarding the effect size (f^2), only the hypothesized path of H5 (f^2 =0.508) showed a large effect. The paths hypothesized in H1 (f^2=0.207), H3 (f^2=0.182) and H4 (f^2=0.241) exhibited medium effects, while H2 (f^2=0.128) had a small effect. Furthermore, the relationships of product information quality (β=0.569; p<0.01) to customer engagement were positive and significant, supporting H4. Finally, customer engagement (β=0.743; p<0.01) positively affected the impulsive buying tendency, hence supporting H5 (see Table 5). Overall, the proposed model explained approximately 29.2% of the variance for streamer credibility, 40.1% for product information quality, 33.8% for customer engagement, and 56.4% for impulsive buying tendency.

Next, the predictive relevance of the model was evaluated using the $PLS_{predict}$ procedure (Shmueli *et al*., 2019). As demonstrated in Table 5, the $Q^2_{predict}$ values for all endogenous constructs were greater than 0, indicating the model's predictive relevance. By extending the prediction assessment, Table 6 shows that the root mean square error (RMSE) of the PLS-SEM model is lower than the RMSE in the linear model (LM), indicating the key endogenous items for the IBT have strong predictive relevance.

[Insert Table 5 here]

[Insert Table 6 here]

5.7 Mediation result

To estimate the proposed mediation role of customer engagement, this study followed the procedure recommended by Cheah *et al*. (2021). Table 5 showed that customer engagement (β = 0.423; p <0.01) significantly mediated the paths between product information quality and impulsive buying tendency. Thus, H6 was supported. The effect sizes of the indirect path were then calculated using the respective standardized v effects and interpreted using the benchmarks of 0.01 (small), 0.09 (medium), and 0.25 (large) (Lachowicz *et al*., 2018). Thus, the mediation path had a medium effect (v=0.176, see Table 5), which signifies the important

role of customer engagement in mediating the link between product information quality and impulsive buying tendency.

5.8 Moderating result

The moderation analysis was examined by a two-stage approach (Becker *et al*., 2023). As exhibited in Table 5, The results indicated that guanxi orientation significantly moderated the relationships between product information quality and customer engagement (β=0.105, p<0.05), and customer engagement and impulsive buying tendency (β=0.065, p<0.05). In terms of the effect size of moderation paths, this study interpreted f^2 using the guidelines given by Kenny (2016): 0.005 (small), 0.01 (medium), and 0.025 (large). The findings showed that both moderation paths (H7a: f^2=0.020; H7b: f^2=0.010) had medium effect sizes, supporting H7a and H7b. The interaction plots showed that the line of high guanxi orientation had a steeper gradient than low guanxi orientation for both significant hypotheses (see Figure 2, Panels A and B). This, thus, indicates that when the customer is strong in guanxi-oriented, the positive relationships between product information quality on customer engagement, and customer engagement on impulsive buying tendency are stronger.

[Insert Figure 2 here]

6. Discussion and implications

6.1 Theoretical implications

Using both signaling theory and SET as the theoretical basis, our results supported all proposed hypotheses and suggested various fruitful implications for future research into LSC. Firstly, this research makes a significant contribution to the field of LSC by utilizing signaling theory in the complex interplay between streamers and customers in the two-way interaction process. We found that streamer interaction quality positively influences streamer credibility (H1), indicating that high streamer interaction quality enhances the relationship with customers and evidences their credibility (Gong and Li, 2019; Zhang *et al*., 2022). We contribute significantly to understanding the complex interplay between streamer signals by emphasizing trust-based relationships to ensure effective streamer-customer communication. Besides, we found positive influences of streamer-centered signals (streamer interaction quality and streamer credibility) on product-centered signals (product information quality) (H2 and H3), evidence that streamer quality positively and significantly impacts customers' judgments of product quality (Xue *et al*., 2020; Yan *et al*., 2022). Our findings expand the understanding of signals

in LSC beyond product-centered factors and solidify the causal relationship between streamer- and product-centered information quality. Furthermore, we found that product information quality positively affects customer engagement (H4), which, in turn, facilitates impulsive buying tendency (H5). The findings indicate that symmetric information exchange is particularly important in reducing customer uncertainty on product fit and arousing customer positive emotion, facilitating customer engagement behaviors such as liking, sharing, and commenting (Oh *et al*., 2017; So *et al*., 2021b). This implies that customers may simplify their decision-making process by heuristically processing streamer-centered information, trusting credible streamers with good interaction quality to reassure them about product information, and ultimately encouraging impulsive buying in LSC (Wang and Scheinbaum, 2018).

Secondly, this research contributes significantly to LSC by uncovering the mediating role of customer engagement in impulsive purchase decisions using SET. Our findings establish that customer engagement serves as a crucial mechanism linking product information quality to impulsive buying tendencies (H6). Existing research focuses on customer engagement as a one-way process for building customer-brand relationships (e.g., Hollebeek *et al*., 2021), overlooking its reciprocal nature and influence on impulsive purchase decisions. Grounding on SET, our research contributed by revealing how customer engagement serves as a reciprocal relationship mechanism, fostering a sense of obligation and a desire to conform, thus reinforcing impulsive purchase tendencies.

Lastly, the interaction analysis indicated that product information quality on customer engagement and customer engagement on impulsive buying tendency differs across the different levels of guanxi orientation (H7a and H7b). Previous studies have suggested that guanxi orientation can moderate attitudes and behaviors (Cropanzano *et al*., 2017; Su *et al*., 2021; Ding *et al*., 2017), and we have contributed to refining guanxi's role in social exchange and impulsive purchase decisions. Our study, supported by SET, empirically investigates how guanxi orientation facilitates the impulsive buying process among Millennial shoppers in the LSC context.

6.2 Practical implications

This study reveals the importance of streamer recommendations in positively influencing customer engagement and impulsive buying tendencies. Our results provide several practical implications for streamers in LSC platforms.

Firstly, as streamer credibility and interaction quality positively influence information quality, streamers should focus on ensuring that product information is communicated

effectively. For example, streamers need to respond to bullet-screen comments and questions promptly, address concerns openly, and create a friendly and supportive community (Zeng *et al*., 2023). Besides, streamers should build credibility by involving continuous learning, displaying professional knowledge, and collaborating with brand-related service personnel to enhance product selection and authenticity (Jiang *et al*., 2022). Additionally, streamers can boost credibility through self-disclosure during real-time interactions, shortening psychological distances with customers and strengthening relationship ties (Chung and Cho, 2017). Moreover, product information quality is important in influencing customer engagement and impulsive buying tendency. To better engage with customers, streamers need to provide believable, useful, and vivid information that matches customers' needs (Guo and Sun, 2022). To deliver more authentic, vivid product demonstrations, streamers can show the manufacturing process of their products through LSC, enhancing customers' trust and engagement.

Secondly, the mediation results showed that the effectiveness of information exchange on impulsive buying tendency primarily depended on the streamers' effectiveness in engaging with customers. It is suggested that streamers provide a more engaging atmosphere to reduce 'binge-watching', as it directly and indirectly impacts customers' impulsive buying tendency. For example, streamers can remind customers of important product information before checkout, accompanied by a limited-time offer (Chen *et al*., 2022a), creating a sense of urgency that encourages impulsive buying. This can be achieved without creating a thrilling moment. By capitalizing on the synergy between engagement, content dynamics, and decision points, streamers can seamlessly integrate impulsive buying opportunities into the customer experience in LSC.

Lastly, the moderation results indicate that guanxi-oriented customers are more likely to engage and make purchase decisions with streamers who provide high-quality information (Dong *et al*., 2017; Gharib *et al*., 2020). The findings suggest that streamers should aim to establish a reciprocal relationship with their customers by offering financial benefits such as coupons, free gifts, and lucky draws, as well as inviting them to join the fan group (Jia *et al*., 2022). According to Zhang *et al*. (2019b), guanxi-oriented shoppers are more likely to actively engage with streamers to obtain valuable information based on the principle of reciprocity in guanxi. Additionally, Wu *et al*. (2021) found that guanxi-oriented shoppers are more likely to make impulsive purchases in a more engaging environment. It is important to note that this behavior is specific to guanxi-oriented shoppers. This indicates a move away from solely

informative strategies toward an emphasis on relationship-based persuasion, which could result in increased engagement and sales.

6.3 Conclusion and further research

This study, rooted in signaling theory and SET, explores the impact of streamers' signals (interaction quality and credibility) on customers' assessment of product information quality and impulsive purchase decisions in the exchange relationship. Our findings reveal that favorable perceptions of streamer interaction quality and trust in the streamer's credibility enhance the evaluation of product information, fostering increased customer engagement and impulsive buying tendencies. Additionally, we investigate customer engagement as a mediator, reinforcing the link between product information quality and impulsive buying tendencies. The results also deepened our understanding that guanxi-oriented customers strengthen the relationships of product information quality to customer engagement and customer engagement to impulsive buying tendency.

Despite these findings, this study has several limitations. Firstly, the data collected are limited to Chinese Millennials, limiting generalizability across diverse cultures. Future research could explore cross-country variations, considering the moderation effects of guanxi orientation in collectivism vs. individualism contexts (Cakanlar and Nguyen, 2019). Secondly, this study fails to consider the possible differences between various LSC platforms. Future investigations should consider the distinct characteristics of various LSC platform types and their effects on customers' impulse buying tendencies (Kang *et al*., 2020). Lastly, it should be noted that the research model did not provide an exhaustive list of all potential antecedents. To gain a deeper understanding of the significant impact of orally expressed information content by the streamer (including the various effects of discounts and the value of coupons) and the influence of negative/positive comments shared by co-viewers, future studies could conduct experimental research to dig deeper into this issue (Tóth *et al*., 2022).

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Figures

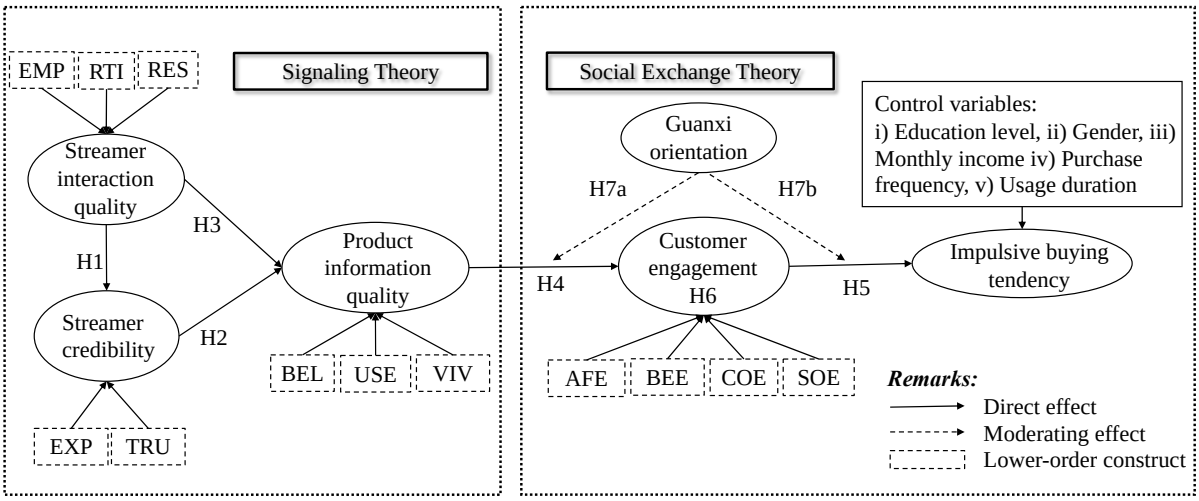
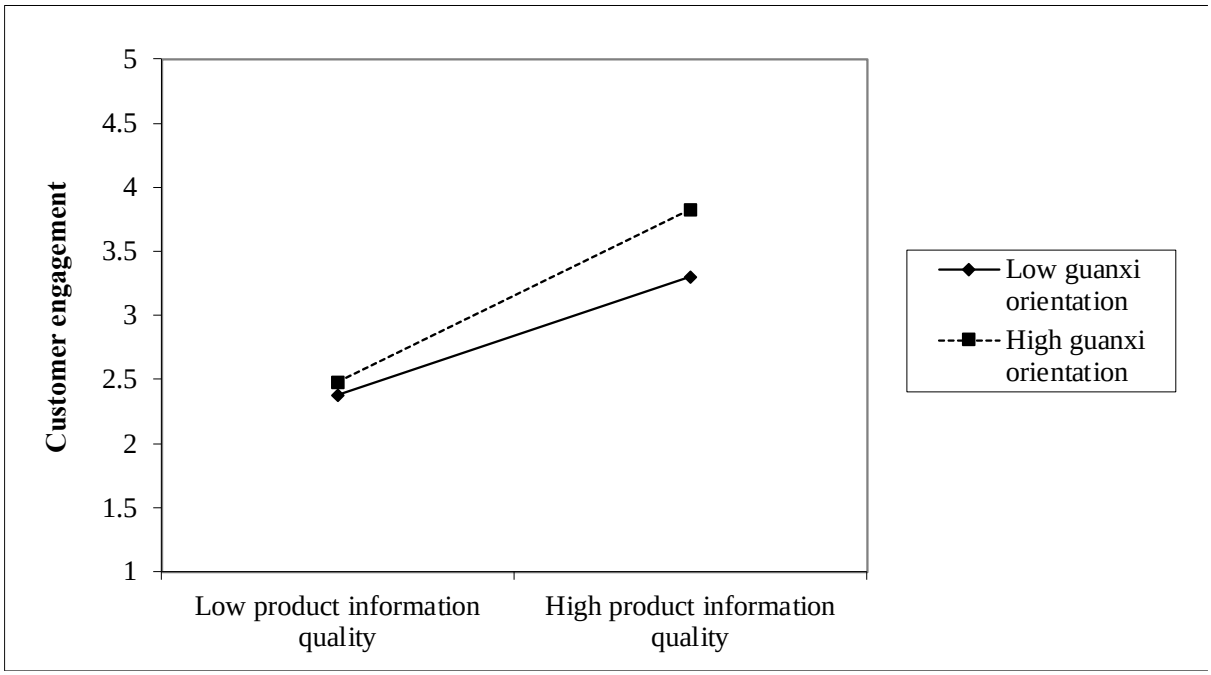


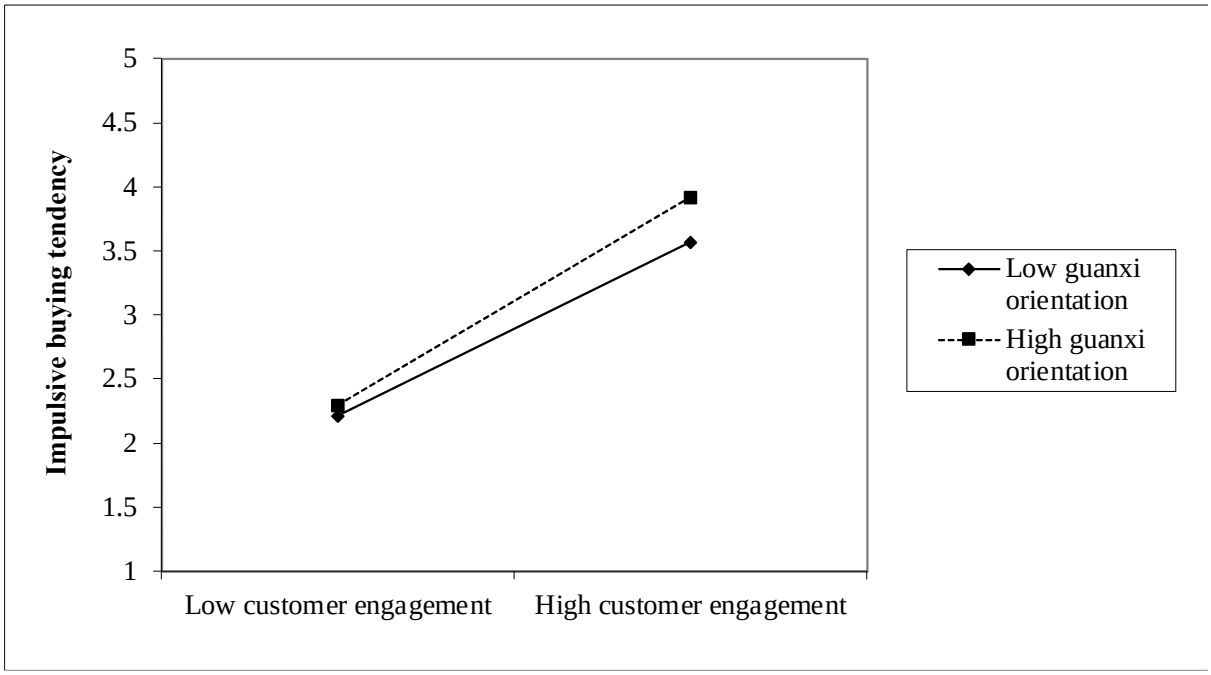
Figure 1. Conceptual Framework

Notes: Note(s): Dashed line boxes are lower-order constructs/dimensions; EMP (Empathy); RTI (Real-Time Interaction); RES (Responsiveness); EXP (Expertise); TRU (Trustworthiness); BEL (Believability); USE (Usefulness); VIV (Vividness); AFE (Affective Engagement); BEE (Behavioral Engagement); COE (Cognitive Engagement); SOE (Social Engagement)

Source: Authors' own illustration.



Panel A



Panel B

Figure 2. Panel A is the interaction plot of product information quality and guanxi orientation on customer engagement, and Panel B is the interaction plot of customer engagement and guanxi orientation on impulsive buying tendency

Source: Authors' own illustration.

Tables

Table 1: Demographic Profile

Variable	Characteristics	N=735	%
Gender	Male	337	45.85
	Female	398	54.15
Highest Level of Education	Below secondary	58	7.89
	Secondary	122	16.60
	Diploma or associate degree	125	17.01
	Bachelor's degree	300	40.82
	Master's degree	110	14.97
	PhD or higher	20	2.72
Monthly Income	Less than RMB5,000	156	21.22
	RMB5,001-RMB8,000	290	39.46
	RMB8,001-RMB11,000	121	16.46
	RMB11,001-RMB14,000	121	16.46
	RMB14,001 or more	47	6.39
Purchase Frequency in the Current 2 Months	Once	137	18.64
	Twice	210	28.57
	Three times	241	32.79
	Four times or more	147	20.00
Usage Duration	Within 1 year	203	27.62
	1-2 years	221	30.07
	2-3 years	171	23.27
	3-4 years	99	13.47
	4 years or longer	41	5.58

Source: Authors' own illustration.

Table 2: Assessment of Measurement Model on Reliability, Convergent Validity, and Full Collinearity

Construct	Item	Loadings	Full collinearity (FC)	Cronbach's alpha	ρ_A	Composite reliability (CR)	Average variance extracted (AVE)
Affective engagement	AFE1	0.795	1.041	0.810	0.862	0.865	0.615
	AFE2	0.796					
	AFE3	0.795					
Behavioral engagement	BEE1	0.852	1.338	0.915	0.917	0.937	0.747
	BEE2	0.863					
	BEE3	0.869					
	BEE4	0.874					
	BEE5	0.862					
Believability	BEL1	0.882	1.324	0.894	0.898	0.926	0.758
	BEL2	0.855					
	BEL3	0.867					
	BEL4	0.879					
Cognitive engagement	COE1	0.904	1.093	0.833	0.874	0.922	0.855
	COE2	0.944					
Empathy	EMP1	0.870	1.248	0.891	0.892	0.925	0.754
	EMP2	0.870					

	EMP3	0.859					
	EMP4	0.875					
	EXP1	0.843	1.062	0.906	0.908	0.930	0.728
	EXP2	0.891					
Expertise	EXP3	0.849					
	EXP4	0.841					
	EXP5	0.841					
	GO1	0.864	1.014	0.944	0.973	0.956	0.812
	GO2	0.917					
Guanxi orientation	GO3	0.911					
	GO4	0.917					
	GO5	0.896					
	IBT1	0.865	1.291	0.837	0.856	0.901	0.753
Impulsive buying tendency	IBT2	0.843					
	IBT3	0.895					
	RES1	0.850	1.368	0.879	0.880	0.917	0.734
	RES2	0.877					
Responsiveness	RES3	0.847					
	RES4	0.853					
Real-time	RTI1	0.891	1.315	0.855	0.863	0.911	0.774
interaction	RTI2	0.872					

	RTI3	0.877					
	SOE1	0.842	1.270	0.810	0.815	0.887	0.724
Social engagement	SOE2	0.868					
	SOE3	0.841					
	TRU1	0.855	1.340	0.905	0.905	0.929	0.725
	TRU2	0.860					
Trustworthiness	TRU3	0.836					
	TRU4	0.852					
	TRU5	0.853					
	USE1	0.865	1.274	0.888	0.891	0.923	0.749
	USE2	0.862					
Usefulness	USE3	0.858					
	USE4	0.876					
	VIV1	0.872	1.313	0.911	0.912	0.934	0.738
	VIV2	0.876					
Vividness	VIV3	0.849					
	VIV4	0.850					
	VIV5	0.849					

Source: Authors' own illustration.

Table 3: Assessment of the Discriminant Validity using HTMT

Constructs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Affective engagement														
2. Behavioral engagement	0.398													
3. Believability	0.443	0.289												
4. Cognitive engagement	0.223	0.134	0.157											
5. Empathy	0.313	0.308	0.338	0.212										
6. Expertise	0.377	0.295	0.326	0.193	0.359									
7. Guanxi orientation	0.045	0.059	0.039	0.067	0.034	0.024								
8. Impulsive buying tendency	0.735	0.496	0.419	0.224	0.343	0.426	0.038							
9. Responsiveness	0.493	0.449	0.333	0.245	0.291	0.347	0.032	0.38						
10. Real-time interaction	0.351	0.327	0.406	0.224	0.268	0.272	0.036	0.332	0.376					
11. Social engagement	0.385	0.285	0.31	0.288	0.311	0.294	0.045	0.425	0.329	0.326				
12. Trustworthiness	0.393	0.34	0.397	0.144	0.343	0.268	0.045	0.32	0.392	0.322	0.312			
13. Usefulness	0.406	0.285	0.298	0.138	0.303	0.316	0.045	0.408	0.281	0.328	0.308	0.335		
14. Vividness	0.421	0.35	0.276	0.189	0.393	0.414	0.029	0.362	0.336	0.271	0.297	0.263	0.421	

Note(s): HTMT<0.85 (Hair et al., 2020)

Source: Authors' own illustration.

Table 4: Assessment of Higher-Order Construct

Higher-order construct	Lower-order construct	VIF	Weights	T-values	CI	Convergent validity
Product information quality	Believability	1.110	0.536	12.991**	[0.452; 0.613]	0.704
	Usefulness	1.215	0.349	7.996**	[0.263; 0.433]	
	Vividness	1.204	0.481	11.29**	[0.400; 0.568]	
Streamer interaction quality	Empathy	1.102	0.533	11.047**	[0.439; 0.628]	0.768
	Real-time interaction	1.165	0.463	8.717**	[0.358; 0.566]	
	Responsiveness	1.152	0.393	7.914**	[0.294; 0.488]	
Streamer credibility	Expertise	1.063	0.633	15.405**	[0.550; 0.711]	0.738
	Trustworthiness	1.063	0.635	15.581**	[0.553; 0.714]	
Customer engagement	Affective	1.130	0.499	10.24**	[0.402; 0.598]	0.886
	Behavioral	1.119	0.497	10.318**	[0.399; 0.588]	
	Cognitive	1.072	0.126	2.531*	[0.028;0.225]	
	Social	1.157	0.352	7.284**	[0.255; 0.446]	

Note(s): * $p<0.05$, ** $p<0.001$; VIF=Variance Inflation Factor; CI=95% confidence interval bias corrected.

Source: Authors' own illustration.

Table 5: Assessment of Structural Model

Hypothesis and relationship	Std beta	Std error	t-value	CI	VIF	f^2	R^2	$Q^2_{predict}$	v
H1: SIQ → SC	0.541	0.039	13.825**	[0.475; 0.604]	1.000	0.207	0.292	0.176	
H2: SC → PIQ	0.328	0.04	8.308**	[0.263; 0.392]	1.413	0.128	0.401	0.207	
H3: SIQ → PIQ	0.393	0.039	9.978**	[0.328; 0.457]	1.413	0.182			
H4: PIQ → CE	0.569	0.042	13.513**	[0.493; 0.630]	1.013	0.241	0.338	0.139	
H5: CE → IBT	0.743	0.025	29.319**	[0.700; 0.782]	1.041	0.508	0.564	0.406	
H6: PIQ → CE → IBT	0.423	0.041	10.412**	[0.351; 0.486]					0.176
H7a: PIQ *GO → CE	0.105	0.056	1.875*	[0.028; 0.184]		0.020			
H7b: CE*GO → IBT	0.065	0.039	1.667*	[0.004; 0.118]		0.010			
Control variable									
Education level → IBT	0.004	0.024	0.146	[-0.038; 0.043]					
Gender → IBT	0.011	0.049	0.216	[-0.071; 0.091]					
Monthly income → IBT	0.004	0.024	0.154	[-0.036; 0.045]					
Purchase frequency → IBT	-0.006	0.024	0.261	[-0.043; 0.033]					
Usage duration →IBT	0.045	0.023	1.930*	[0.006; 0.083]					

Note(s): NA means not applicable for the situation when a single exogenous construct is used to predict an endogenous construct (Hair et al., 2020); *p < 0.05; **p < 0.01; VIF=Variance Inflation Factor; PIQ=Product Information Quality; SIQ=Streamer Interaction Quality; SC=Streamer Credibility; CE=Customer Engagement; IBT=Impulse Buying Tendency; GD=Guanxi Orientation.

Source: Authors' own illustration.

Table 6: Assessment of PLS$_{predict}$

Item	$Q^2_{predict}$	PLS-SEM_RMSE	LM_RMSE	PLS-SEM_RMSE - LM_RMS
IBT1	0.097	1.430	1.437	-0.007
IBT2	0.093	1.436	1.439	-0.003
IBT3	0.109	1.409	1.410	-0.001

Note(s): LM = linear model; RMSE = root-mean-square error.

Source: Authors' own illustration.

Appendix

Appendix A: List of measurement items

Product Information Quality (Zhang et al., 2020)	
Believability	
BEL1	The product information from the streamer is reliable.
BEL2	The product information from the streamer is believable
BEL3	The product information from the streamer is trustworthy.
BEL4	The product information from the streamer is sincere.
Usefulness	
USE1	The product information from the streamer is valuable.
USE2	The product information from the streamer is informative.
USE3	The product information from the streamer is helpful.
USE4	The product information from the streamer is useful.
Vividness	
VIV1	The product information from the streamer has stimulated my senses.
VIV2	The product information from the streamer is clear.
VIV3	The product information from the streamer is concrete.
VIV4	The product information from the streamer is realistic.
VIV5	The product information from the streamer is colorful.
Streamer Interaction Quality (Zhang et al., 2020)	
Empathy	
EMP1	Streamers give me individual attention.
EMP2	Streamers understand my specific needs.
EMP3	Streamers had my best interests in mind.
EMP4	Streamers offer personalized service to me.
Real-time Interaction	
RTI1	The interaction with streamers is real-time.
RTI2	The real-time interaction with streamers can meet my needs.
RTI3	The real-time interaction with streamers is efficient.
Responsiveness	
RES1	Streamers are always happy to talk with me.
RES2	Streamers always answer my questions and requests promptly.

RES3	Streamers' responses are closely related to my problems and requests.
RES4	Streamers can provide relevant information for my inquiries in time.
Streamer Credibility (Ohanian, 1990)	
Expertise	
EXP1	The streamer is an expert.
EXP2	The streamer is experienced.
EXP3	The streamer is knowledgeable.
EXP4	The streamer is qualified.
EXP5	The streamer is skilled.
Trustworthiness	
TRU1	The streamer is dependable.
TRU2	The streamer is honest.
TRU3	The streamer is sincere.
TRU4	The streamer is reliable.
TRU5	The streamer is trustworthy.
Customer engagement (Vivek et al., 2014; Dessart et al., 2016)	
Affective engagement	
AFE1	I find live-streaming shopping is interesting.
AFE2	I am interested in anything about live-streaming shopping.
AFE3	When interacting with people during live-streaming shopping, I feel happy.
Behavioral engagement	
BEE1	I share my ideas with others during live-streaming shopping.
BEE2	I seek ideas or information from others during live-streaming shopping.
BEE3	I am likely to recommend streamer's live streaming to my friends.
BEE4	I am likely to become a fan and a follower of the streamer.
BEE5	I am likely to keep track of the activities of a streamer.
Cognitive engagement	
COE1	I spend more time on live-streaming shopping.
COE2	Time flies when I am interacting with people during live-streaming shopping.
Social engagement	
SOE1	I like sharing my personal shopping experience with other viewers.
SOE2	I enjoy live-streaming shopping more when I am with other viewers.
SOE3	Live-streaming shopping is more fun when other people around me do it too.

Guanxi Orientation (Ding et al., 2017)	
GO1	Chinese society is composed of a kind of personal guanxi net.
GO2	I enjoy the life that includes human concern and kindness.
GO3	Personal guanxi is an important resource in social interaction.
GO4	People should get on with each other harmoniously.
GO5	I will try to build a good relationship with others.
Impulse Buying Tendency (Beatty and Ferrell, 1998)	
IBT1	When I watch live-streaming, I buy things that I had not intended to purchase.
IBT2	I am a person who makes unplanned purchases in live-streaming shopping.
IBT3	It is fun to buy spontaneously in live-streaming shopping.