

A Stimulus–Organism–Response (S–O–R) Framework for Live Streaming Commerce with a Socio–Technical Perspective

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ABSTRACT : This study exploits the bibliometric map of the research fields of e-commerce to guide the theoretical framework development of consumers behaving in the live-streaming e-commerce situations. The analysis is based on the data collected from the current customers of Tao Bao, JD.com, Mushroom Street, Little Red Book, JumeiYoupin, and other platforms. With an abstract base of 2,000 articles, the bibliometric map illuminates various critical success factors and knowledge fields that thrust e-commerce towards success. A focused deduction leads to a theoretical concept that shares the structure of the stimulus-organismresponse (S-O-R) theory of consumer behaviors, and there are social and technical domains of stimulus. The social stimuli include social influence, interaction, personal innovativeness, impulsive buying tendency, and vicarious learning. The unified theory of acceptance and use of technology, theory of reasoned activities, theory of planned behavior, S-O-R theory, and IS (information system) success model inspire understanding of social and technical factors. Methodically, a multilayered perceptron-neural network (MLP-NN) illustrates its utility to generate the knowledge base to guide structural equation modeling (SEM) analysis configuration. The overall results lead to some significant theoretical and practical implications, for instance, the endogenous and exogenous attention of social stimuli, the trust and boredom-transformable social values, and enjoyment to influence flow experience states of consumers in live streaming commerce.

KEYWORDS – Bibliometric study, customer value, e-commerce, live streaming commerce, socio-technical approach, S-O-R, unified theory of acceptance and use of technology

I. INTRODUCTION

Traditional e-commerce, dominated by web pages, has evolved into today's socially engaged versions, such as social commerce (s-commerce), live streaming commerce [1], and mobile commerce (m-commerce), resulting in customers adopting online buying as a new habit [2]. As more people want more significant social links and humanity in their relationships [3], the embedded social mechanism in e-commerce will have to provide the consumers' leisure demands beyond mere transactional service [4]. As technologies are constantly evolving and with the prevalent use of artificial intelligence (AI), new versions of e-, s- or m- (mobile) commerce will always emerge, such as conversational commerce that makes innovative uses of algorithm-based voice assistances, natural language processing (NLP) technology, AI systems, and big data [5]. This study will focus on the live streaming aspect of e-commerce or social commerce [6].

China Internet Network Information Center [7] reports about 617 million live streaming users, which will account for over 60% of the total Internet users by the end of 2020, and most notably is that the, live-

streaming commerce has reached over 15% of e-commerce sales in China, approximated at over 300 billion dollars in 2021 [1]. [8] reports in Forbes that live streaming e-commerce is another recent strategic catalyst that propels China's e-commerce retail sales to cross 1 trillion dollars in 2020. The creativity part of the live streaming fad in e-commerce in China, according to [8], is about "promoting and selling goods through influencer streams on their own social media channels, most often housed on China's online shopping malls", and as such, sprouting Alibaba's Taobao Live, with the lion's share of live-streaming at the time of reporting in Forbes at around 80%. It is also estimated that live streaming commerce has more than \$60 billion annually, with over 30% of China's population now viewing livestreams, and although Gen-Z and Millennials are the leading first group of acceptance, the middle-age Chinese and seniors are now widely joining the bandwagon [8]. Nowadays, e-commerce shopping and live streaming are highly intertwined, as Taobao Live and its rival JD.com. Seeing the trend in acceleration, the e-tail giant JD.com has also ramped up its live-streaming efforts.

Despite continuing publications in live streaming e-commerce [9], there are still abundant spaces for theoretical and empirical contributions, especially relating to theoretical integration and neural network simulation, to guide the development and validation of structural equation models. This study exploits the big-data bibliometric analyses of the literature database and proposes a socio-technical approach to conceptualize and validate a stimulus-organism-response (S-O-R) framework for studying live streaming commerce. The socio-technical approach is exploited, as live streaming shopping is a novel marketing method that exploits the advantages of the technological tools of "live broadcast" and "e-commerce", and the interactive social atmospheres and mechanisms. In sum, the following captures the research objective of this study:

This study exploits a bibliometric map of co-occurrence of themes of the extant literature in e-commerce to guide the conceptual model development for explaining consumer behaviors in live streaming commerce. Methodically, multilayered perceptron-neural network (MLP-NN) simulation provides the predictive bases for the theoretical validation using structural equation modeling (SEM) statistics. Both data analysis methods offer numerous insights for implications that add to the knowledge repertoires of the extant literature.

II. LITERATURE REVIEW

The bibliometric study is used in the literature review to provide a broad picture of the status of the research field [10] linked to "e-commerce" and "live-streaming," which is based on metadata from publishing databases such as Scencedirect.com. The use of bibliometric analysis is not intended to be exhaustive in this study; instead, by better understanding the advances and trends in research [11] using the bibliometric study that is linked to a developing e-commerce issue, namely "live streaming," it guides the creation of hypotheses and theoretical framework.

The VOSviewer software is used to plot the bibliometric co-occurrence network, as shown in Fig. 1, which illuminates the most relevant topics and their interconnections in the "e-commerce" field by relying on the meta-database of 2,000 articles extracted from Scencedirect.com. The main clusters identified are (A) factors enabling consumers to form attitudes and make purchase decisions (the blue color), (B) consumer behaviors field, which depicts essential factors influencing purchase intention such as trust, usefulness, enjoyment, hedonic value, social judgment, utilitarian motivation (red color), (C) the supply chain and demand infrastructures and strategies such as retail, marketing, segmentation, physical store, online channels, and competition (purple color), (D) the operating system which involves algorithm, system design for e-commerce, network, shop floor, and manufacturing management, scheduling, and job scheduling (yellow color), and (E) the contextual and stakeholder relevancies such as COVID, woman, student, travel, and demographic (green color). The rationales for the interrelatedness of the five clusters are, for instance, as follows: While online review can operate as a decision-making aid for consumers on e-commerce purchases [12], the system supplies a productive integrator and base for a robust supply chain to the e-commerce industry, so as not to disrupt market price [13], and earn the confidence and intention of the consumers. In addition, during the COVID-19 prevalence during

stimuli such as service experiences [25] to influence consumer behaviors (Sultan et al., 2021). The organism signifies the field of the psychological impact of the stimuli [26]. The simplicity of the S-O-R structure also offers the innovative spaces for conceptualizing service strategies [25], and for deriving incentives and mechanisms to induce impulse buying [27].

Wide ranges of publications relating to the use of the S-O-R framework are available, for instance, in panic buying [28], organic food purchase [29], and energy-saving behaviors [30]. The study of live-streaming commerce is still in the emerging stage, and VOSviewer software-generated bibliometric map of the "live-streaming" theme shows a straightforward structure that the stimulus-organism-response (S-O-R) model can fit to explain how customers' behaviors can be influenced, as shown in Fig. 2.

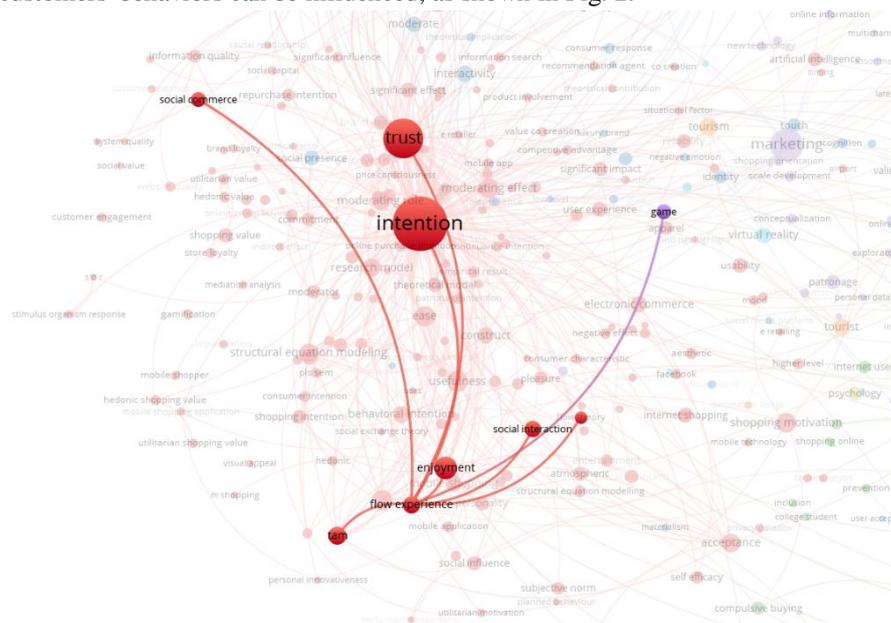


Fig. 2. A bibliometric map of limited live-streaming shopping literature from sciencedirect.com.

Fig. 2 further confirms that the socio-technical approach is a core mechanism to influence intention, involving the technology acceptance model (TAM) and social interaction. Tracing to [31], the socio-technical system (STS) approach views the organization as a work system with two interrelated subsystems, namely technical and social systems (p.14). Common socio-technical theories to studying consumer behaviors are the technology acceptance model (TAM) and the unified theory of acceptance and use of technology [32], the theory of reasoned activities (TRA), and the theory of planned behavior [33], the stimuli-organism-response (SO-R) model [4], and [34]s IS Success model. The IS Success model views the systemic aspect of quality, such as information and service quality, as essential drivers. For example, [35] uses IS Success model [34] to study consumers' social purchasing behavior.

In the unified theory of technology acceptance and use, four factors influence consumers' behavioral intentions: performance expectancy (the expected benefit from using the technology), effort expectancy (the expected ease of using the technology), social influence (the perception that significant others believe in using the technology), and facilitating conditions (the expected technical or organizational support that the technology will provide) [32]. The unified theory of acceptance and application of technology has the precise goal of the theory of planned behavior (TPB) since the significant other influence resembles subjective norms and other factors represent a part of consumer confidence. Many research papers discover either direct implementations of oft-cited theories or theoretical frameworks or modest modifications, including consumers' innovativeness toward new technology as a moderator in TPB [36].

In the context of the S-O-R framework, the stimuli refer to environmental cues that influence an individual's psychological states [37], activate the evaluative process of consumers [38] known as an organism, and influence consumer responses. Accordingly, the S-O-R framework delivers the following hypotheses that this study adopts to study the consumer behaviors in live streaming commerce, and the types of stimuli will be conceptualized based on socio-technical perspective and an integrative set of theories previously explained in the sequel:

- H1: Stimulus factors explain the variance of organism factors (S → O)
- H2: Organism factors explain the variance of customer responses (O → R)
- H3: Stimulus factors explain the variance of customer responses (S → R)

Ultimately, Table 1 reveals the stimulus-organism-response structure conceptualized from a socio-technical perspective. Statistical inference analysis methods such as structural equation modeling (SEM) and neural network (NN) simulations would explore and identify the significant factors in S and O to influence R, as presented in a typical neural network simulation structure in Fig. 3.

Table 1. Operationalizing the Conceptual Model

Theories	Socio-Technical Approach	S	O	R
S-O-R theory of consumer behavior	Social	Social Influence Interaction Personal innovativeness Impulsive buying tendency Vicarious learning	Utilitarian value Hedonic value Social value Perceived value Trust	Customer loyalty Addiction Impulsive Buying
The unified theory of acceptance and use of technology, reasoned activities, planned behavior theory, S-O-R theory of consumer behavior, and IS success model.	Technical	Performance expectancy Effort expectancy Synchronicity Quality of Service and System	Flow Experience Perceived enjoyment	

Specifically, Fig. 3 depicts the meta-theory structure of neural network simulation, which this study uses to build a theory of consumer responses (customer loyalty, addiction, and impulsive buying) from the input signals s_j , which has social and technical stimulus inputs, and organism factors. As noted in Table 1, social stimulus inputs are social influence, interaction, personal innovativeness, impulsive buying tendency, and vicarious learning. Technical stimulus inputs are performance expectancy, effort expectancy, facilitating condition, synchronicity, and quality of service and system. The neural network simulation will determine optimal weights W_{ki} (the contribution of each stimulus and organism input signals to the neuron). The summing junction is a linear weighted input signal $u_k = \sum_{i=1}^n s_i W_{ki}$ where $i = 1, \dots, n$ indicates the corresponding input or synaptic weight of the k neuron, and b_k is the bias elements, leading to $v_k = u_k + b_k$. The activation function $\psi(\bullet)$ limits the amplitude of the output of the neuron described by $y_k = \psi(v_k)$, and the output is y_k [39].

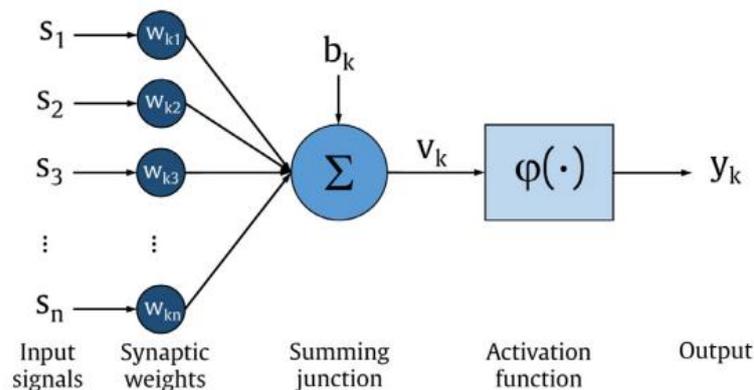


Fig. 3. A typical neural network simulation structure

The proposed S-O-R model is more comprehensive than the current trend of development captured in the extant literature on live streaming, as shown by the VOSviewer software-generated bibliometric map in Fig. 3.

The following discusses the rationales and logic of considering the types of social and technical stimulus variables and organism and response variables of the S-O-R model from the socio-technical approach in live streaming commerce. Nevertheless, to what extent each variable is significantly essential to explain the variances of organisms and responses will be determined and validated using neural network simulation and structural equation modeling (SEM) statistics.

2.3. Social Stimulus Variables

2.3.1. Social Influence

Social influence connotes a positive atmosphere of the live streaming session made possible by the viewers' reciprocity and exhibits a social proof that indicates the popularity or trustworthiness of products and services [40]. Accordingly, social influence can be anchored in social impact theory, which explains the influence that others have in a social setting [41]. Social influence tactic is essential in uncertain situations, which can positively impact consumer attitude, shape social norms and perceived behavioral control towards a product or service, and thus, shares the essence of the theory of planned behaviors [42]. Strategically, live streaming using social influence tactics can be considered playing out influencer commerce [43]. Operatively, through exchanges of resources such as opinions of viewers and potential customers, a live streaming platform creates social influence and provides the informational, emotional, and tangible support [44], leading to a positive impact on customer perceptions of values, trust, and other organismic factors, including an intention to continue, as illustrated in Table 1.

2.3.2. Interactions

As live streaming is a form of social commerce, it can be inferred that interaction and participation should be promoted [45]. Interactivity is a crucial technological feature of social commerce, referring to the degree to which a communication technology allows for creating an environment that facilitates real-time reciprocal interaction and information sharing [46]. Through interactions, customers exchange information to understand better the offers, form trust, and better perceptions of customer values, leading to stronger purchase intentions [45]. Dynamic interactivity has also significantly influenced impulsive online buying [47].

2.3.3. Innovativeness

Apart from the significant roles of live streaming in promoting reciprocal interaction and social influence, personal characteristics such as innovativeness can be an essential factor, as live streaming is a relatively new product to s-and e-commerce. Innovativeness characterizes a degree of personal tendency to

readily adopt a new practice, product, or service [48]. From the perspective of the theory of planned behavior [49], innovativeness is a nature of consumer attitude towards acceptance of new ideas [50] and can positively affect online shopping intention [36].

2.3.4. Impulsive buying tendency

Livestreaming sessions, especially those promoted and stimulated by online celebrities, tend to induce impulsive buying. Originally, impulsive buying tendency is often associated with unplanned buying [51], but has gradually been recognized as a consumer behavior dominated by customers' emotional experience, and thus, there is rapidness of behavior precluding thoughtful deliberation [52]. Alternatively, other researchers show that impulsive buying tendency is also positively related to consumers' dispositional mindfulness and, thus, is also rational [53]. Reasons for impulsive buying are indeed numerous; for instance, it can be a rational plan but under the influence of time pressure [54].

2.3.5. Vicarious learning

Vicarious learning refers to learning by observing, for instance, how the live-streaming host plays out and demonstrates the products, and can have a positive effect on new product adoption [55], such as consumer emotion and perceptions of products [56]. As such, it can be implied that vicarious learning is about role model influence, and towards this aspect, [57] offers cognitive-developmental theory and social learning theory in the explanations. Specifically, the cognitive-developmental theory posits that learning is a cognitive-psychological process of adjustment to one's environment [58]. Thus, when it is inferred to live streaming, potential customers engage in a continuing cognitive-psychological process to understand the exhibited products. Alternatively, social learning theory posits that consumers acquire norms and perceptions favorable to induce adoption and product purchase intention [57]. Thus, as implied in social learning theory, vicarious learning is similar to word-of-mouth learning in influencing consumer decision processes [59].

2.4. Technical Social Stimuli

2.4.1. Variables Performance expectancy and effort expectancy

Performance and effort expectancies are the two variables typically considered in the unified theory of acceptance and use of technology [60]. Performance expectancy refers to the degree to which consumers feel the adoption of live-streaming shopping is beneficial, and effort expectancy refers to the perceived ease of use of live streaming shopping. These variables have been shown as significant predictors of behavioral intention in technology consumption and adoption [61]. Performance and effort expectancies are tightly related to the attributes that contribute to the diffusion of innovation, represented by "relative advantage," "complexity," "compatibility," "trialability," and "observability" [48], and psychologically [62] shows that performance and effort expectancies reduce resistance and anxiety of individuals towards a new system. Thus, a positive perception of technical stimulus variables, such as performance and effort expectancies, should positively influence the organismic field, as given in Table 1.

2.4.2. Synchronicity

Synchronicity is a critical technical attribute that aims to bring a seamlessly positive experience to consumers, reflecting shorter psychological distance and caring of the hosts [41]. The theory of media synchronicity claims that communication is improved when the chosen media supports the synchronization required by a communication process [64]. In short, a high degree of synchronicity allows the consumers to engage in a communication interaction to exchange communicative stimuli [63] quickly, thus affecting social intimacy and inducing trust [64].

2.4.3. Quality of System and Services

The quality of a technological system and services is essential to influence shopping participation, such as in mobile format [65], or, correspondingly, in live streaming commerce. Both system and service qualities are typically combined and provide unified roles, especially in a technologically oriented system such as mobile

shopping. According to [66], mobile shopping is not just a technological gadget or platform but a cultural object that influences the lifestyle of the consumers. Similarly, both system and service qualities should play an essential stimulus role for an innovative service system, such as live streaming commerce.

2.5. Organism Variables

In this study, the organismic variables consider customer values, such as utilitarian value, hedonic value, social value, overall perceived value, trust, enjoyment, and flow experience. The organism is viewed as the perceptual and psychological result of the consumer's cognitive and affective apparatus. [67] explain that the consumer's cognitive apparatus is a complex knowledge structure that embodies intricately interwoven subsystems of beliefs called memory schemas. Customer-perceived values have been widely acknowledged to influence consumer decision-making [68]. When customers receive utilitarian value, meaning meeting the functional needs and the price requirement, and the hedonic value and enjoyment, which manifests fun and enjoyment [69], they will exhibit continuance intention [70]. The different customer values are also sources of consumer motivations [67]. As noted in [71], the increased state of arousal and emotions, including the need to fantasize, boost positive feelings that only enhance hedonistic shopping experiences, which impulsive buyers desire.

Flow experience is another organismic factor shown in the bibliometric map in Fig. 2, which describes an organism state in which people are so intensely involved in an activity that nothing else seems to matter; the experience itself is so enjoyable that people will do it even at a high cost, for the sheer sake of doing it [72, 73]. In short, a consumer's flow arises from being completely immersed in an activity [74]. Trust factor replaces anxiety, a flow experience barrier [75,76]. Trust is expressed in the consumer's belief [77], which, in the case of live streaming commerce, signifies it has performed to the level that the consumers form positive beliefs about the reliability of the stated functions.

2.6. Response Variables

The conceptual model adds impulsive purchase as an additional response-oriented variable, on top of loyalty, that is not presented in any form by the bibliometric map shown in Fig. 2. Impulsive online buying is particularly significant among female consumers [78] and online celebrities [79]. Those who buy on the spur of the moment also have a higher level of brand addition [80]. Thus, addiction is another response in this study, as shown in Table 1. Customer loyalty, impulsive buying, or addiction can be considered favorable behavior toward live streaming e-commerce. The S-O-R model, represented and depicted through hypotheses H1 to H3, suggests that managing both the social and technical stimuli appropriately would lead to favorable perceptions of offered values, gains the trust, and fosters flow experiences, which in turn, generate positive responses such as loyalty, addiction, and impulse buying. Addiction is reflected in the more extended periods spent on live streaming and shares characteristics of internet addiction [81].

III. RESEARCH METHODS

3.1. Sample and Data Collection

The data for this study were collected using a questionnaire-based survey method. The goal of the survey, ethical criteria for autonomy and anonymity, and guidelines on responding to both general information (e.g., gender, age, highest education) and theoretical components are all included in the survey instructions. Regular live streaming e-commerce consumers of Tao Bao, JD.com, Mushroom Street, Little Red Book, JumeiYoupin, and others received invitations to participate. However, the specificities such as the number of clients from each live streaming e-commerce site are not controllable due to the convenience-based approach to data collection. Using 5-10 observations per questionnaire item as the guideline for SEM analysis [82], a

minimum sample size of 285 (computed from 19 latent constructs multiplied by three questionnaire items and multiplied further by five observations), up to 570 (19X3X10), is recommended.

3.2. Measurement Tools

A five-point Likert scale provides the closure format for the survey responses: 1 = strongly disagreed to 5 = strongly agreed. The questionnaire design aligns with the rationales and logic of the S, O, and R variables presented in the literature review section. A pilot test of fifty consumers provides a statistical base to validate the appropriateness of reliability measures of the questionnaire items explaining each variable. The pilot stage mainly uses the reliability assessment and exploratory factor analysis to ensure unitary dimension and no cross-loading factors beyond 0.4. Minor adjustments are then made in languages and Chinese translations, which again requires the consensus of three researchers of reasonable survey-based competencies. The following lists the operationalization details of the constructs with the variable labels that match the connotations used in the "results" section, together with the adapted references:

- V1 (Impulsive buying tendency: I think that: ... I am an impulse purchaser.... buy things I do not need. ... much of my life centers around buying things ... others might consider me a "shopaholic."
- V2 (Performance expectancy, [9]): Livestreaming shopping saves me time for shopping. Livestreaming shopping helps me choose the suitable products I need. Livestreaming shopping enhances the way I shop.
- V3 (Personal innovativeness, [36]): When I hear about live streaming shopping, I look for the possibility of trying it. I am usually the first to try out something new in the market. I am keen to join live-streaming shopping because the anchor may provide new knowledge.
- V4 (Effort expectancy, [60]): refers to the perceived ease of use of live streaming shopping. It is easy for me to shop using live streaming shopping. It takes me a short time to get familiar with live streaming shopping. It is easy for me to become skillful at using live streaming shopping.
- V5 (Synchronicity, [28, 83]): When I livestream shop, the platform quickly processes my comments input. When I livestream shop, seeing comments sent by others is very fast. When I livestream shop, I can see others' comments without any delay. When I livestream shop, the platform quickly responds to my comment inputs.
- V6 (Social influence, [36]): Viewers or potential customers in live streaming shopping influence each other about the quality of the product(s). In general, viewers or potential customers in live streaming shopping support each other. In general, the social chats and messages in live streaming shopping influence my decision.
- V7 (Interaction, [27,28]): When I Livestream shop, I can exchange and share opinions easily with the streamer or other audiences. When I Livestream shop, the streamer knows our needs and interacts actively with us. When I Livestream shop, the streamer provides sufficient opportunities to respond and ask questions.
- V8 (Quality of System and Services, [34]): Overall, the livestream shopping service meets the quality expectations, e.g., quick response, politeness, caring, and needs. Overall, the livestream shopping app system has a good design. Overall, the information provided during the live stream shopping session is beneficial.
- V9 (Vicarious learning, [28, 84]): By watching live streaming during the shopping, I can feel what the streamer is trying to say about the recommended products and his or her experiences. By watching live streaming during the shopping, I can imagine what the streamer is trying to say about the recommended products and his or her experience. By watching live streaming during the shopping, I can envision what the streamer is trying to say about the recommended product and his or her experience.
- V10 (Utilitarian value, [85]): The product(s) on the live streaming e-commerce platform have a reasonable price. The product(s) has consistent quality while live-streaming shopping. The product(s) meet my needs.

- V11 (Hedonic value, [9]): Livestreaming shopping is enjoyable because I can interact with the anchor. Livestreaming shopping is fun because I enjoy the shopping process. Livestreaming shopping is enjoyable as the products are worthy of the money spent.
- V12 (Social value, [86]): I value live-streaming shopping because it enhances my social status with my circle of friends and colleagues. I value live-streaming shopping because they help me maintain a relationship with friends. I value live-streaming shopping because it enables me to connect to today's social trends.
- V13 (Perceived enjoyment, [86]): Using live-stream shopping is: Fun. Enjoyable. Pleasurable. Very interesting.
- V14 (Perceived value, [86]): Overall, the use of live streaming services delivers good value to me. Considering the efforts I put into using a live streaming shopping service, it is worthwhile. Considering the time I spent using a live streaming shopping service, it is worthwhile.
- V15 (Trust, [9]): Livestreaming shopping is trustworthy. I trust the quality of goods purchased on live streaming shopping. Live streaming shopping has an excellent after-sales service system. The law can fully protect my interest in live streaming shopping.
- V16 (Flow experience, [73]): I consider myself completely absorbed in the live streaming shopping session and ignored what happened around me. I felt completely immersed in the live streaming shopping with joy. When I Livestream shop, I generally feel that time is passing quickly. When I Livestream shop, I often focus too much and forget about other things I have to do. When I Livestream shop, I usually do not pay attention to what is happening around me.
- V17 (Addiction, [86]): I use live streaming shopping services longer than I planned to. Much of the time was spent participating in live streaming shopping events. Livestreaming shopping takes up a lot of my leisure time.
- V18 (Customer loyalty, [36]): I will continue live streaming shopping. I will involve more in live streaming shopping. I will tell others about my positive experience with live streaming shopping. I will speak favorably about live streaming shopping. I will recommend live-streaming shopping to others.
- V19 (Impulsive buying, [71,87]): I often cannot help buying the product(s) in Livestream shopping. I often could not restrain the desire to buy the promoted products. I often Livestream shop without planning to buy, but I bought.

3.3. Data Analysis

Prior to neural network simulations and SEM computations, the survey instrument's quality is assessed, including reliability measure, convergent validity, and discriminant validity. The stimulus-organism-response (S-O-R) structure covers 19 constructs, including technical and social factors in stimulation, as well as a slew of business and psychological variables. The analysis exploits neural network simulation's ability to robustly conclude similar results of multiple regression methods [88]. The predicted base of neural network simulation helps construct the S-O-R model of structural equations. It validates the socio-technical guided S-O-R structure using goodness-of-fit, RMSEA (root mean square error of approximation), NFI (normed fit index), CFI (comparative fit index), IFI (incremental fit index), RFI (relative fit index), and RFI (relative fit index) [89].

IV. RESULTS

Various sample-size requirements for SEM computation have been proposed, such as a sample size of 100- 200 [90], 5-10 observations per questionnaire item, or ten instances per variable [82, 91]. There are 19 theoretical constructs in total, each with three measurement items; hence, sample sizes ranging from 285 (=19X3 items X 5 observations) to 570 (=19X3X10) are considered adequate [92].

For this study, 517 valid survey returns serve the datasets for data analysis. Models based on larger samples are more likely to converge successfully with more indications and higher factor loadings [92]. Table 2 shows the demographics of the survey participants, with male and female participation rates of 42.7 percent and

57.3 percent, respectively. 82.8 percent of the study participants have more than three years of e-commerce experience, with 59.2 percent having used live streaming fewer than twice per week. Tao Bao platform is preferred by the majority of survey participants (47.2%), followed by JD.com (14.5%). In addition, 45.8% of the survey participants reported having had some aspects of negative live-streaming e-commerce experiences.

Table 2. Demographics and Livestreaming E-Commerce Experience Profiles

Gender: Male: 42.7% Female: 57.3%	Age: < 18: 0.2% 18-25: 46.6% 26-35: 21.1% 36-45: 20.1% 46 or above: 12%	Highest Education: High school: 4.6% Vacation: 51.5% Bachelor: 22.8% Master or above: 21.1%	Career: In-school: 25.3% Company staff: 36.2% Government Unit: 18.2% Freelancer: 11.6% Other: 8.7%	E-Commerce Experience: One year or less: 8.5% 1-2 years: 8.7% 3-5 years: 29.2% Five years or more: 53.6%
Weekly Livestream E-Commerce Usage: Less than two times: 59.2% 2-4 times: 16.6% 5-7 times: 9.1% Seven or above: 15.1%	Most Preferred Platform: Tao Bao: 47.2% JD: 14.5% Mushroom Street: 2.7% Little Red Book: 6.4% Jumei Youpin: 1.2% Other: 28%	Monthly Salary: Below 2,000 RMB: 41.2% 2-4,000: 19.3% 4-6,000: 14.5% 6,000 or above: 25%	Never Negative Experience with Livestreaming E-Commerce: Yes: 45.8% No: 54.2%	

Table 3 shows reliability and convergent and discriminant validity for the study's nineteen constructs. Both convergent and discriminant validities provide non-overlapping construct validation, which entails making educated measurements interpretations that reflect the construct's meaning [93], as indicated by the square root of total variance extraction (TVE) more than cross-correlations, together with a factor loading of each questionnaire item greater than 0.50, and TVE greater than 0.5 [94].

Specifically, the results of the MLPNN are as follows: The primary predictors from MLPNN for impulsive purchase include impulsive buying trend (with normalized importance = 100), followed by addiction (with normalized importance at 58.8), loyalty (with normalized importance at 53.7), economic value (with normalized importance at 49.5), innovativeness (with normalized importance at 48.2), and trust (with normalized importance at 44.6). The impulsive buying trend is the most critical predictor of addiction, followed by flow experience, enjoyment, trust, and social value. Customers' economic value and flow experience are the most important determinants of customer loyalty, followed by perceived value, innovativeness, addiction, and enjoyment. MLPNN identifies trust and impulsive purchase trends as crucial predictors of flow experience, followed by enjoyment and social value.

With the help of the neural network results in Table 4, SEM becomes relatively simple. The SEM structure for goodness-of-fit validation is depicted in Table 5, which presents the standardized path loadings used to predict V10 to V19, with the R-squared explaining the construct's variation at the bottom of the table. The following are the SEM statistics: NFI = 0.996, RFI = 0.98, IFI = 0.999, TLI = 0.996, CFI = 0.999, RMSEA = 0.021, $2/df = 1.232$, $df = 33$, NFI = 0.996, RFI = 0.98, IFI = 0.999, TLI = 0.996, CFI = 0.999, RMSEA = 0.021, which gives a robust fit of the postulated model.

The analysis of Table 5 has numerous meaningful implications for both theoretical and practical aspects. The discussions will gradually move from left to right. The first block is about the customer value domain. Value is context-dependent [96], and this study deals with live streaming commerce. The result in Table 5 supports hypothesis H1 that socio-technical stimuli are significant predictors of favorable perceptions of customer values, represented by utilitarian, hedonic, social, and enjoyment. Social values and enjoyment are essential to live streaming commerce.

Next, Table 5 presents that utilitarian value is a significant predictive base for all other values to favorably form, such as hedonic and social values and enjoyment. The "trust" factor shares a similar determinant structure to the customer value field. Flow experience refers to a motivational state of complete concentration on a given task [97], which is live streaming commerce in this study. Table 5 presents the significant predictive roles of trust, social values and enjoyment, and the customer-oriented social stimuli (impulsive buying tendency and personal innovativeness) on flow experience. The last block deals with the zones of dependent variables, which has an addiction, customer loyalty, and impulse buying. Hypothesis H2 is supported.

Nevertheless, as to H3, social stimuli overtake the technical stimuli. The synchronicity aspect of the technical stimuli is essential for impulse buying, which manifests un-delayed responses from the host to the consumers. For addiction, the system and service quality of the technical stimuli is essential. For loyalty, performance expectancy is significant, which refers to the extent to which the consumers believe that using live streaming commerce will help them achieve their goals.

Table 5. SEM Path Coefficients and Variance Percentage Explained

Constructs	V10	V11	V12	V13	V14	V15	V16	V17	V18	V19
V1	0.13	0.03	0.11	0.13		0.13	0.21	0.35	0.03	0.41
V2	0.05	0.04	0.13	0.03	0.14	0.1			0.05	
V3	0.06	0.21	0.25	0.26		0.16	0.07	0.09	0.13	0.12
V4		0.06	0.04	0.03						
V5	0.07	0.06	0.03	0.02		0.04				0.04
V6		0.06	0.08					0.07		0.08
V7	0.06	0.13	0.05	0.18						
V8	0.39	0.22			0.14			0.08		
V9	0.26	0.07	0.03	0.04		0.12			0.05	
V10		0.17	0.28	0.11	0.11	0.09	0.11	0.06	0.05	
V11			0.06	0.25	0.32		0.05			0.12
V12					0.21	0.23	0.18	0.12	0.19	
V13				0.07	0.14	0.08	0.17	0.15	0.06	0.05
V14						0.15	0.02			0.02
V15							0.22	0.13	0.01	
V16								0.26	0.16	
V17									0.17	0.19
V18										0.1
R-Squared	0.66	0.69	0.7	0.67	0.73	0.8	0.7	0.75	0.75	0.71

Note: V1=Compulsive buying trend. V2 = Performance expectancy. V3 = Innovativeness. V4 = Effort expectancy. V5 = Synchronicity. V6 = Social influence. V7 = Interaction. V8 = System and service quality. V9 = Vicarious learning. V10 = Utilitarian value. V11 = Hedonic value. V12 = Social value. V13 = Enjoyment. V14 = Perceived value. V15 = Trust. V16 = Flow. V17 = Addiction. V18 = Loyalty. V19 = Impulse Buying.

Table 6 displays the findings of the ANOVA and t-tests, which reveal significant differences between the survey participants who have had poor experiences with live-streaming e-commerce and those who have never had unfavorable experiences. Compared to Mushroom Street, the most popular live-streaming e-commerce platforms, Tao Bao and JD.com, score lower on all criteria, including addiction, loyalty, and impulsive buying. In general, the surveyed customers with more weekly live streaming e-commerce participation show more favorable perceptions, attitudes, and behaviors towards all the theoretical factors considered in this study.

Table 6. ANOVA and T-Test Results

		V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12	V13	V14	V15	V16	V17	V18	V19	
Gender	Male	221	3.14	3.43	3.36	3.47	3.48	3.50	3.38	3.48	3.55	3.42	3.35	3.32	3.44	3.38	3.41	3.32	3.16	3.26	3.27
	Female	296	3.25	3.52	3.37	3.66	3.60	3.73	3.58	3.59	3.61	3.51	3.52	3.36	3.50	3.48	3.48	3.33	3.18	3.40	3.38
	t-value				-2.28		2.85	-2.53					-2.11								
	Sig. (2-tailed)				0.02		0.04	0.02					0.04								
Age	18 Below	1	3.00	3.00	4.00	3.33	3.00	3.00	3.00	5.00	5.00	5.00	5.00	5.00	4.00	5.00	5.00	5.00	3.00	5.00	4.00
	18-25	241	3.16	3.46	3.35	3.54	3.45	3.63	3.44	3.50	3.57	3.50	3.46	3.30	3.45	3.44	3.41	3.28	3.15	3.30	3.26
	26-35	109	3.32	3.58	3.44	3.65	3.69	3.72	3.64	3.71	3.71	3.56	3.54	3.49	3.65	3.60	3.56	3.43	3.32	3.46	3.45
	36-45	104	3.23	3.44	3.26	3.58	3.56	3.56	3.40	3.53	3.55	3.40	3.29	3.27	3.39	3.28	3.39	3.29	3.02	3.28	3.30
	46 or Above	62	3.17	3.51	3.45	3.63	3.69	3.63	3.58	3.47	3.48	3.33	3.46	3.34	3.39	3.38	3.47	3.37	3.24	3.36	3.45
Highest Education	High School	24	3.74	3.69	3.85	3.58	3.81	3.71	3.82	3.74	3.82	3.74	3.75	3.86	3.73	3.81	3.86	3.63	3.79	3.90	3.75
	Vacation	266	3.16	3.43	3.32	3.51	3.45	3.60	3.40	3.52	3.55	3.45	3.41	3.28	3.41	3.36	3.38	3.22	3.11	3.29	3.23
	Bachelor	118	3.29	3.48	3.40	3.66	3.63	3.69	3.59	3.55	3.62	3.52	3.44	3.41	3.54	3.51	3.51	3.51	3.30	3.44	3.52
	Master or Above	109	3.11	3.57	3.32	3.68	3.67	3.63	3.52	3.57	3.59	3.43	3.47	3.30	3.51	3.45	3.44	3.32	3.05	3.23	3.27
	F-Value		2.85		2.54		2.84							3.02					4.21	4.06	3.67
Sig. (2-tailed)		0.04		0.06		0.04							0.03					0.01	0.01	0.01	
Career	In School	131	3.01	3.40	3.29	3.47	3.35	3.53	3.35	3.49	3.57	3.51	3.41	3.28	3.37	3.39	3.39	3.18	3.04	3.26	3.11
	Company Staff	187	3.24	3.52	3.42	3.59	3.63	3.68	3.52	3.57	3.57	3.43	3.46	3.38	3.52	3.43	3.44	3.34	3.19	3.35	3.37
	Gov. Unit	94	3.41	3.72	3.49	3.75	3.80	3.86	3.65	3.71	3.76	3.68	3.54	3.40	3.70	3.57	3.59	3.57	3.27	3.50	3.57
	Free Lancer	60	3.35	3.34	3.35	3.47	3.38	3.50	3.52	3.43	3.55	3.37	3.47	3.36	3.40	3.44	3.47	3.40	3.40	3.35	3.34
	Other	45	3.02	3.24	3.13	3.64	3.50	3.44	3.41	3.42	3.39	3.27	3.27	3.19	3.22	3.30	3.29	3.13	2.94	3.19	3.27
	F-Value		2.84	2.73		4.55	2.83							3.09				2.56			2.89
Sig. (2-tailed)		0.02	0.03		0.00	0.02							0.02				0.04			0.02	
E-Commerce Experience	1 Year or Less	44	3.45	3.41	3.63	3.29	3.62	3.52	3.46	3.56	3.70	3.52	3.41	3.48	3.56	3.48	3.52	3.51	3.30	3.44	3.48
	1-2 Years	45	3.71	3.76	3.63	3.76	3.86	3.79	3.79	3.85	3.81	3.81	3.79	3.59	3.66	3.50	3.79	3.73	3.77	3.64	3.73
	3-5 Years	151	3.24	3.60	3.41	3.59	3.55	3.70	3.55	3.58	3.63	3.59	3.53	3.45	3.54	3.51	3.56	3.41	3.29	3.41	3.41
	5 Years or More	277	3.07	3.39	3.26	3.59	3.49	3.59	3.41	3.48	3.51	3.35	3.35	3.21	3.40	3.37	3.32	3.19	2.99	3.24	3.20
F-Value		6.24	2.99	3.89		2.66					4.82	3.61	3.69				5.02	8.80	3.08	4.42	
Sig. (2-tailed)		0.00	0.03	0.01		0.05					0.00	0.01	0.01				0.00	0.00	0.03	0.00	
Weekly Livestreaming E-Commerce Usage	Less than 2 times	306	2.88	3.21	3.10	3.37	3.36	3.42	3.27	3.36	3.40	3.25	3.22	3.10	3.21	3.20	3.19	3.03	2.83	3.05	3.00
	2-4 times	86	3.58	3.85	3.68	3.72	3.73	3.89	3.78	3.71	3.81	3.71	3.67	3.62	3.80	3.64	3.81	3.69	3.54	3.55	3.75
	5-7 times	47	4.03	4.00	3.91	4.00	4.09	4.08	4.06	4.18	4.13	4.10	4.09	3.91	3.97	3.92	4.02	4.06	3.89	4.10	3.97
Most Preferred Platform	7 above	78	3.59	3.85	3.72	4.01	3.78	3.90	3.71	3.72	3.75	3.72	3.71	3.65	3.85	3.83	3.72	3.66	3.65	3.77	3.79
	F-Value		32.86	22.78	23.77	14.64	14.52	14.78	18.75	15.77	14.03	19.30	20.39	18.91	24.23	18.76	24.71	27.23	30.81	30.54	31.10
	Sig. (2-tailed)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	TaoBao	244	3.33	3.62	3.47	3.71	3.62	3.70	3.54	3.62	3.67	3.58	3.56	3.45	3.58	3.59	3.53	3.43	3.29	3.47	3.42
	JD	75	3.34	3.48	3.32	3.52	3.59	3.53	3.58	3.56	3.57	3.50	3.40	3.33	3.54	3.41	3.46	3.45	3.27	3.31	3.34
Monthly Salary	Mushroom Street	14	3.98	3.67	3.83	3.48	4.07	3.71	3.52	3.83	3.57	4.07	3.62	3.57	3.38	3.45	4.00	3.41	3.57	4.06	3.88
	Little Red Book	33	3.45	3.79	3.58	3.62	3.68	3.93	3.72	3.71	3.61	3.43	3.52	3.44	3.63	3.47	3.64	3.43	3.29	3.35	3.49
	Jumei Youpin	6	3.21	3.61	4.33	3.72	3.58	3.44	3.39	3.83	4.22	3.50	4.22	4.22	3.96	3.72	4.21	4.13	3.78	3.57	4.17
	Other	145	2.80	3.17	3.08	3.38	3.32	3.51	3.31	3.34	3.43	3.24	3.21	3.07	3.22	3.17	3.16	3.02	2.82	3.05	3.06
	F-Value		7.81	4.96	6.06	2.31	3.46	1.81	1.88	2.60	2.02	3.95	4.05	4.44	3.55	3.96	5.83	4.34	4.90	5.51	4.34
Sig. (2-tailed)		0.00	0.00	0.00	0.04	0.00			0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Never Negative Experience	Below 2000	213	2.90	3.25	3.16	3.39	3.31	3.46	3.27	3.35	3.39	3.30	3.25	3.13	3.25	3.22	3.20	3.04	2.89	3.12	3.03
	2000-4000	100	3.54	3.70	3.48	3.57	3.65	3.76	3.56	3.65	3.72	3.60	3.54	3.53	3.58	3.54	3.61	3.47	3.40	3.51	3.62
	4000-6000	75	3.61	3.78	3.61	3.88	3.87	3.90	3.82	3.75	3.77	3.75	3.74	3.49	3.73	3.76	3.75	3.70	3.41	3.66	3.62
	6000 Above	129	3.22	3.54	3.47	3.73	3.69	3.66	3.61	3.66	3.71	3.51	3.54	3.45	3.62	3.52	3.55	3.48	3.31	3.38	3.43
F-Value		14.72	8.70	6.72	6.27	10.55	5.37	9.07	6.14	6.49	5.78	7.17	6.17	8.45	8.16	10.37	11.48	8.89	8.25	11.61	
Sig. (2-tailed)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Yes	Yes	237	3.41	3.69	3.55	3.72	3.71	3.77	3.69	3.69	3.77	3.66	3.62	3.55	3.66	3.65	3.70	3.61	3.44	3.56	3.50
	No	280	3.04	3.31	3.21	3.47	3.42	3.52	3.32	3.42	3.44	3.32	3.30	3.16	3.32	3.25	3.23	3.09	2.94	3.15	3.19
	t-value		4.07	4.39	4.24	2.93	3.79	3.07	4.82	3.51	4.27	4.23	4.21	4.59	4.27	5.02	6.06	6.02	5.38	4.97	3.36
Sig. (2-tailed)					0.00		0.02														0.00

In addition, customers with high-school education at the highest level and females, in general, tend to have more favorable perceptions across the entire S-O-R field. There seems to be a habitual pattern manifested in years of e-commerce experience, which shows favorable perceptions of the entire S-O-R field in a positive trend up to 2 years, then gradually moving in the opposite direction. Also, there is generally a positive relationship between salary and the entire S-O-R field, but the pattern starts to reverse at 6,000 RMB or above.

V. CONCLUSION

For the comprehensive nature of the theoretical model, this study exploits the bibliometric map of the research field of e-commerce. It proposes a socio-technical approach to conceptualize the stimulus-organism-response (S-O-R) structure of consumer behaviors to live streaming commerce. Based on 570 valid returned survey responses, this study confirms the validity of the theoretical structure using the simulation results of a multilayered perceptron neural network (MLP-NN) as the guiding base for the configuration of structural equation modeling (SEM).

5.1. Interpretation of the Findings

First, this study demonstrates that a neural network simulation is a valuable tool that can inductively identify predictors to explain consumer behaviors' organistic and response states in live streaming commerce. The knowledge base of the neural network provides a structural intuition in guiding the conceptual configuration of the structural equation modeling (SEM) analysis. The results address the theoretical gap identified in the literature review section – that is, the extant literature lacks a comprehensive coverage of the socio-technical aspects of live streaming commerce, and this study fills the gap by proposing a stimulus-organism response (S-O-R) structure that is conceptualized from a socio-technical perspective.

The three hypotheses that outline the S-O-R structure of consumer behaviors are supported, and there are subtle details about the significant ability of each type of variable in the prediction. The following discusses the finding derived from the neural network-guided SEM analysis.

Hypothesis H2 states that organism factors are significant predictors of the response variables, which have an addiction to live streaming commerce, loyalty, and impulse buying. There are also sparse effects from a few stimuli (Hypothesis H3) on the response variables, mainly from impulsive buying tendency and personal innovativeness. The finding is also reflected in the extant literature that live streaming sessions, especially those promoted and stimulated by online celebrities, tend to induce impulsive buying [79]. In addition, as live streaming is a relatively new product in e- and s-commerce arenas [9], personal innovativeness, which characterizes a degree of personal tendency to adopt a new practice readily, and reflects a type of consumer attitude towards acceptance of new ideas [50], can significantly influence consumer trust, flow experience states, and value perceptions of the live-streamed offers. Furthermore, hypothesis H1, which states the role of socio-technical predictors to explain the variance of the organistic factors, is robustly supported, especially this study observes a crowded socio-technical influence on the hedonic value, social value, and enjoyment. In sum, the socio-technical approach to S-O-R model conceptualization is well supported.

In addition, without the support of the following socio-technical theories, the model may not be able to receive a higher level of variance explanation, at R^2 ranging from 0.66 to 0.80: the technology acceptance model (TAM) and the unified theory of acceptance and use of technology [32], the theory of reasoned activities (TRA), and the theory of planned behavior [33], the stimuli organism-response (S-O-R) model [4], and [34]'s IS Success model.

The following discusses the subtle discoveries of this study that further contribute to the extant literature.

The roles of socio-technical stimuli match the findings in the extant literature as represented, for instance, by [28] and [98]. Nevertheless, there are subtle differences, and this study offers some unique discoveries.

The SEM path structure presents that the social factors, consisting of impulsive buying tendency and personal innovativeness, and social influence, have direct influences on the three domains of responses (addiction, loyalty, and impulse buying) and the organistic fields being described by the different types of perceived customer values, enjoyment, trust and flow experience. Social influence is exogenous attention, such

as the herding message and the interaction [99], and personal innovativeness and impulsive buying tendency can be reckoned as endogenous attention, which refers to consumers' goal-driven attention [99]. As such, the social stimuli structure contributes to the human behavioral field of theory of attention [100]. The technical stimuli, represented predominantly by performance and effort expectancy, synchronicity, and system and service quality, mainly influence the response variables via the organistic mediators. Thus, the socio-technical system that makes live streaming successful includes the quality works of the actors (the live-streaming host, the potential or existing customers as the participants), the technological aspects, i.e., performance and effort expectancy [9], synchronicity [28], and quality of service and system [34]. The finding merely aligns with the "social presence" theme in the impact on impulse buying behavior in live streaming commerce [1] and extends to identifying the socio-technical details of social presence, including personal characteristics. Personal characteristics such as impulsive buying tendency and innovativeness of customers are the two rare factors discussed in the extant literature. Performance expectancy is a domain of the theory of customer expectation disconfirmation [20].

Furthermore, utilitarian value is a robust base for other customer values, such as hedonic and social values, to be significantly meaningful. Numerous researchers have also found that utilitarian reasons are the most important motivators for consumer use of shopping [101, 102]. However, other natures of customer values are equally important, such as without social value, consumers may not quickly adopt technology [103]. In this study, social value and enjoyment are illustrated to overcome the boredom that prevents flow experience immersion from arising in live streaming commerce. Favorable perceptions of values are also shown to significantly influence consumer trust in live streaming commerce in this study, which overcomes anxiety that prevents flow experience from arising. Thus, values offered to customers are the fundamental ingredients that play the organistic role in influencing consumer behaviors [104].

[72] presents flow experience as a state of concentration in which individuals are immersed in an activity, such as live streaming commerce in this study, and two states prevent flow experience to arise, namely anxiety and boredom. This study identifies trust as a factor that transforms anxiety and social values and enjoyment as factors that alleviate the boredom states of consumers. In [105]'s research using the technology acceptance model (TAM), anxiety is acknowledged as the fear of making any severe errors while using technology, and the result is equally applicable to live streaming, both technological and social. Only the impulsive buying tendency and personal innovativeness of the social stimuli have direct and significant weight in explaining the variance of flow experience. The rationale for the significant role of impulsive buying tendency in consumer decisions shares the operationalization concepts of [106], which has the cognitive aspects such as lacking planning and deliberation and, most importantly, the affective aspects such as feelings of pleasure and excitement. Fig. 4 presents the determinant structure for flow experience.

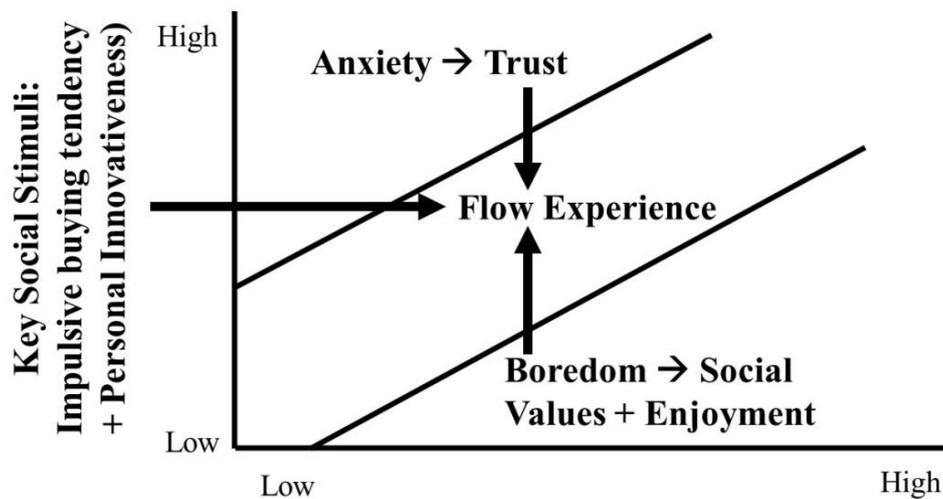


Fig. 4. Flow experience states in live streaming commerce

Specifically, for a flow state to arise, the trust factor (which is opposite to the anxiety factor that blocks the occurrence of the flow state [72, 75]) has to arise. The following predictors significantly explain this phenomenon in order of importance: social value, personal innovativeness, overall perceived values offered by live streaming commerce, impulsive buying tendency of consumers, vicarious learning from the hosts, performance expectancy, enjoyment, and synchronicity of the live stream system.

This study also finds that the flow experience state plays a vital role in influencing addiction and loyalty, translating into impulsive buying. The general notion of impulsive buying is an uncontrollable drive or desire to obtain, use, or experience a feeling, substance, or activity that leads an individual to repetitive behavior[107].

5.2. Practical Implications

Our research provides important implications for live-streaming e-commerce operators. First, the study points out that customer loyalty and addiction significantly influence the impulsive behaviors of customers. Though the addiction nature is different from that of substance (e.g., nicotine or caffeine) and internet addiction, it is inevitable that live-streaming e-commerce, especially the host-social interactions and the displays of products, can have a significant psychological impact [108]. [109] share a similar finding on value influencing pharmacy patronage. In addition, as the flow state enables the immersive attention of the customers [72], the business operators, represented by the live-streaming host, should pay attention to strategies to induce a favorable atmosphere that can induce the flow state of the participating customers. [110] share the expectancy theme of user beliefs on customers' perceptions of live chat usage in mobile banking. Furthermore, the socio-technical stimuli, with the predominant ones being impulsive buying tendency, performance expectancy, innovativeness of the customers, interaction, system and service quality, and vicarious learning, have significantly impacted the value perceptions and enjoyment of the customers. Thus, the practitioners should proactively direct the customers' expectations of live-streaming e-commerce accordingly.

5.3. Limitations

This study is not without limitations. The fundamental limitation is the sampling approach, which relies on the snow-ball conveniences of various social media channels for accessing the participants. Judging by the significant R-square variations of explanation of both organism and response constructs, the theoretical framework has reached a robust validity. Thus, we suggest that this study be replicated on a national scale and

includes customer segmentation of rural communities and the different tiers of cities in China. Second, using the comparative insights of the data analysis, such as relating to customers having positive and negative experiences, the further study can exploit in-depth interviews for understanding the relationships between the nature of experiences and the theoretical variables. Third, the S-O-R model offers a framework for conceptualizing business model logic and entrepreneurial competence training for business operators in live-streaming e-commerce.

VI. Acknowledgments

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