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Assessment of Customers' Evaluations of Service Quality in Live-Streaming Commerce: Conceptualizing and Testing a Multidimensional and Hierarchical Model

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Abstract: Live-streaming commerce (LSC) is a new shopping method that combines the characteristics of social commerce and e-commerce. Since the global coronavirus disease 2019 (COVID-19) outbreak, the number of branded platforms is growing rapidly, and their competition is fiercer than ever. Understanding consumer needs and improving service quality have become the key issues for survival. This study aims to develop and empirically validate a multidimensional hierarchical model for measuring service quality on LSC platforms. A hierarchical reflective construct was proposed to capture dimensions based on the literature on e-retail and social commerce service quality. The proposed model was rigorously tested using two waves of survey data through the partial least squares method. Results showed that the service quality of LSC is a third-order, reflective construct and includes five primary dimensions (the streamer's interaction quality, physical environment, website quality, outcome quality, and ordering process) and twelve sub-dimensions (trustworthiness, expertise, responsiveness, telepresence, consumption scenarios, information quality, system operation quality, fulfillment and refund/compensation, privacy/security, contact, and ease of use). Findings also supported the hypothesis that service quality has a significant impact on customers' satisfaction and their behavioral intentions. Furthermore, we tested an alternative model, and the results showed that the relationship between dimensions and overall assessment is reflective rather than formative. We offered directions for further research on LSC service quality and discussed managerial implications stemming from the empirical findings.

Keywords: live-streaming commerce; service quality; quality measurement; multidimensional and hierarchical model

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1. Introduction

The development of information and communication technology is changing the retail environment and facilitates live-streaming commerce (LSC). In China, the e-commerce industry continues to flourish, particularly when the LSC economy proliferated from 2021 to 2023 [1]. The market size of LSC exceeded CNY 1.2 trillion in 2021, with an annual growth rate of 197% [2] and reached approximately CNY 1991.6 billion in the first half of 2023 [3]. The LSC-related enterprises have emerged accordingly, with 23,000 companies and 520 million LSC users in the first half of 2023 [3]. LSC platforms must differentiate themselves by meeting the needs of customers better than the competition. High levels of perceived customer service quality can positively influence customer satisfaction and firm profitability [4]. Delivering high service quality is a basic commercial strategy for creating competitive advantage [5,6].

Studies have examined consumer behavior in online shopping and electronic retailing and its effects on the corresponding service quality [6–8]. Similarly, service quality is equally essential in the LSC setting. Service providers should also evaluate their service quality

and seek the critical drivers for service improvement [9]. Previous research noted that service quality evaluations are likely context dependent [5,10]. Although LSC platforms were grounded on e-commerce, the evaluative process used in determining LSC service quality (LSC-SQ) has similarities and differences. Specific attributes may influence, for instance, customer interaction with the streamer and the streamer's performance level, which may signal superior LSC-SQ. Dealing with people–technology interactions indicated that customer evaluation of LSC services is a distinct process. Measures of service quality for online shopping or e-retailing environments and for LSC platforms share some standard dimensions. However, those of LSC-SQ must capture additional dimensions. Furthermore, although a few researchers have focused on the development of service quality models pertaining to social commerce (s-commerce) [11–13], research gaps remain, particularly in the scope of the quality dimension included. Existing measures do not capture all aspects of the purchasing process and, therefore, do not constitute a comprehensive assessment of an LSC platform's service quality. According to Dabholkar, Thorpe, and Rentz [10], developing an industry-specific measurement model for LSC-SQ is important.

The second research issue is regarding the conceptualization of LSC-SQ. Researchers agreed that service quality is a multidimensional, higher-order construct [4,10,14]. Customers examine service quality through multilevel evaluations. including primary and sub-dimensions [10,15]. The hierarchical model is used to model a level of abstraction higher than those with simply first-order constructs. Based on Petter, Straub, and Rai [16], using a multidimensional construct can increase granularity and detail on different aspects of a construct. Zheng et al. [9] employed several separate unidimensional constructs as the LSC-SQ measurement. Some of the s-commerce service quality scales were the second-ordered model with a simple first-order structure tested [12,13]. Thus, the relationships among LSC-SQ attributes, dimensions, and overall quality assessment have not been reflected in widely used measurements.

For the reasons mentioned above, additional studies should draw on a theoretical reference when developing the conceptualization of LSC-SQ. We found that drawing on the framework for retailer service quality introduced by Dabholkar, Thorpe, and Rentz [10] as a theoretical reference to gain a comprehensive view of LSC-SQ is helpful. Their framework enabled us to integrate e-retailing and s-commerce service quality measurement and add further facets of LSC-SQ. Aligned with Lu, Zhang, and Wang [17], the present study specified LSC-SQ as a third-order multidimensional construct and adapted the hierarchical and multidimensional service quality model mainly owing to the similarity of mobile service. These prior service quality models were primarily based on reflective measurement configurations, which also formed the basis of most scale development literature in general. Further theory-based research in the context of LSC is needed. The model would capture the multidimensional nature of LSC-SQ and explain the overall latent construct well. We aimed to contribute to the current research in methodology terms by rigorously testing the proposed service quality model.

Furthermore, our attention was warranted in investigating the model specification of LSC-SQ because correct model specification has emerged as a critical issue in e-service quality research. The conceptual definitions of constructs could be specified at a high level of abstraction, including reflective and/or formative dimensions. Some researchers noted that service quality may be appropriately conceptualized as a formative construct [7,8]. However, we adopted a reflective approach to modeling where we operationalized five components as the second-order dimensions on a separate global measure of LSC-SQ and used a third-order hierarchical model. Failure to specify a model correctly could bias estimates of the structural relationships between constructs. Such failure could undermine statistical conclusions about theoretical relationships among the constructs and lead to poor managerial decision-making [18,19]. Thus, we tested an alternative formative model in which a third-order hierarchical LSC-SQ construct had second-order dimensions where the dimensions affected the overall perceptions of service quality. Given the importance of this issue in theory and practice, the model assessment deserved much attention.

We have identified several research gaps that may offer considerable potential for significant contributions to the advancement of knowledge on LSC-SQ. This study aims to propose a multidimensional, hierarchal model for measuring LSC-SQ. Specifically, our key objectives are as follows: (a) to provide a conceptualization of the LSC-SQ construct that caught the construct domain, (b) to systematically develop a model to measure LSC-SQ from the customers' perspective, (c) to test the alternative model, and (d) to examine the effects of this conceptualization of LSC-SQ on customer satisfaction and behavioral intentions. Overall, we use a multidimensional, hierarchal method to develop the LSC-SQ model. This method provides a more appropriate tool to represent a level of abstraction higher than those with simply first-order constructs [10]. It may capture the multidimensional nature of LSC-SQ in each dimension which represents some aspect of the overall latent construct and provide a comprehensive understanding of service quality in the LSC context.

Our study has the following contributions. First, we propose a multidimensional and hierarchical model and identify the factors influencing LSC-SQ. Second, we compare different model specifications and clarify that using reflective approaches seems theoretically appropriate in the LSC context. Third, we provide a tool that practitioners can use to measure the service quality of their LSC platform. We also identify aspects of improvement required and (re)locate their resources in these areas to improve the associated service quality.

The remainder of this paper is organized as follows. In the next section, we provide the theoretical background and a summary of the literature. Then, we propose the research framework and formulate the hypotheses. Afterward, we describe the research method. Following the results of the empirical analyses by testing the models, we present the conclusion by outlining the theoretical and practical implications and research limitations and propose research directions for future studies.

2. Literature Review

This section briefly reviews the literature to summarize the work that has been related to the area of LSC-SQ. We first review the literature from marketing and LSC systems that explores the LS viewer/customer experience. Next, we investigate the quality attributes regarding the traditional and online retailing services to understand and model the perceived quality of LSC purchase experiences. Since LSC is a subset of s-commerce, we then discuss the related service quality determinants and the measurement development process in the literature. Finally, we summarize what we know and do not know about LSC-SQ, focusing on the research that is needed to learn about it.

2.1. Service Characteristics of LSC

LSC service should be explicitly defined to give a clear picture of what we examined in this study. A live broadcast is a form of synchronous social media that includes some unique features, such as synchronicity and authenticity [20]. In this way, users could interact with the show's content in real time, allowing instant communication between viewers and live broadcasters. LSC is grounded in s-commerce and has evolved as a new way of making purchases. Based on Liang and Turban [21], s-commerce consists of e-commerce activities and transactions within the social media environment. Through such a platform using Web 2.0 software, customers can obtain support and recommendations from one another, share their experiences, find products and services, make purchases, communicate with businesses, and create a social environment of online communities [12,22].

Thus, LSC has attributes of s-commerce, which entails attributes of e-commerce and has distinct characteristics of social media [23]. According to Ma, Gao, and Zhang [24], LSC further enabled by Web 3.0 technology allows for multidimensional interaction. Compared with s-commerce, except with further interactivities, much improvement in visualization, entertainment, and professionalization has been identified within the LSC context [25]. Traditional e-commerce sites, such as Amazon and Taobao, have transformed into LSC sites to attract consumer shopping.

This study focuses on the way of LSC as a form of "livestream + e-commerce", where live streaming is the tool and e-commerce is the foundation. This operational model overcomes the dual limitations of time and space, allowing consumers to purchase products without leaving their homes and sellers to interact with buyers in real time, thereby having an engaging shopping experience and further interpersonal connection [25]. In addition, the LSC platform provides social activities and entertainment [26]. Live streamers often play the role of sales personnel who are content creators and have considerable viewers consistently watching the broadcast shows as regular followers or potential customers. The LSC shopping experiences involve experiences of e-commerce beyond service in terms of a high degree of interdependence between customers and streamers along the way [27]. Therefore, we argue that Taobao Marketplace and JD.com are the electronic versions of the brick-and-mortar retail stores, and customers visited the websites as they would have in regular shopping malls. The ability of the LSC platform to perform the functions to satisfy customers will measure their LSC-SQ perceptions.

Thus, more components than e-commerce or s-commerce should be added to evaluate LSC-SQ. For instance, an answer or response to a customer's request represents a specifically mediated personal service encounter. In the LSC context, the streamers' services may be regarded as the core offering that delivers the benefits customers sought and is distinct from the e-retailing service itself. If customers were not optimistic about the offering, then they would not use it repeatedly. Otherwise, employing this shopping channel would not make sense. The LSC service providers should first deliver a high-quality service through streamers. From the customer's point of view, high-quality service quality is crucial, and in many cases, it is a real-time encounter. For the service quality construct that was investigated, our approach included the conceptual overlaps inherent in previous studies, which mixed traditional and online retailing service elements with people-based service elements [6].

2.2. Retailing Service Quality

Service quality perceptions have been defined as a consumer's judgment of an entity's overall excellence or superiority [28]. From this definition, service quality is a consumer's overall evaluation of the service experience. The five SERVQUAL dimensions of reliability, responsiveness, assurance, empathy, and tangibles capture the general domain of service quality [4]. These dimensions are well suited to measure service quality in offline services. SERVQUAL has been empirically dominated by people-delivered services. However, Dabholkar, Thorpe, and Rentz [10] argued that SERVQUAL has not been adapted to retail store environments. They developed a new model to evaluate retail service quality at three different levels—the overall, dimension, and sub-dimension levels. In brief, the service quality factor is viewed as a higher-order factor defined by five primary dimensions (i.e., physical aspects, reliability, personal interactions, problem-solving, and policy) and six sub-dimensions (i.e., appearance, convenience, promises, doing it right, inspiring confidence, and being courteous and helpful).

Furthermore, SERVQUAL did not reflect the unique characteristics of the online or information management services. The electronic service environment is entirely different and dominated by the person–machine interface. Based on Parasuraman, Zeithaml, and Malhotra [8], e-commerce service quality refers to the extent to which an online store facilitates efficient and effective shopping, purchasing, and delivery. Thus, a new measurement scale with a new set of quality dimensions in the electronic context has been developed. The E-S-QUAL measurement is the most often employed scale in the online retailing literature, and the four dimensions that measure service quality are efficiency, fulfillment, system availability, and privacy. The dimensions of efficiency and fulfillment are the most critical and equally important facets of web site quality. In addition, the importance of service recovery in online transactions has been recognized and the E-RecS-QUAL has been developed with three dimensions: responsiveness, compensation, and contact. The construct of

e-commerce service quality encompasses all phases of a customer's interactions with an online store and covers pre- and post-service delivery experiences on the web.

Some researchers focused on service quality in terms of online shopping. The structure and meaning of the elaborated dimensions have been determined. Wolfinbarger and Gilly [6] defined electronic service quality as the beginning to the end of the transaction; the dimensions include information search, privacy policies, website navigation, the ordering process, customer service interactions, delivery, return policies, and satisfaction with the ordered product. Thus, the available metrics covered numerous attributes of online stores, such as the attractiveness of the online assortment, the convenience of the ordering process, and the quality of the return policies, among others. Kim and Stoel [29] indicated that website quality for sites selling apparel products is conceptualized as a 12-dimensional construct. Given the significant correlations among the 12 factors, they tested the proposed six dimensional second-order factor models, and the results did not support their hypotheses. However, they proposed further studies for the existence of higher-level dimensions in terms of retail website quality. Collier and Bienstock [7] conceptualized e-retailing service quality in that consumers form quality evaluations based on the interactive process that takes place online (process), the outcome of how the product or service is delivered (outcome), and the manner in which service failures (if they occur) are handled (recovery). Contrary to past conceptualizations proposed by Parasuraman, Zeithaml, and Malhotra [8], as well as Wolfinbarger and Gilly [6], Collier and Bienstock [7] argued that e-retailing service quality comprises formative rather than reflective indicators.

The dimensions mentioned above are well suited to measure service quality in online shopping and e-retailing services. However, LSC services have unique characteristics that e-commerce services do not possess, which can affect the perception of service quality. These characteristics include streamer's performance and LSC platform environment issues. Thus, a significant extension that fulfills a major gap in the extant research is required.

2.3. S-Commerce Service Quality

S-commerce is a kind of e-commerce activity that is grounded in Internet-based social media. Based on Huang and Benyoucef [30], s-commerce has two types: e-commerce on social network platforms and social media platforms on e-commerce websites. In brief, s-commerce consumers comprise the network communities and are offered system interactivity. The distinctions between both types of commerce are in terms of marketing, customer control, and system interaction [30]. The difference between service interface design has also been identified [31].

A few researchers have proposed the service quality dimensions of s-commerce. Lee, Cha, and Cho [32] explored e-service quality in s-commerce and identified four factors, namely, efficiency, system availability, fulfillment, and privacy. Wu, Shen, and Chang [33] investigated e-service quality on Facebook. They concluded that the criteria include reliability, responsiveness, information, security, ease of use, and trust. Leeraphong, Mahatanankoon, and Papasratorn [34] retrieved five main factors, that is, reliability, responsiveness, assurance, reputation, and information quality for measuring customer-to-customer e-service quality on Facebook. Choi and Kim [11] also found four factors, namely, informativeness, product diversity, communication possibility, and responsiveness to e-service quality in s-commerce. Hu, Dai, and Salam [35] focused on building a conceptual model of the relationship quality of s-commerce; the main factors included technology quality (accessibility, attractiveness, flexibility, and reliability), service quality (service content, service convenience, service delivery, and customer value), and experience quality (emotion and immersion). Shin, Park, and Kim [13] identified key functional and hedonic quality factors that affect consumer satisfaction in s-commerce. The functional quality dimensions included performance, reliability, durability, safety, and accessibility, whereas the hedonic quality dimensions were image, awareness, novelty, enjoyment, and impressiveness. Jami Pour et al. [12] used the fuzzy analytic hierarchy process (FAHP) and showed that s-commerce service quality is a hierarchical and multidimensional construct consisting of

six key dimensions: information quality, social interaction quality, design quality, functional quality, social trust/security, and social support. A comparison of these dimensions identified with those evident in the relevant e-retailing or online shopping literature indicates considerable overlap, mainly focusing on websites' functional attributes such as functionality, system availability, fulfillment, and privacy. Most researchers agree that the key s-commerce quality determinants differ from those of e-commerce.

2.4. Summary

As a new form of video-based social media, LSC facilitates e-retailers showing the product details from different standpoints, trying on the clothes, interacting with customers in real time and demonstrating the production process of the products, by enabling synchronous communication [36]. Based on Ma, Gao, and Zhang [24], LSC is more interactive, visual, entertaining, and professional than s-commerce. These service characteristics all relate to the sense of consumers located in the LSC context where they feel like they are in a mediated environment [37]. Such an environment comprises human-made technologies, and consumers may not accurately acknowledge the role of technologies in influencing their buying experience [38]. An existing LSC-SQ measurement proposed by Zhang et al. [9] had a narrow focus on information quality and interaction quality, as numerous attributes were not covered.

The studies regarding s-commerce service quality have covered many criteria ranging from website functionality (e.g., system availability, information quality), shopping process (e.g., ease of use, privacy, security) and the product delivery process (e.g., fulfillment) [11–13,32–34]. If not delivered, the recovery process should include the conception of service quality based on electronic commerce-related studies [7,8] because the related attributes have been found to affect the customer shopping experience [39,40]. However, the measurements of s-commerce service quality were incomplete and did not cover such scale items. Thus, although LSC-SQ could be regarded as a subset of s-commerce service quality, differences between them may exist that reinforce the provision of services on LSC platforms.

When considering LSC as a new and broader phenomenon, the quality dimensions in the s-commerce context may not completely reflect the customers' expectations regarding LSC services. The most notable ones include the lack of performance evaluation of streamers and the physical environment regarding the platform (except the website functionalities). Consumer presence is regarded as the essence of understanding LSC consumer behavior and encompasses social presence and telepresence [41]. Social presence refers to a buyer's perception of intimacy with a seller and other buyers in terms of human contact and human warmth. By contrast, telepresence is represented by customers' perception that they are present at a seller's location from a remote place [42]. Thus, they should include the service attributes regarding the social presence to evaluate the service performance of streamers. Moreover, they should consider the factors related to telepresence to assess the service quality of an LSC environment. Both address the need to design context-specific models for the LSC platforms. The specific LSC-SQ dimensions should complement the s-commerce service quality dimensions identified in those past studies. Furthermore, despite employing the quantitative techniques, most studies regarding s-commerce quality did not discuss the factor structure of the quality dimensions in terms of model specification. Therefore, knowing that the existing measure did not reflect the unique characteristics of the LSC service market, the present study aims to develop a hierarchical and multidimensional model to remedy such shortcomings.

3. Developing the Conceptual Framework

3.1. LSC-SQ as a Hierarchical Reflective Model

Based on Parasuraman, Zeithaml, and Berry [28], we define LSC-SQ as the customers' overall evaluation and judgment of the excellence of services provided through LSC platforms. The definition encompasses all the broad groups of LSC service delivery channels.

Service quality perceptions in a traditional, brick-and-mortar retail setting have been described as a third-order factor, comprising three levels: (1) customers' overall perceptions of service quality, (2) primary dimensions, and (3) sub-dimensions [10]. Several primary dimensions shared a common theme represented by the higher-order global perceived service quality construct. In addition, these dimensions had sub-dimensions that combined related attributes into subgroups. Such a structure was regarded as accounting for the complexity of human perceptions completely. Some previous studies on the service quality construct, for instance, Fassnacht and Koese [5] and Lu, Zhang, and Wang [17], have adopted a similar conceptualization. Kumar and Banerjee's [43] results also show that collaboration in supply chain is a third-order, reflective construct.

Despite having strong theoretical support for the higher-order factor structure for LSC-SQ, a review of the relevant service quality literature pertaining to online shopping, e-retailing, and s-commerce was conducted to propose possible factors. Carman [44] noted that the service quality measure instrument can be adapted by adding scale items or factors pertinent to different situations. Blut et al. [45] recommended that new measures can be developed using insights and combining items from existing measures. Thus, the present study combined items from the scales in the relevant literature by adding scale items and factors pertinent to LSC services to create an adequate LSC-SQ measurement. We agree that the service experiences in terms of the shopping process and outcome were important to online retail or s-commerce customers. However, both dimensions were found to encompass three to four factors [15,17] by extending or modifying Rust and Oliver's framework [46]. That is, an overlap may exist within the individual dimension. Having other separate and critical dimensions of LSC-SQ in implementation would be helpful for LSC platforms. Furthermore, most of the sub-dimensions were handpicked from the literature and applied to the LSC-SQ domain. In line with Blut et al. [45], combining findings from the review of the relevant literature, we propose that LSC-SQ has a hierarchical factor structure (Figure 1). The rationale for the model is as follows.

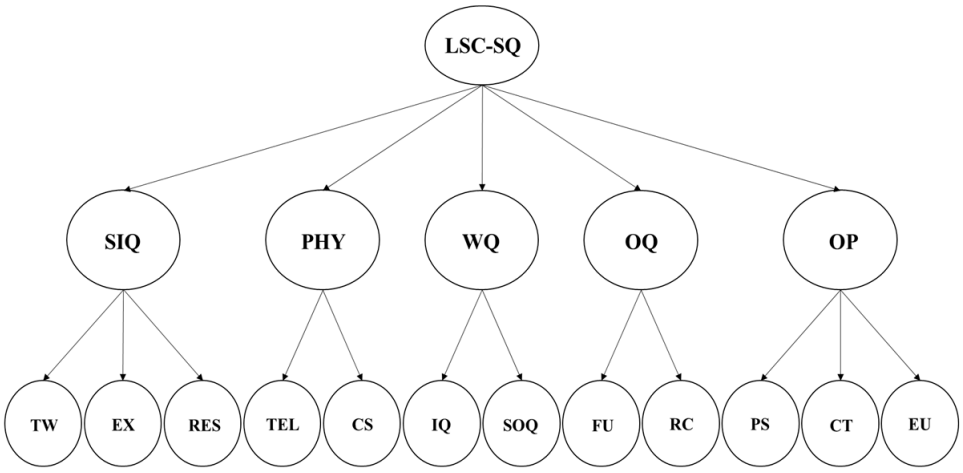

Figure 1. The proposed reflective LSC-SQ model.

3.2. Components of Hierarchical LSC-SQ Model

This study extends existing related research by conceptualizing LSC-SQ as a third-order multidimensional construct. We employ reflective relationships among attributes, dimensions, and overall quality. Five dimensions are proposed to share an underlying theme; they were distinct but highly correlated. Then, a common higher-order factor is presented as an overall LSC-SQ. The LSC literature noted that some dimensions were highly complex in that they had more than one component to them.

Figure 1 shows the conceptual framework. Service quality is the overall dimension which consists of five underlying dimensions: the streamer's interaction quality, physical environment, website quality, outcome quality, and ordering process. Each primary dimension has its sub-dimensions and reflected two to three facets forming twelve first-order

constructs in total. Such constructs are trustworthiness, expertise, responsiveness, telepresence, consumption scenario, information quality, system operation quality, fulfillment, service recovery, privacy/security, contact, and ease of use. Next, these dimensions and sub-dimensions are explained in detail.

3.2.1. Streamer's Interaction Quality

The first dimension we propose is the streamer's interaction quality. This dimension is defined as a functional quality reflecting the quality of the streamer's interactions with customers during the live broadcasting show. Social attributes (e.g., responsiveness of service providers) are essential to customers of retail stores in evaluating service quality [10]. In the LSC context, social presence has been a significant factor in customer purchase intention, which refers to the customer's perception of closeness to the seller through human contact and intimacy [47]. To do so, customers perceive streamers as natural people. This case seems to be a challenge for streamers to enhance buyers' participations in live shopping activities [48]. Streamers' duties include forming a small community, constantly discussing, feeling others' presence, arousing emotional reactions, and even building social relationships [24]. In this case, customers may feel immediacy during real-time interactions with streamers.

Thus, the streamer's interaction quality is to evaluate the services offered for facilitating communication and interaction among LSC participants. The LS sales process is similar to the typical direct sales process [25]. The streamer is akin to a salesperson in the traditional market or serves the role of a spokesperson [49] or an endorser of products/brands [50]. Zhang et al. [51] proposed that the streamers' roles should be reflected by corresponding characteristics, where matching the attributes with roles is necessary. That is, attractiveness, popularity, affinity, and price support may be related to consumers' subjective feelings. Moreover, the other four traits, namely, expertise, credibility, interactivity, and responsiveness may directly contribute to streamers' performance [36,50,52]. Thus, we propose three sub-dimensions—expertise, trustworthiness, and responsiveness to evaluate the service performance of streamers. The rationale is as follows.

Expertise refers to streamers with knowledge of brands/products and plays a vital role in parasocial interaction and attraction [53]. Streamers' content attributes also demonstrate their experiences in specific aspects compared with others [54]. Consumers of s-commerce learn from and are affected by the knowledge and experiences of streamers whom they know or trust [55]. Trustworthiness is the consumer's perception of the endorser's honesty, believability, and integrity [56]. The credibility of highly trustworthy streamers has a significant impact on endorsement effectiveness related to product attitudes and buying intention [57,58], particularly when endorsed brands/products do not require an endorser's expertise. Streamers may not need to be perceived as experts, and their continuous interactions through social media can provide information to customers by evaluating their level of trustworthiness. As to responsiveness, according to Zhang et al. [36], this sub-dimension refers to the willingness of the streamers to help customers and deliver prompt services. This sub-dimension is related to the exchanges between consumers and streamers within their social interactions. Streamers can quickly give feedback to customers' questions, benefiting from the real-time interactions. In addition, streamers may express empathy regarding their caring and individualized attention in solving customers' questions and providing personalized services.

3.2.2. Physical Environment

Our second proposed dimension is the physical environment. This dimension has a specific definition compared with previous research on service quality [5,10,17], which refers to the physical aspects of the LSC platform. Ho, Liu, and Chen [39] indicated that the physical environment is an essential factor for LSC customers' watching and purchase intentions. The first aspect of this dimension is related to consumption scenarios. Consumers tend to desire entertainment pleasures when shopping on the LSC platform [59]. They often

experience the immersive atmosphere of the environment. Such a circumstance where the decoration, furnishings, and configuration cause LSC shoppers to become highly engaged in the context easily stimulated their attention and enthusiasm for participation [9,47]. The consumption scenarios include streamers' in-person demonstrations and comprehensive and dynamic product displays [60]. For example, LSC consumers could value the visual match between their images and the clothes displayed by the streamer. Such try-on displays provide a practical reference for buyers and product appearance becomes highly available to customers [61].

The second aspect is telepresence, which refers to a phenomenon that makes consumers feel as if they are physically in a brick-and-mortar retail store [62]. The presence of live streaming contains interaction, immersion, and perceptually realistic illusion in a seller-generated world [63]. The agricultural products could be seen in the cultivation process through the computer screen to gain a deep understanding of the production to resemble the offline consumption setting. Such telepresence is crucial in reducing the psychological distance between consumers and merchants [47], decreasing consumers' psychological perception of uncertainty regarding products [9] and further enhancing the entertainment pleasures during LSC shopping.

3.2.3. Website Quality

The third dimension we proposed is website quality, which manifests as an interface cue that directly influences the likelihood of consumer buying experiences [64]. Some studies have emphasized that the website functions influence LSC consumers' purchasing intention [61]. Buyers conduct online transactions mainly by interacting with the website. We draw on prior conceptualizations of retailing and online shopping service quality, including Collier and Bienstock [7], Fassnacht and Koese [5], and Parasuraman, Zeithaml, and Malhotra [8], to outline what we argue—information quality and system operation quality. When examining website service quality in retailing, the quality of the content has a positive influence on consumer attitudes and behaviors [65]. According to Xu, Wu, and Li [61], information quality is related to the information content provided to consumers, which is up to date, reliable, relevant, and customized for consumers to make consumption-based decisions. An LSC platform is expected to convey product information and social cues in a highly transparent manner [55].

E-commerce seeks maximal efficiency between customers and the system, and a well-designed website is required to facilitate purchase behavior [6]. Similarly, the user interface is an essential link between the customers and the retail store in LSC-based shopping environments. Dong, Zhao, and Li [62] noted that system operation quality characterizes the website's technical performance during the LSC service encounter. This sub-dimension reflects the essential requirement of using LSC services to provide customers with a less complicated interface with easy navigation and stable network connection [17]. We measure the features influencing the efforts required to browse and navigate the LSC platform.

3.2.4. Outcome Quality

The fourth dimension we proposed is outcome quality to capture the outcome of the service experience. Collier and Bienstock [7] indicated that one construct cannot adequately capture all the unique dynamics that take place at the outcome of a service when the buyer and seller are separate. We extend our focus to the post-purchase consumption stages, such as fulfillment and service recovery, to capture a consumer's attitude at the end of a service. From Parasuraman, Zeithaml, and Malhotra [8], fulfillment is considered as a technical quality related to the LSC platform's promises about order delivery and item availability. In other words, LSC service providers should complete their tasks/obligations and lead customers to a good feeling about the post-purchasing experience based on Lu, Zhang, and Wang [17] and Zhao, Zhang, and Chau [66]. In our study, fulfillment includes the service punctuality (e.g., delivery of the right product within the time frame promised) and

tangible evidence (e.g., the accurate display of a product so that what customers receive was what they thought they ordered) from the concept of Wolfinbarger and Gilly [6].

Parasuraman, Zeithaml, and Malhotra [8] and Collier and Bienstock [7] argued that service recovery could have just as much impact on quality perceptions of an online experience, which refers to the extent to which the website compensates customers for problems. This rule is also expected to be applied in an LSC context. Similar to Ho, Liu, and Chen [40], we do not believe that live streaming changes the fundamentals of marketing. Recovery measures are essential with LSC-SQ because consumers are just one click away from switching to another LSC retailer. Considering the LSC context is highly relevant to online services, discarding validated and empirically supported research is not necessary. We propose this sub-dimension using Shafiee and Bazargan's framework [67].

3.2.5. Ordering Process

The fifth dimension we proposed is the ordering process that takes place between the consumer and the LSC platform. Customer experience is highly related to the process of service delivery [68]. This dimension has a broader meaning, and we combine privacy/security, contact, and ease of use into one dimension, although these have been shown in the e-quality literature to belong to different conceptual domains [7,8].

Based on Collier and Bienstock [7], privacy refers to companies not sharing information with third parties unless the customer gives permission. Privacy also includes the security of customers' sensitive information. According to Parasuraman, Zeithaml, and Malhotra [8], contact refers to the availability of assistance through online representatives. Given that streamers merely appear during their broadcasting show time, this sub-dimension reflects the interaction quality of the online representatives with customers, concerning how well their questions could be answered, the service provider's willingness for assistance, and how quickly their problems/complaints could be resolved [17]. People-based services may be the most distinct elements between the e-commerce and the LSC contexts. Ease of use is the ability of a customer to enact a transaction with the least amount of effort [7]. That consumers perceive convenience, such as saving time and less effort, may facilitate shopping and transaction processes on the LSC platform [39,50].

Based on the unique characteristics of the LSC setting, we propose five second-order dimensions, each of which comprises two to three sub-dimensions to increase our understanding of how customers evaluate LSC-SQ. Interestingly, some sub-dimensions recurred consistently in the e-retailing literature such as ease of use, compensation, information quality, privacy/security, and responsiveness. In our view, this case indicates the existence of a basic set of sub-dimensions that researchers should consider when evaluating LSC-SQ. Although research has focused on the service quality of s-commerce, a noticeable point is that the facets and their nature regarding LSC-SQ, such as the streamer's interaction quality and the platform environment, have not yet been thoroughly examined.

3.3. Consequence Variables of LSC-SQ

Service quality has been identified as a driver of satisfaction and customer loyalty [66,69]. Based on the findings from the extant literature, positive assessments of LSC-SQ could be directly correlated with engaging in favorable LSC platform loyalty intentions and customer satisfaction to predict the consequences of LSC-SQ. Thus, we hypothesize:

H1. *LSC-SQ has a significant positive influence on customer satisfaction with the corresponding platform.*

H2. *LSC-SQ has a significant positive influence on customer loyalty to the corresponding platform.*

4. An Alternative Model of LSC-SQ

We adopt a traditional, reflective approach to modeling where five service quality dimensions have been operationalized on a separate global measure of LSC-SQ. High levels of technical service quality are the result of high overall service quality perceptions, and the dimensions are distinct but highly correlated. In light of the literature on LSC shopping [39,40], the scale items showed high correlations on marketing mix factors such as streamers, physical environment and shopping process. Thus, we conclude that a reflective model (Figure 1) using the reflective indicators to conceptualize the construct seems to be justified.

However, a question may arise whether the model specification between the second- and third-order levels should be formative or reflective. An alternative to reflective model conceptualizations is the use of formative models. Jarvis, MacKenzie, and Podsakoff [70] explained that using a formative approach appears to be theoretically appropriate. Some researchers argued that e-service quality may be greatly conceptualized through formative rather than reflective indicators [8,71]. Based on Brady and Cronin [15], LSC customers may aggregate their evaluations of the sub-dimensions to form their perceptions of a platform's performance on each of the five primary dimensions. These perceptions then lead to an overall perception of service quality. That is, customers may form their LSC-SQ perceptions based on an evaluation of performance at multiple levels and ultimately combine these evaluations to achieve an overall service quality perception.

Nevertheless, testing whether customers form an evaluation of LSC-SQ at the dimension level and whether the testing results are consistent with the data would be interesting. The alternative model (Figure 2) includes a third-order structure with the second-order components forming a third-order overall object score, which represents the focal object being rated, that is, the five dimensions affect overall LSC-SQ perceptions.

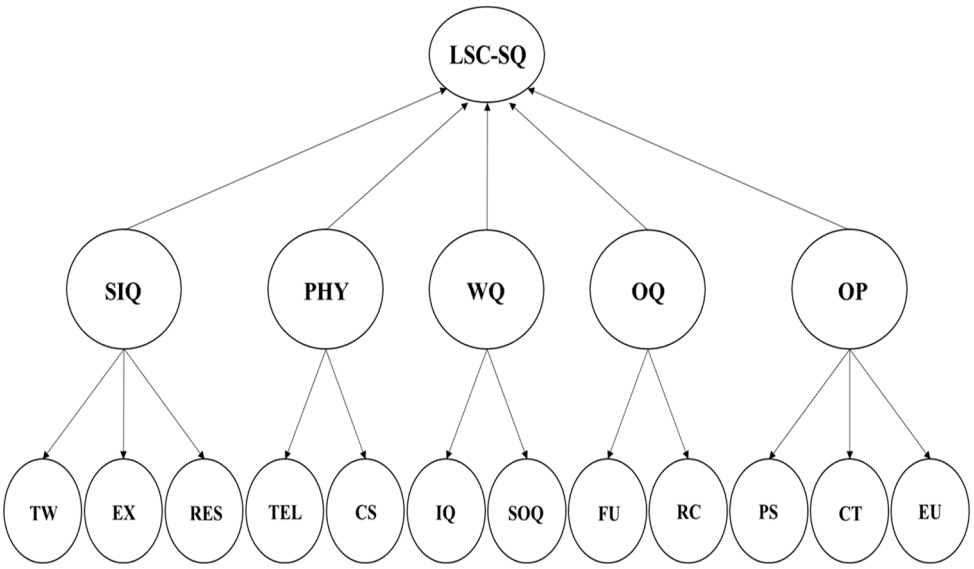

Figure 2. The alternative formative LSC-SQ model.

5. Research Methods

5.1. Measure Development

Potential items for measuring the 12 sub-dimensions of LSC-SQ (first-order factors) were obtained from the available related literature, which is mentioned in Section 3.2. Based on Brady and Cronin [15], employing a formative approach to develop the measurement would require additional indicators and the additional scale items were borrowed for our study. Following Hinkin's outline for item generation [72], we included numerous measures in the initial survey to allow for the deletion of items after further analyses. The

result was a pool of 55 items to measure the 18 constructs (including twelve sub-dimensions, five primary dimensions, and the overall LSC-SQ) in the model.

5.2. Pretest and Refined Survey Instrument

A pre-test was conducted to refine the instrument and obtain customers' perceptions of the noted first-order dimensions. A total of 90 respondents who were LSC buyers participated in the pretest. They were asked to evaluate the importance of each measurement item and comment on the wording of the items. Responses to all items were on a seven-point Likert-type scale, anchored by 1 = totally disagree and 7 = totally agree; neither agree nor disagree at the scale midpoint was rated a 4. A criterion was established to eliminate the less important items, that is, those with average scores below 4.0 or the standard deviation above 1.5. Hence, 51 items were left, which formed the basis of the questionnaire in the follow-up surveys.

The LSC-SQ survey was set up with three parts. In Part 1, all respondents were asked first to ensure they had LSC shopping experiences and to recall the last LSC retailer with which they enacted a transaction and then answered the related questions. Thus, they could avoid vague responses and lapses in memory. In Part 2, the respondents were asked to answer the LSC-SQ questions. Finally, in Part 3, they were asked to describe their reactions toward satisfaction with their last LSC retailer transaction, behavioral intention, and the demographic information.

5.3. Data Collection

Two-wave online surveys were conducted for data collection. The data from the first survey were used to identify the LSC-SQ dimensions and the related factor structure of the proposed model; the data from the second survey were used to verify the hierarchical model further. We used the service of a popular web-survey website (https://www.wjx.cn/), which is a well-known marketing research institute in China, to obtain empirical data. Those with LSC buying experiences were invited to participate in the surveys. We used the Internet IP address to identify two groups of respondents to prevent the respondents from filling out the questionnaire twice. In other words, no repeated responses were obtained from the same respondents. A total of 414 and 713 valid responses were obtained.

5.4. Data Analysis

Some researchers used the partial disaggregation technique to test their proposed multidimensional and hierarchical service quality models [10,17]. According to Dabholkar et al. [10], this technique allows researchers to combine scale items into composites to reduce higher levels of random error and still retains the advantages of the total disaggregation method. However, how to combine the items becomes a key issue that influences the model estimation results [17]. Based on Dabholkar et al. [10] and Lu et al. [17], the rationale of combining the items was that all items related to a latent variable should reflect in the same way on that latent variable: any combination of these items should generate the same model. Furthermore, this method could not simultaneously analyze a third-order factor model; that is, the model should be tested in three stages.

Given that our goal was to assess the proposed hierarchical LSC-SQ model, testing the model in its entirety was the priority. Thus, we employed the partial least squares (PLS) modeling approach in the present study. Compared with the covariance-based structural equation model, PLS is a variance-based approach and suitable for predictive applications and theory building [73]. Based on MacKenzie, Podsakoff, and Jarvis [19], this approach leads to high parsimony and low model complexity. Some researchers [43,74,75] indicated that PLS is well suited for assessing the parameters of a hierarchical, reflective model. In addition, we applied non-parametric bootstrapping [75,76] as implemented in SmartPLS with 5000 replications. We followed the steps outlined by Kumar and Banerjee [43] and added existing literature in terms of extending the methodology to assess

hierarchical models using PLS. SmartPLS 3.0 software was employed as an analytical tool (https://www.smartpls.com accessed on 9 November 2022).

Figure 3 illustrates the process employed in developing the LSC-SQ model. Adopting the research model of Dabholkar et al. [10] and drawing on insights from the extant literature, we provide a definition of LSC-SQ, explore it as a hierarchical construct, and delineate its domain (Step 1). Next, we develop an initial pool of items and conducted a pretest to refine the instrument (Step 2). Then, we conducted the first wave online survey (Step 3) to identify the factor structure of the proposed model by using the PLS approach (Step 4). In addition, we tested an alternative model to discuss the issue of formative model specification (Step 5). Finally, we conducted the second wave online survey to verify the hierarchical model further and assess the nomological validity of the LSC-SQ measure in the consequence variables (Step 6).

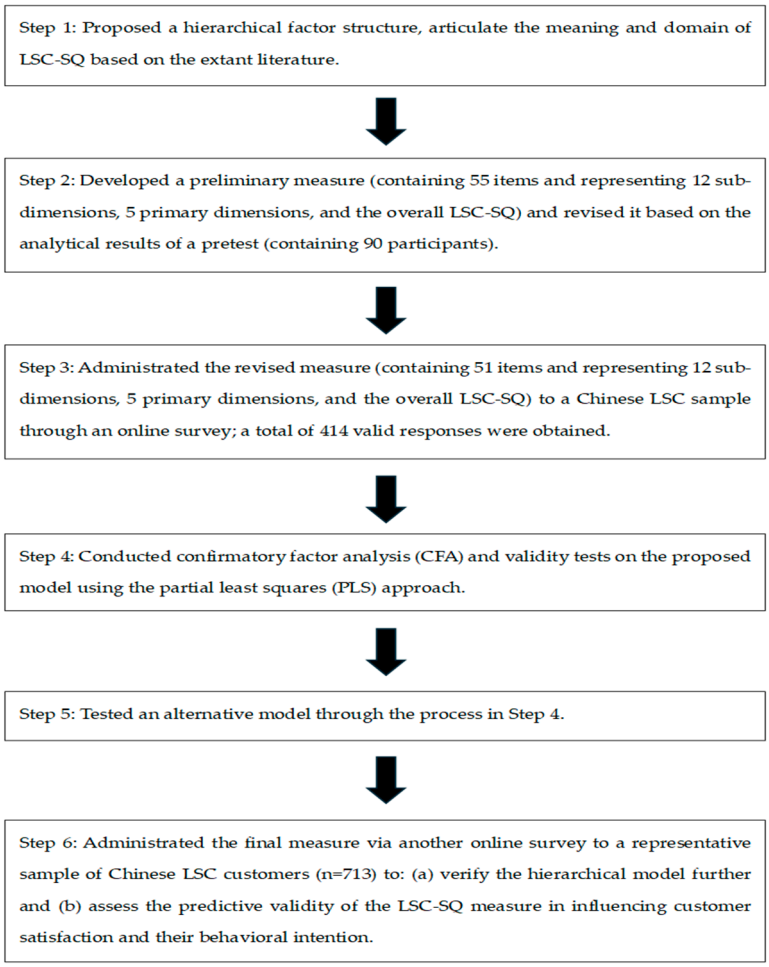

Figure 3. Process employed in developing the LSC-SQ model.

6. Results

Table 1 provides the demographic information and details of the purchase behavior of the respondents. The respondents in the two-wave survey had similar watching habits and socio-economic characteristics. Most respondents were young and well educated and had high-paid jobs. However, discrepancies were found in the usage of LSC platforms in the two waves of respondents. Tao Bao and Jing Dong were the first two ever used platforms; Tik Tok was the most recently used LSC website. The results indicated the fast change in consumer preferences toward LSC brands.

Table 1. Profiles of the respondents from two samples.

Items	Percentage %		Items	Percentage %	
	N [1]	N [2]		N [1]	N [2]
Gender			Avg. watching time		
Male	33.00	37.31	Under 31 min	28.30	31.84
Female	67.00	62.69	31~60 min	47.41	43.62
Age			1~2 h	48.00	21.32
19~24	14.15	13.18	More than 2 h	4.01	3.23
25~29	36.08	34.50	Watching frequency		
30~39	43.87	44.60	Nearly every day	23.58	23.00
40~49	4.72	6.03	2~4 times a week	57.55	54.98
50 or older	1.18	1.68	Once a week	9.43	10.66
Education			2~3 times a month or less	9.04	11.36
High school or below	1.42	2.52	Shopping frequency per month		
Junior college	6.60	7.71	1~3	25.00	26.51
Bachelor	83.73	83.59	4~6	35.38	38.15
Graduate school	8.25	6.17	7~9	22.41	18.23
Occupation			More than 9	17.22	17.11
Student	7.78	5.89	Consumption amount (RMB)		
Freelance	4.25	5.19	Under 100	15.57	12.62
Service	10.38	13.88	101~200	42.92	43.90
Finance	11.32	11.50	201~600	31.84	32.68
Manufacturing	37.50	38.43	601~1000	6.37	7.71
Public administration	9.20	8.7	More than 1001	3.31	3.08
Information Technology	14.15	9.54	Contact time		
Farming, fishery, forestry and feeding	0.94	0.56	Less than 6 months	2.59	2.66
Housewife	0.24	1.12	6 months to 1 year	16.75	15.01
Others	4.25	5.19	1~1.5 years	20.99	21.74
Marital Status			1.5~2 years	19.81	22.86
Married	75.00	74.61	More than 2 years	39.86	37.73
Unmarried	24.53	24.96	Ever used LSC platforms [3]		
Others	0.47	0.42	Tao Bao	92.92	88.92
Monthly income (RMB)			Jing Dong	50.71	54.14
Under 1500	4.01	2.38	Mo Gujie	8.49	11.50
1500~2999	5.42	4.35	Sina Weibo	5.42	10.10
3000~4999	7.78	7.57	Tik Tok	87.5	91.44
5000~5999	12.50	12.48	Kwai	40.8	44.60
6000~6999	9.67	14.45	Others	1.89	1.82
7000~7999	13.68	14.87	Recently shopping on LSC platform		
Above 8000	46.93	43.90	Tao Bao	38.68	32.96
			Jing Dong	3.54	5.47
			Tik Tok	48.35	51.19
			Kwai	8.49	9.54
			Others	0.95	0.84

[1] Sample size = 424; [2]. Sample size = 713; [3]. Multiple choices.

Common method bias (CMB) frequently occurs when data for independent and dependent variables have been collected at the same time from the same respondents. The easiest way to assess the potential impact of CMB was to refer to the approach of Bagozzi, Yi, and Phillips [77] using the correlational matrix: if the correlation between variables is less

than 0.9, then the data have no CMB issue. Table 2 presents the correlational matrix between the primary constructs of the first-wave data. All correlational values were less than 0.8. Furthermore, the Harman one-factor test was conducted based on Podsakoff et al. [78], and the results indicated that a single-factor model did not fit the data well. Therefore, CMB was mitigated.

Table 2. Bivariate correlations between main constructs and square roots of average variance extracted (N = 424).

	TW	EXP	RES	SIQ	TEL	CS	PHY	IQ	SOQ	WQ	FU	RC	OQ	PS	CT	EU	OP	SQ
TW	0.89																	
EXP	0.57	0.81																
RES	0.55	0.47	0.81															
SIQ	0.59	0.56	0.67	0.89														
TEL	0.21	0.23	0.47	0.34	0.77													
CS	0.57	0.70	0.41	0.46	0.30	0.79												
PHY	0.60	0.71	0.46	0.58	0.29	0.53	0.94											
IQ	0.33	0.20	0.65	0.34	0.38	0.39	0.35	0.86										
SOQ	0.30	0.39	0.61	0.33	0.67	0.42	0.34	0.44	0.85									
WQ	0.39	0.40	0.51	0.41	0.58	0.40	0.49	0.33	0.62	0.81								
FU	0.14	0.23	0.62	0.15	0.48	0.22	0.20	0.22	0.40	0.43	0.72							
RC	0.49	0.29	0.28	0.39	0.30	0.25	0.37	0.30	0.40	0.41	0.36	0.86						
OQ	0.47	0.47	0.56	0.43	0.45	0.30	0.50	0.36	0.46	0.49	0.22	0.49	0.95					
PS	0.44	0.45	0.67	0.48	0.49	0.54	0.44	0.62	0.63	0.67	0.39	0.40	0.47	0.75				
EU	0.55	0.53	0.66	0.53	0.32	0.39	0.66	0.29	0.23	0.39	0.15	0.36	0.63	0.37	0.89			
PC	0.46	0.39	0.58	0.36	0.35	0.53	0.38	0.55	0.38	0.4	0.24	0.28	0.40	0.49	0.35	0.76		
OP	0.20	0.28	0.55	0.23	0.65	0.25	0.18	0.21	0.70	0.53	0.60	0.40	0.40	0.49	0.18	0.20	0.77	
SQ	0.22	0.19	0.28	0.29	0.52	0.23	0.23	0.44	0.63	0.48	0.36	0.25	0.28	0.56	0.17	0.37	0.57	0.90

Please refer to Table 3 for the abbreviations of the constructs.

6.1. Assessment of the Measurement Model

A measurement model should assess (1) reliability, (2) convergent validity, and (3) discriminant validity using confirmatory factor analysis (CFA). Table 3 presents the measurement model estimation. The values of composite reliability (CR) for all constructs were above 0.70, indicating internal consistency. The values of AVE ranged from 0.52 to 0.77, allowing convergent validity. Table 2 provides an overview of the correlation coefficients matrix of the constructs. A comparison of the AVE values with the squared multiple correlations reveals that the AVE values exceed the correlations in all cases, thereby demonstrating discriminant validity for each construct [79]. Overall, the measurement model indicated a high degree of reliability, as well as convergent and discriminant validity.

Table 3. Measurement model results of the proposed reflective model (N = 424).

Constructs	Items	Mean	SD	Factor Loading	CR	AVE
Trustworthiness (TW)	TW1	5.37	0.93	0.84	0.91	0.72
	TW2	5.26	1.20	0.84		
	TW3	5.32	1.12	0.87		
	TW4	5.44	1.14	0.83		
Expertise (EX)	EX1	5.59	1.05	0.65	0.76	0.52
	EX2	5.75	1.05	0.75		
	EX3	6.25	0.82	0.75		
Responsiveness (RES)	RES1	5.58	1.16	0.74	0.80	0.57
	RES2	5.94	0.99	0.82		
	RES3	5.79	1.04	0.69		

Table 3. *Cont.*

Constructs	Items	Mean	SD	Factor Loading	CR	AVE
Telepresence (TEL)	TEL1	5.19	1.33	0.83	0.87	0.62
	TEL2	5.41	1.22	0.82		
	TEL3	5.23	1.24	0.85		
	TEL4	4.59	1.52	0.65		
Consumption scenario (CS)	CS1	5.75	1.07	0.77	0.79	0.55
	CS2	5.69	1.05	0.75		
	CS3	5.76	0.95	0.72		
Information quality (IQ)	IQ1	5.25	1.06	0.82	0.86	0.61
	IQ2	5.31	1.06	0.79		
	IQ3	5.72	0.99	0.76		
	IQ4	5.62	1.01	0.75		
System operation quality (SOQ)	SOQ1	4.67	1.59	0.86	0.88	0.70
	SOQ2	5.10	1.38	0.80		
	SOQ3	4.68	1.56	0.86		
Fulfillment (FU)	FU1	5.46	1.02	0.70	0.82	0.60
	FU2	5.78	1.06	0.78		
	FU3	5.81	0.95	0.83		
Refund/ compensation (RC)	RC1	5.26	1.30	0.62	0.81	0.59
	RC2	5.90	1.02	0.84		
	RC3	5.74	1.07	0.84		
Privacy/security (PS)	PS1	5.34	1.22	0.83	0.83	0.61
	PS2	5.17	1.32	0.81		
	PS3	4.47	1.43	0.71		
Contact (CT)	CT1	5.86	0.96	0.72	0.78	0.54
	CT2	5.86	0.99	0.78		
	CT3	5.40	1.15	0.69		
Ease of use (EU)	EU1	5.76	0.90	0.76	0.73	0.54
	EU2	5.87	1.08	0.71		
	EU3	5.80	1.21	0.59		
Streamer's interaction quality (SIQ)	SIQ1	6.09	0.92	0.76	0.78	0.63
	SIQ2	5.74	1.03	0.83		
Physical environment (PHY)	PHY1	5.45	1.07	0.88	0.86	0.75
	PHY2	5.80	0.97	0.85		
Website quality (WQ)	WQ1	5.72	1.00	0.58	0.74	0.59
	WQ2	5.53	1.12	0.92		
Outcome quality (OQ)	OQ1	6.02	0.77	0.75	0.78	0.64
	OQ2	5.88	0.90	0.84		
Ordering process (OP)	OP1	6.00	0.87	0.73	0.76	0.61
	OP2	5.82	1.08	0.83		
Overall LSC-SQ (SQ)	SQ1	5.61	1.06	0.87	0.87	0.87
	SQ2	5.59	1.03	0.89		

6.2. Assessing Hierarchical Reflective LSC-SQ Model

We specified LSC-SQ as a third-order, hierarchical, reflective construct. The structural equation model was examined to test the structural equations among the latent constructs, determining their significance and the predictive ability of the model. The bootstrap re-sampling method (5000 re-samples) was used to determine the path coefficients and the R^2 values. The results (Figure 4 and Table 4) revealed that all path coefficients from the higher-order construct of LSC-SQ to second-order constructs and from second-order construct to first-order construct were significant at the 5% level. In addition, the R^2 values of the constructs ranged from 0.16 to 0.49, which were greater than the recommended

value of 0.15 [76]. The CR and AVE of overall LSC-SQ were 0.87 and 0.77, respectively, which were above the cut-off values, 0.8 and 0.6. Hence, the notion of LSC-SQ being a third-order construct was validated. Tenenhaus, Amato, and Esposito Vinzi [80] noted a goodness-of-fit (GoF) measure for global validation of a PLS model, which was defined as the geometric mean of the average communality (communality = AVE in PLS) and average R^2 of endogenous constructs. The value of GoF varies from 0 to 1. This study obtained a GoF value of 0.43 which exceeded the cut-off value of 0.36 for a large effect size of R^2. Therefore, the study findings were acceptable.

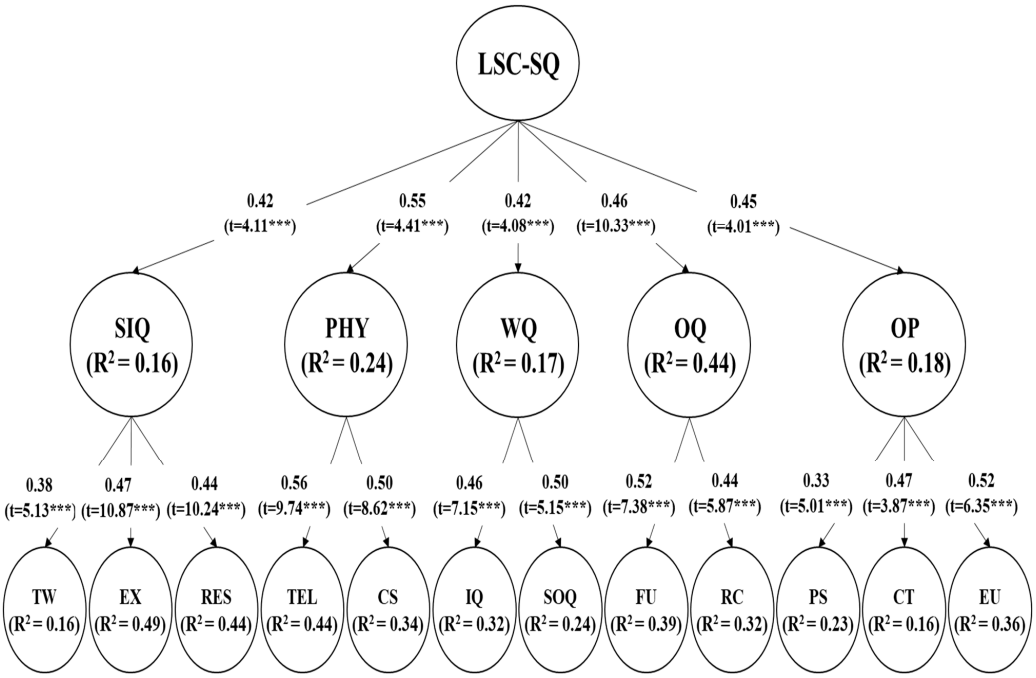

Figure 4. Estimation results of the structural model (N = 424). *** $p < 0.001$.

Table 4. A summary of the path coefficients for the proposed reflective model.

Paths	Verifying by the First-Wave Data (N = 424)			Verifying by the Second-Wave Data (N = 713)		
	Coefficient	t-Value	Significant	Coefficient	t-Value	Significant
SIQ → RES	0.44	10.24 ***	Yes	0.36	10.37 ***	Yes
SIQ → EXP	0.47	10.87 ***	Yes	0.45	14.05 ***	Yes
SIQ→ TW	0.38	5.13 ***	Yes	0.36	10.88 ***	Yes
PHY → CS	0.50	8.62 ***	Yes	0.55	17.19 ***	Yes
PHY→TEL	0.56	9.74 ***	Yes	0.51	17.13 ***	Yes
WQ → IQ	0.46	7.15 ***	Yes	0.43	11.96 ***	Yes
WQ →SOQ	0.50	5.15 ***	Yes	0.37	11.80 ***	Yes
OQ → FU	0.52	7.38 ***	Yes	0.46	12.76 ***	Yes
OQ → RC	0.44	5.87 ***	Yes	0.46	13.79 ***	Yes
OP → PS	0.33	5.01 ***	Yes	0.31	9.53 ***	Yes
OP → CT	0.47	3.87 ***	Yes	0.41	11.00 ***	Yes
OP → EU	0.52	6.35 ***	Yes	0.45	12.25 ***	Yes
SQ → SIQ	0.42	4.11 ***	Yes	0.43	13.00 ***	Yes
SQ → PHY	0.55	4.41 ***	Yes	0.53	17.34 ***	Yes
SQ → OP	0.45	4.01 ***	Yes	0.41	11.97 ***	Yes
SQ → WQ	0.42	4.08 ***	Yes	0.30	7.61 ***	Yes
SQ → OQ	0.46	10.33 ***	Yes	0.45	12.05 ***	Yes

Note: *** $p < 0.001$.

6.3. Testing an Alternative Model

As discussed earlier, we specified the paths from second- to higher-order construct of LSC-SQ and from second- to first-order construct as an alternative model (Figure 2). Using the same techniques as mentioned above, the results (Table 5) revealed that most of the paths in the model were significant at the 5% level except for the link from the streamer's interaction quality to LSC-SQ, which was insignificant. The results showed that the streamer's performance did not contribute to the overall LSC-SQ, which contradicts the existing literature. Some researchers argued that streamers are a determinant in the context of LSC [40,47,51], and this factor differentiated from other online commerce services. Thus, this alternative model specification did not make sense, and we accepted the hierarchical reflective model confidently.

Table 5. A summary of the path coefficients for the alternative formative model.

Paths	Verifying by the First Wave Data (N = 424)		
	Coefficient	**t-Value**	**Significant**
SIQ → RES	0.44	10.20 ***	Yes
SIQ → EXP	0.47	11.61 ***	Yes
SIQ→ TW	0.38	7.87 ***	Yes
PHY → CS	0.50	12.32 ***	Yes
PHY → TEL	0.56	13.57 ***	Yes
WQ → IQ	0.46	11.78 ***	Yes
WQ → SOQ	0.50	13.60 ***	Yes
OQ → FU	0.52	13.20 ***	Yes
OQ → RC	0.44	10.70 ***	Yes
OP → PS	0.47	12.73 ***	Yes
OP → CT	0.18	12.83 ***	Yes
OP → EU	0.33	8.37 ***	Yes
SIQ → SQ	0.09	1.62	No
PHY → SQ	0.32	5.40 ***	Yes
OP → SQ	0.18	3.70 ***	Yes
WQ → SQ	0.15	3.32 **	Yes
OQ → SQ	0.16	2.74 **	Yes

Note: ** $p < 0.01$; *** $p < 0.001$.

6.4. Cross-Validation of the Hierarchical Reflective Model

Validation was undertaken using a new data set collected from another online survey to verify the underlying factor structure in the proposed model from the previous analysis. A similar task was performed, and the questionnaire was identical to that in the first-wave survey. In total, 713 valid responses were obtained. As shown in Table 1, the socio-demographic categories of the sample were similar to those that were reported by the first-wave survey.

We applied the same statistical techniques. The measurement model estimation results indicated that the values of CR for all constructs were above 0.7 and the values of AVE ranged from 0.53 to 0.77. The CR and AVE of overall LSC-SQ were 0.86 and 0.77, respectively, which were above the cut-off values. Similarly, the measurement model estimated by the second-wave data set indicated a high degree of reliability, as well as convergent and discriminant validity.

Table 4 shows the estimation results regarding the structural equation model, indicating that all path coefficients were significant at the 5% level. According to Falk and Miller [81], the R^2 values of the constructs ranged from 0.12 to 0.32, which were greater than their recommended value of 0.10. The GoF value of 0.36 was obtained, satisfying the requirement of the cut-off value. Therefore, the findings verified that the model was adequate.

In the final stage of model verification, the authors examined how LSC-SQ predicted customer behavior as the measurement was designed to do. According to Zeithaml, Berry,

and Parasuraman [82], behavioral intention variables play an important role in assessing the nomological validity of measurement tools with service quality. A total of eleven statements listed in the Appendix A constituted two constructs, including six satisfaction items and five behavioral loyalty items that were utilized to assess the predictive validity of the LSC-SQ measure. All the statements were measured using the same scale with the endpoints "Strongly disagree" (1) and "Strongly agree" (7). A path analysis was conducted to test the relationship among LSC-SQ, satisfaction and behavioral loyalty. The results indicated that H1 and H2 were supported: LSC-SQ had a direct effect on customer satisfaction ($\beta = 0.62$, t-value = 20.35) and the effect of LSC-SQ on their loyalty intentions was also significant ($\beta = 0.56$, t-value = 14.47). Thus, LSC-SQ served as an important variable for predicting satisfaction as well as behavioral intention. The proposed measurement model exhibited good predictive validity.

7. Discussion and Conclusions

A mere transfer of electronic service quality measures may not adequately capture the nature of LSC-SQ owing to LSC as a new service environment and the interactive characteristics. Our proposed hierarchical model has been constructed based on a comprehensive literature review. We followed other researchers' recommendations [10,15] but also considered the unique characteristics of LSC services. The empirical analysis indicates that the proposed hierarchical structure was strongly supported, indicating that the LSC-SQ model was valid. Thus, customers evaluated LSC-SQ according to the proposed five dimensions. In addition, they viewed overall service quality as a higher-order factor, and that the basic dimensions had sub-dimensions associated with them in the customer's mind. Furthermore, we tested the alternative model, and the results indicated that the relationship between dimensions and overall assessment was reflective rather than formative.

In summary, the analytical results conveyed that a third-order hierarchical construct, LSC-SQ significantly reflected all dimensions (constructs) of the first- and second-order constructs under examination. Thus, this study captured a hierarchical structure of LSC-SQ. That is, aspects low in the hierarchy were correlated and gave rise to broad dimensions at the high level. Precisely, LSC-SQ reflected five dimensions, namely, the streamer's interaction quality, physical environment, website quality, outcome quality, and ordering process. These dimensions formed second-order factors in the hierarchy of LSC-SQ. The streamer's interaction quality reflected trustworthiness, expertise, and responsiveness. The physical environment reflected telepresence and consumption scenarios. Then, website quality reflected information quality and system operation quality. Moreover, outcome quality reflected fulfillment and refund/compensation, and the ordering process reflected privacy/security, contact, and ease of use. These twelve sub-dimensions represented first-order factors in the hierarchy of LSC-SQ.

7.1. Theoretical Implications

This study articulated a theoretical case for developing a reflective model specification for the LSC-SQ construct and tested it empirically, making several contributions to the literature. First, the existing literature did not comprehensively focus on the levels and dimensions of LSC-SQ. The fundamental theoretical contribution of this study is the development of LSC-SQ as a hierarchical reflective construct. Such a construct has been conceptualized as a multidimensional third-order model with a reflective configuration, and empirical evidence has been provided to validate the model. In addition, the model has been extended to incorporate the effect that LSC-SQ has on customers' satisfaction and loyalty regarding the LSC platform. Overall, by empirically examining multiple domains in multiple levels, this study provided a comprehensive understanding of LSC-SQ.

Second, the developed measurement comprises items from existing measures to establish a new measurement. The reliability and validity of this measure were assessed. The developed measure showed good reliability and validity and could predict customer behavior. Third, this research further strengthened the existing literature in terms of

extending the methodology to assess hierarchical models using PLS technique because few studies discussed whether the model specification should be a formative or reflective form in modelling hierarchical constructs.

Although the construct of LSC-SQ causes five primary dimensions and most of the dimensions are the ones that researchers recommended, some of the sub-dimensions are different owing to the LSC context. The results could be explained as follows: except for the additional aspects such as the streamer performance and the platform environment, customers' perception in terms of LSC-SQ may be a stereotype inherited from online shopping and e-retailing services [6–8]. In brief, consumers are accustomed to the service performance of brick-and-mortar stores [10] and e-retailers [6–8] and then take LSC-SQ with those dimensions and sub-dimensions for granted. In other words, the domain of LSC-SQ should include all aspects of the e-SQ and more.

7.2. Managerial Implications

This study serves as a fundamental guideline for LSC platforms to improve their service quality and provides important implications for practitioners. The results showed that all five dimensions of LSC-SQ were significant to practitioners, and their importance was rated from customers' perspectives. Platforms should focus on achieving all five dimensions to capitalize the full benefits of LSC-SQ. A whole LSC service is an integral part of any platform's operation. Failure to achieve one dimension may act as the foundation to weaken and falter other dimensions. The third-order configuration provides a more precise picture to identify problem areas within their platforms (at the dimension or sub-dimension level). Such an understanding, in turn, could help platform managers concentrate resources on improving particular aspects of service quality effectively.

We stressed that LSC-SQ was an abstract idea and multidimensional construct. Considering that all loadings of second-order constructs (Figure 4) on the third-order construct (LSC-SQ) were nearly the same (0.42–0.55), it might be inferred that all second-order constructs were equally crucial for LSC-SQ. However, the physical environment (0.55) appeared to be the most significant factor, followed by outcome quality (0.46), the ordering process (0.45), the streamer's interaction quality (0.42), and website quality (0.42) for LSC-SQ. LSC-SQ reflected the physical environment which played an important, if not the most important, role in evaluating the assessment. This finding was in line with that of other studies [83,84], which indicated that telepresence was the driving force of LSC buying behavior and certainly was absent in traditional and online retailing contexts. The environment created by the LSC platforms not only enhances customers' shopping experiences but also facilitates service quality delivery [83]. Furthermore, this case could be an element that distinguished the LSC brand from its competitors. In this way, among others, the physical environment was relatively the most crucial component in LSC-SQ.

Contrary to expectations, the dimension of the streamer's interaction quality was a relatively less important factor of LSC-SQ. However, Verhoef, Neslin, and Vroomen [85] found weak customer loyalty and, by implication, poor relationship quality in electronic channels owing to the lack of personal contact between customers and service providers. From the marketing perspective, most streamers own their reputation as credible sources that attract followers, and they could be regarded as endorsers of products or brands [50]. However, building a long-term customer–seller relationship relies on excellent services, including interactivity [86]. The efforts from the streamers and the physical environment may be effective in building the brand image of the LSC platform to satisfy consumers' expectations in terms of shopping on this distribution channel. Thus, these approaches echoed the suggestions of Ho, Liu, and Chen [40] to wrap up the LSC platform performance in an effective way.

The study also illustrates the physical environment and streamer's interaction quality facets of LSC-SQ in terms of hardware- and software-focused functional areas which are vital to achieving competitive advantages. According to Ho, Liu, and Chen [40], the hardware of an LSC platform includes the layout of the broadcast room and the opera-

tional mechanism for consumers while also representing the characteristics of the streamer. Managers may focus on the studio and the related equipment used for the show to fit the style of the streamer to improve the physical environment of the platform. Enhancing telepresence and consumption scenarios may emphasize the aesthetic design, create attractive content, help the customers receive the information, and facilitate social functions to fulfill their needs [83,84]. Furthermore, platform managers may allocate resources to equip streamers with interaction skills to attract customers' attentions and improve their service performance, including trustworthiness, expertise, and responsiveness.

Website quality should be regarded as the fundamental element of LSC-SQ because information quality covers the extent to which any information is provided during the interaction process with user interface, and system operation quality captures the goodness of data transfer and data processing during the delivery process. LSC customers can be easily turned off when the site is difficult to access, or cannot be navigated easily, for much time may be unnecessarily used up. The performance pertaining to these key features of a website affects searching for, conveying, and browsing shopping-related information.

The quality of the ordering process was another critical factor in evaluating LSC-SQ. It involves transactions, including the elements such as personal security, customer services, and workable functions, that are quickly linked and make it easy to order the wanted merchandise. Finally, the service quality dimension turns to focus on outcome quality. From the customer's perspective, error-free service delivery is always crucial. As Fassnacht and Koese [5] stated, recovery services are needed in some situations, but not wanted in the first place. Indeed, the service options such as call center agents or personnel for e-mail communication do not become relevant unless some kind service failure occurs and recovery is needed. Nevertheless, platform providers should take that into account because people-based service elements in service recovery would become evident to make contributions over existing LSC-SQ, particularly with no significant difference in the core service offering.

Our research results could allow LSC retailers and their platform designers to identify specific areas of platform quality that need attention to improve shoppers' perceptions and facilitate their subsequent purchase decisions. Platform designers could use such information to allocate resources to those areas that need improvement effectively. For instance, the stronger correlation was between information quality and ease of use (0.55, Table 2) and indicated that LSC shoppers' perception of the quality of information contained in a website was transferable to their perception of how easy the website was to understand and navigate. Furthermore, an in-depth evaluation of competitors' platforms would provide a much clearer picture of how an enterprise's platform compares with others. The proposed model may be applied either in its entirety to conduct a comprehensive assessment of LSC-SQ or focused on a specific dimension. Streamers on their stage (physical environment) are similar to the front-desk employees of the LSC platform; the website constitutes the interface between customers and the platform. A user-friendly ordering process could facilitate shopping; then, a good logistics and distribution service enables customers to receive their merchandise quickly without error.

7.3. Limitations and Directions for Future Research

This study has been subject to a few limitations that could be addressed in future research. First, to some extent, replications of the current research model in different countries/regions would likely strengthen and validate the study's findings. Additional data could be collected in the future and give scope for future research. Second, cultural differences and other types of LSC should be considered when applying our results to other countries. Third, the measurement items of the constructs in this study have mainly been adopted from previous studies. Some sub-dimensions were merged with the items. Future research could use a qualitative research design to refine and accommodate additional items or sub-dimensions for measuring the underlying constructs. Third, longitudinal data could bring out some interesting results for LSC-SQ comparisons within and between

platforms. Finally, some researchers recommended to consider the application of the cross-validated predictive ability test (CVPAT) and its extensions when analyzing the theoretical models [87,88]. Indeed, the prediction-oriented model assessments and comparisons are essential for theory development and validation. However, we proposed a whole new model of LSC-SQ and theoretically established models did not exist, so we could not conduct CVPAT for a pairwise comparison of the predictive power of competing models. Nevertheless, the developed model can be replicated with other samples. The extent to which the findings could be generalized is an issue related to comparing the quality dimensions identified and the external validity of the scale's dimensionality.

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Appendix A

Table A1. Measurement Items in the Research Model.

Constructs/ Variables	Items	Source
Trustworthiness (TW)	I feel the live streamer is trustworthy (TW1). I feel the live streamer is honest (TW2). I feel the live streamer is dependable (TW3). I feel the live streamer is sincere (TW4).	[50]
Expertise (EXP)	The streamer understands my specific needs (EXP3). The streamer has sufficient knowledge to attend to customer (EXP2). I feel the live streamer is skilled (EXP3).	[50]
Responsiveness (RES)	The streamer cares about customers' responses during the live broadcasting (RES1). The streamer is happy to communicate with customers (RES2). The streamer provides relevant information on my inquiry in a timely manner (RES3).	[62]
Telepresence (TEL)	While watching the live broadcasting, I was totally immersed in the world that the live stream created (TEL1). While watching the live broadcasting, it seems that I have really seen the products (TEL2). While watching the live broadcasting, I felt like an immersive experience (TEL3). The live stream created a new world for me, and the world suddenly disappeared when the live stream ended (TEL4).	[62]
Consumption scenarios (CS)	The broadcast room is clean, and the decoration and furnishings are bright and tidy (CS1). The live broadcast setting matches the style of the products (CS2). Customers can see the product thoroughly and in detail (CS3).	[39]

Table A1. *Cont.*

Constructs/ Variables	Items	Source
Information quality (IQ)	The content provided by the streamer is reliable (such as product, brand, and use experience) (IQ1). The content provided by the streamer is true (IQ2). The streamer provides real-time information to meet customers' needs during the live broadcasting (IQ3). The content provided by the streamer is complete (IQ4).	[61]
System operation quality (SOQ)	Even if many customers enter the live room at the same time, there will be no delays or errors (SOQ1). After entering the live room, customers can carry out any operation they are interested in without any inconvenience (SOQ2). The live-streaming shopping platform allows audiences/customers to watch video and hear sound with no stuck phenomenon (SOQ3).	[62]
Fulfillment (FU)	The online receipt informs me of the total charges that will be debited against the payment APP (FU1). The product that came was represented accurately by the live streaming platform (FU2). The product is delivered by the time promised by the company (FU3)	[6]
Refund/ compensation (RC)	Providing compensation in case the ordered items are not delivered on time (RC1). The company willingly handles returns and exchanges (RC2). The return policy at the live streaming platform is reasonable (RC3).	[6,67]
Privacy/security (PS)	The company protects information about my live-streaming shopping behavior (PS1). The live-streaming shopping platform does not share my personal information with other sites (PS2). The company uses payment gateways for transactions instead of using its own payment mechanisms (PS3).	[7,8]
Contact (CT)	It's easy to track the shipping and delivery of items purchased at the live streaming platform (CT1). Providing the ability to directly speak to a live person in case of any problems (CT2). Having customer service representatives available online to handle customer complaints directly and immediately (CT3).	[6,8]
Ease of use (EU)	The live-streaming shopping platform provides procedures for ordering (EU1). A first-time buyer can purchase from the live-streaming shopping platform without much help (EU2). The live-streaming shopping allows customers to make a purchase whenever they want (EU3).	[39,50]
Streamer's interaction quality (SIQ)	The broadcasting style of the host is interesting (e.g., interesting things to say, having an acting talent) (SIQ1). The host has good presentation skills to demonstrate products (SIQ2).	[39]
Physical environment (PHY)	I can feel the good shopping atmosphere (PHY1). I would highly rate the physical environment of the LSC platform (PHY2).	[15]
Website quality (WQ)	The LSC platform is always available for business (WQ1). The LSC platform launches and runs right away (WQ2).	[8]
Outcome quality (OQ)	I have an excellent experience about what the LSC platform provides to its customers (OQ1). I feel the company willing and ready to respond customers' needs (OQ2).	[39]

Table A1. *Cont.*

Constructs/ Variables	Items	Source
Ordering process (OP)	Easy and quick purchase (for example, directly clicking on a link to buy during the live broadcast) (OP1). Customers save time and effort by the live streaming shopping platform (OP2).	[39]
Overall LSC-SQ	I would say that the LSC platform provides superior service (SQ1). I believe that the LSC platform offers excellent service (SQ2).	[15]
Satisfaction (SAT)	If I had to do it over again, I would make the most recent live-streaming purchase on this platform. It was the right thing to make the most recent live-streaming purchase on this platform. Truly enjoyed purchasing from this platform. The choice to purchase from this platform was a wise one. Satisfied with the most recent decision to purchase from this platform. Happy with the most recent live-streaming purchase on this platform.	[69]
Loyalty Intention (LI)	Encourage friends and relatives to do business with this platform. Say positive things about the website to other people. Do more business with the platform in the near future. Recommend the platform to those who seek the advice. Consider this live-streaming platform as the first choice for shopping that I most recently purchased.	[69]

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