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Enhancing customer value co-creation and stickiness in social commerce: integrating PLS-SEM and NCA for deeper insights into customer-to-customer dynamics

Ying Zhou [1], Sameer Kumar[2✉] & Fumitaka Furuoka[2]

Social commerce(s-commerce), which emphasizes the predominance of customers, has become an important tool of company social marketing and provides new challenges to businesses in attracting customers. Based on customer-dominant logic theory, this study presents a model of the impact of electronic customer-to-customer interaction(eCCI) on customer stickiness with the mediation effect of customer value co-creation dimensions, specifically functional value and hedonic value in the s-commerce context and self-efficacy as a moderator in light of customer-dominant logic. This study adopted a survey method and obtained data from users in two s-commerce sites in China. The statistical technique of partial least squares structural equation modeling (PLS-SEM) and the analytical process of necessary condition analysis (NCA) were employed to analyze the data. The PLS-SEM results indicate that eCCI influences customer value co-creation, which in turn affects the consumer stickiness of s-commerce sites.The moderated mediation results showed that self-efficacy moderated the relationship between eCCI and customer stickiness.The NCA results identified the eCCI is meaningful and significant necessary conditions for fostering customer value co-creation and customer stickiness. The combined findings demonstrated to researchers and practitioners how to identify the critical factor that influence customer value co-creation and customer stickiness. The study provides novel insights into the mechanism underlying why consumers "stick" to s-commerce websites. Furthermore, the moderated mediation model extended customer-dominant logic and demonstrated the moderating influence of self-efficacy. The theoretical and practical implications of these findings are discussed.

[1] School of Management, Guangdong Ocean University, Zhan Jiang, China. [2] Asia–Europe Institute, University of Malaya, Kuala Lumpur, Malaysia.
✉email: sameer@um.edu.my

Introduction

Social commerce (s-commerce) is a new and rapidly expanding type of online trading that is generated by the usage of social media for electronic-commerce (e-commerce) transactions (Bi Intelligence, 2018). According to Qu et al. (2023), one significant distinguishing factor between s-commerce and e-commerce is electronic customer-to-customer interaction(eCCI). S-commerce encourages greater customer interaction and collaboration and builds more socially-oriented customer communities, whereas e-commerce sites tend to alienate customers from one another (Zhang et al., 2014; Huang and Benyoucef, 2015; Selem et al., 2023). In s-commerce, for instance, customers share product information and ask friends or other customers for suggestions to obtain a better deal from sellers (Kim and Park, 2013).In this regard, s-commerce combines the benefits of e-commerce with social media by using the potential of social media to strengthen interactions among many stakeholders (Sedalo et al., 2022).

Moreover, eCCI promotes the transformation of customers from passive "receivers" of information to active "co-creators" of information (Jahn and Kunz, 2012) and has given customers access to more retailers and more brands. On the other hand, customers of an s-commerce platform face a relatively low conversion cost (Kang et al., 2021). It is a typical occurrence for individuals to transfer from one platform to another that offers comparable s-commerce services. As a result, s-commerce platforms are facing challenges in strengthening customer stickiness. In this case, practitioners should not just focus on acquiring customers but also on "sticking" them (i.e., stickiness; Lu and Lee, 2010), as customer loyalty is essential to achieving better long-term profits. Stickiness, widely used to measure online customer loyalty, was discovered to enhance the conversion rate from visitors to buyers (Lin et al., 2010). Previous research has established that stickiness is crucial in creating an optimal user experience and driving customer preference towards a particular website (Polites et al., 2012). As a result, it is critical to comprehend how to increase customer stickiness concerning an s-commerce site and then motivate them to stay on. This field is crucial for increasing user stickiness as the consumer progressively concentrates on customer value creation during the purchase process (Nafees et al. 2021). Moreover, in the context of s-commerce, customer co-created value is determined by the online interaction, which subsequently influences user stickiness during the purchase process (Qu et al., 2023).

As s-commerce promotes high eCCI, customer value is impacted by using s-commerce platforms, which may impact customer stickiness. To date, however, there has been a lack of scholarly focus on investigating the effects of eCCI in the s-commerce context (Geng et al., 2020). Furthermore, little research has examined its impact on customer stickiness toward s-commerce sites, viewed as particular online entities (Wu and Li, 2018), especially in the perception of customer value co-creation (Adapa et al., 2020). Based on an examination of the social commerce literature, several findings may be made, eCCI, customer value co-creation, and customer stickiness. First, a significant research gap exists in customer stickiness in eCCI. The impact of eCCI on customer stickiness has been conspicuously overlooked in prior research due to the recent emergence of social commerce as a focal area of interest (Qu et al., 2023).Second, the existing body of literature has predominantly concentrated on exploring the effect of customer value co-creation in offline environments, particularly within industries such as the catering and tourism sectors (Rihova et al., 2018; Chuang, 2023). A substantial void remains regarding the connection between social commerce and customer value co-creation, necessitating a more comprehensive investigation. Consequently, this study aims to

assess the influence of eCCI on user stickiness through the perspective of customer value co-creation, with the goal of not only advancing current scholarly knowledge but also furnishing actionable recommendations for s-commerce platforms.

In addition to customer value co-creation, prior research has indicated that self-efficacy plays a significant role in adaptive information sharing (Ngoc Hoi, 2023). Furthermore, self-efficacy has been identified as an influential factor in shaping consumer behavior (Wang et al., 2013).In other words, self-efficacy pertains to individuals' confidence in their ability to navigate potential situations effectively and is frequently identified as the primary determinant of their performance (Bandura, 1977). Particularly within the field of s-commerce, where users typically lack familiarity with one another, exchanging useful thoughts, knowledge, or experiences has been recognized as an essential obstacle (Yan and Davison, 2013). It has been shown that individuals with higher levels of self-efficacy tend to have a greater inclination towards expressing their ideas, sharing information, and recounting personal experiences on s-commerce sites, thereby leading to prolonged engagement on these platforms. Nevertheless, the significance of self-efficacy remains to be determined since the limited scholarly focus has been focused towards this particular setting. Therefore, the present study aims to investigate further the moderating role of self-efficacy in relationship to the effects of customer value co-creation on customer stickiness.

Therefore, the objective of this study is to enhance comprehension of the impacts of eCCI on customer stickiness in s-commerce, specifically from the standpoint of customer value co-creation. This research is especially led by the following questions: What are the primary determinants that impact customer stickiness in s-commerce? In this study, we examine the particular effects of eCCI on the customer value co-creation, as evaluated by functional and hedonic values. Additionally, we investigate the influence of customer value co-creation on customer stickiness.What is the significance of self-efficacy in respect to the other predictors? By answering these questions, these studies attempts to contribute to the existing body of knowledge since it focuses on five crucial aspects of the s-commerce industry that are rarely examined. First, the thorough literature review on eCCI can aid marketing scholars in this field. Nicholls (2010) pointed out that one of the biggest problems in CCI research is eCCI, which stands for "CCI in an e-service environment. "We address this problem in more detail. Moreover, this study contributes to the s-commerce literature by verifying the effect of eCCI on customer stickiness in testing the mediating role of customer value co-creation. The indirect effect of self-efficacy as a moderator is incorporated to assess its effect on customer value co-creation and stickiness. Third, given that past studies have found that customer value creation is multidimensional (reflective-formative), this research develops a new model by modeling them as second-order constructs. It uses partial least squares structural equation modeling (PLS-SEM) following the assessment procedure suggested by Sarstedt et al. (2019) to evaluate the research model.Fourth, this study is well-grounded by the lens of customer-dominant logic (C-D logic) (Heinonen et al., 2010) to propose a framework by addressing the need for further research on customer stickiness and the underlying value drivers in s-commerce (Zhang et al., 2017; Heinonen et al., 2018). Fifth, this study predominantly utilized PLS-SEM and NCA techniques to examine the data obtained from the survey questionnaire.The combined utilization of PLS and NCA has the potential to promote the development of theories and practical implications for both research and business practices (Richter et al., 2020).Our findings may help s-commerce businesses create more successful strategies to improve their competitiveness in the online market.

Table 1 Customer-dominant logic used in customer service.

Authors(year)	Context	Methodology	Main Findings
Heinonen et al. (2010)	service industry	conceptual paper	First outline of customer-dominant logic characteristics.
Heinonen et al. (2013)	service industry	conceptual paper	The study expanded the concept of value by acknowledging its multi-contextual and dynamic nature, which is depending on the consumers'lifestyles and ecosystems.
Cheung and To (2014)	service industry	quantitative research	This study aims to better the comprehension of customer behavior by examining the factors and mechanisms that influence the relationship between customer involvement and service delivery based on customer-dominant logic.
Anker et al. (2015)		quantitative research	This study presents an examination of the fundamental ontological and semantic underpinnings of consumer dominant value generation in order to ascertain the validity of the argument for a separate Customer-dominant logic.
Cheung and To (2016)	service industry	quantitative research	Customer-dominant logic and customer co-creation should be highlight in service recovery.
Fang et al. (2021)	soical commerce industry	quantitative research	Customer-dominant logic provides a more complete picture of the brand page phenomenon.
Cheung and To (2021)	service industry	quantitative research	This study examined the impact of consumer engagement on co-creation, utilizing the customer-dominant logic framework as a theoretical lens.
Li and Han (2021)	online community	quantitative research	This research utilizes the concept of customer-dominant logic to investigate the factors that influence consumer engagement behaviors within the setting of growing online interest communities.

Similarly, customers claim that they are value creators under the customer-dominated logic; nevertheless, this logic considers customers to be part of an expanded customer environment (Heinonen et al., 2018).

Literature review

ECCI and customer value co-creation from customer-dominant logic. The proliferation of s-commerce has led to a surge in customer interactions, making customer-to-customer interaction (CCI) an essential research area (Nicholls, 2010; Eigenraam et al., 2018). According to Johnson and Grier (2013), CCI pertains to the dynamic process of information exchange between several customers within a service-oriented environment. This concept holds particular relevance in the context of online environments, where individuals have convenient access to digital tools for communication (Morgan-Thomas and Veloutsou, 2013). Accordingly, Nicholls (2008) introduced the term 'eCCI' to refer to its online counterpart. Due to the growing popularity of s-commerce and the importance of social interaction in shaping the consumer experience, further research is required to explore eCCI across different contexts (Ghahtarani et al., 2020). Following this, we define eCCI as the communication that occurs among two or more customers due to their online interactions with s-commerce websites (Zhou et al., 2022). Furthermore, the potential impact of eCCI and the customer value co-created through online interaction should be investigated.

Customer value co-creation has been a crucial factor in explaining customer behavior and potential business goals (McDougall and Levesque, 2000). According to Prahalad and Ramaswamy (2004) and Vargo and Lusch (2008), customer value creation is the process through which businesses and customers jointly generate benefits for both parties. By developing a conceptual framework and establishing a structure for understanding and effectively managing value co-creation, Payne et al. (2008) have made a significant contribution to value co-creation. Their framework encompasses three primary processes: customer value-creation, supplier value-creation, and encounter. The encounter process highlights the importance of reciprocal interactions(Fan et al., 2020).

The present research places customers as the focal point of investigation. It adopts a comprehensive interpretation of C-D

logic, as opposed to the goods-dominant (G-D) (Mele et al., 2014) or service-dominant (S-D) (Vargo and Lusch, 2014) logic approaches utilized by previous studies. According to the G-D and S-D logics, service providers and consumers can only generate value through collaboration (Helkkula et al., 2012). By contrast, C-D logic places the customer at the center of marketing decisions and activities. Customers are seen as partners and co-creators of value through their resource exchange and interactions(Vargo and Lusch, 2008). Similarly, the C-D logic posits that customers are not only value producers but also value creators in an expanded customer environment that encompasses all aspects of their consumer activities, including experiences, emotions, interactions, and personal history (Heinonen et al., 2018). This case compares the company's emphasis on goods-related values and provider-to-customer co-creation of services (Heinonen et al., 2010). Customer value co-creation is recognized as an integral facet of the service paradigm, where the consumer experience is collaboratively shaped by the integration of service elements into customer activities. This is particularly salient in the context of s-commerce services, as offered by service providers through social media platforms or when they incorporate social media technologies into their websites to facilitate the co-creation and delivery of services (Hu et al., 2019).

In the s-commerce context, customers assume a central role when examined through the lens of service consumption and the corresponding experience, elucidating the significance of the service and the service provider within the context and activities of the customers In other words, Customers have the ability to collaboratively generate distinctive experiences by means of eCCI (Zhou et al., 2022). eCCI occupies a pivotal position in the collaborative generation of enduring and distinctive customer experiences and value during the utilization of services and products, exerting consequential effects on customer stickiness.Therefore,it is rational to contemplate C-D logic concepts. and value co-creation to serve as essential frameworks for examining the phenomenon of eCCI and customer value co-creation within the context of s-commerce. Some related research has supported this idea (See Table 1).

This study identifies eCCI as one of the aspects of customer participation that facilitate the entire social commerce development process from the value creation standpoint. Unlike previous

studies that consider eCCI as a fundamental consumer activity facilitating information exchange, this study regards eCCI as a broader involvement of customers in distinct stages of s-commerce advancement. Within this viewpoint, this study uses Zhou et al. (2022) perspective on eCCI, which sees customer behaviors inside and outside the social commerce service sphere as a means of creating customer value. Customers may find meaning in their feelings or expectations around the value-generating process. In this manner, customer value will help to bridge the gap and maintain connections with the s-commerce website, encouraging customers to "stick" around.

Customer value co-creation. Customer value co-creation may give companies a competitive edge and is a key factor in their success. In this co-creation process, through constant communication and interaction, these two subjects create a tailored service experience (Grönroos, 2008). A number of scholars have formulated an innovative viewpoint centered on the customer's standpoint, positing that the creation of customer value is contingent upon the dynamic interplay between customers and enterprises, as well as the relationship between them (Schau et al., 2009). Some consider functional and hedonic values to be two categories of value co-creation. They have broadened the scope of their research to include social media and conducted several empirical studies in this area. Following their research, scholars have established that information (Hajli et al., 2014; Hajli and Lin, 2014) and enjoyment (Zhang et al., 2017; Wu and Li, 2018) are the two most important factors that attract s-commerce users.

Functional value, one of the two aspects of value co-creation, refers to the functional advantages that may solve problems or satisfy customers' needs through the interaction process. Functional value, in particular, stresses the useful and practical components of social media and is mostly associated with obtaining and updating information. Customers may readily compare product prices on s-commerce sites and connect with other customers to find the product information they need, which satisfies their value expectations, such as product knowledge. If customers receive the desired information, it will affect their perceptions of value. In addition, hedonic value focuses more on the emotional benefit. It is related to the non-functional benefits (i.e., self-fulfilling) gained from using s-commerce sites, such as enjoyment and happiness (Van der Heijden, 2004). Some scholars have confirmed that functional value and hedonic value are crucial for motivating user behavior in the s-commerce context (Gan and Wang, 2017). Customer value creation is, therefore, referred to as a second-order formative variable with hedonic and functional components.

Customer stickiness. In the context of s-commerce, the effectiveness of an application is determined by the user's stickiness to the site. Put simply, the primary goal of an s-commerce website is not just appealing to the user to complete a transaction, but rather to foster a sustained and heightened level of user engagement with the site, either by prolonging their visit length or by increasing the frequency of their usage. *Stickiness* is a crucial ability for businesses to attract and keep customers (Zott et al., 2000). The term stickiness was coined to describe a website's capacity to attract customers to remain on the site longer and to enhance their intention to return or reuse the site (Kim et al., 2016). Similarly, on s-commerce websites, the term "customer stickiness" refers to a circumstance that motivates users to stay online for long periods. A conclusive definition of stickiness is the extent of the visit or the frequency of visits.

Kour and Chhabria (2022) advocate for further study into the concept of stickiness, emphasizing that it should not be

equivalent to loyalty. Stickiness has been recognized as a critical precursor to various attitudinal and behavioral consequences, including purchase intention, customer trust, loyalty, and retention (Kumar Roy et al., 2014). It is the measurement of consumer loyalty on online platforms, which rises with interactivity (Kour and Chhabria, 2022). Khalifa et al. (2002) believed that customer stickiness is the behavior of customers' repeated purchase of favorite products and services over a period, which is the premise of customer loyalty. In other words, loyal customers are bound to be sticky customers, and sticky customers are not all loyal customers. Thus, customer stickiness is the premise of customer loyalty, and customer stickiness can promote customer loyalty to products and services, which aims at building a higher level of customer loyalty. According to the previous study, the decision to utilize a website for an extended period depends on usage experience, particularly regarding values received (Zhang et al., 2017). This might be seen as a response from individuals subsequent to their initial adoption, whereby they are driven by distinct motivating factors. Therefore, customer stickiness, which displays customers' ultimate choices following initial adoption, is the response in this research model based on C-D logic.

Self-efficacy. Self-efficacy, a key concept in social cognition theory, influences all facets of behavior, from the formation of new behaviors to the maintenance of established habits (Bandura, 1977). Self-efficacy, the "belief in one's capabilities to organize and execute the courses of action required to produce given attainments," is a situational variable that may be altered or impacted (Bandura, 1977). Bao and Shang (2021) conducted a meta-analysis of self-efficacy. They concluded that the stronger an individual's self-efficacy, the more motivated they are to interact, leading to their continued use of Web 2.0 platforms. Self-efficacy is crucial in social commerce since customers may interact with others (Thakur, 2018). Accordingly, self-efficacy is adopted in this study to predict customer stickiness on s-commerce sites. Self-efficacy is related to an individual's comprehensive evaluations of their capacity to complete a series of purchasing procedures on s-commerce platforms, as opposed to evaluations focused on basic component abilities like completing a membership form or placing an order.

Research model and hypotheses

Using the C-D logic as a foundation, we proposed a research model incorporating eCCI and customer value creation to analyze the stickiness of s-commerce site customers. Based on the given theoretical context, Fig. 1 illustrates the proposed model. To investigate the relationships among the model's several components, hypotheses were constructed and tested.

Electronic customer-to-customer interaction and customer value co-creation. eCCI on s-commerce sites can increase customers' benefits and value. As mentioned, eCCI is the term used to describe how consumers connect and communicate their views, ideas, and feelings. Higher involvement in s-commerce might encourage customers to debate concerns and exchange product information and user experiences (Liang and Turban, 2011). The more often customers discuss products or services with other customers, the more trustworthy their knowledge becomes and the more value they generate. Thus, customers who effectively market items may experience a sense of achievement and acceptability. Additionally, customers who purchase desired products based on user recommendations may experience hedonic benefits. That is, eCCI gives them benefits, including learning, socializing, having fun, and even forming friendships.
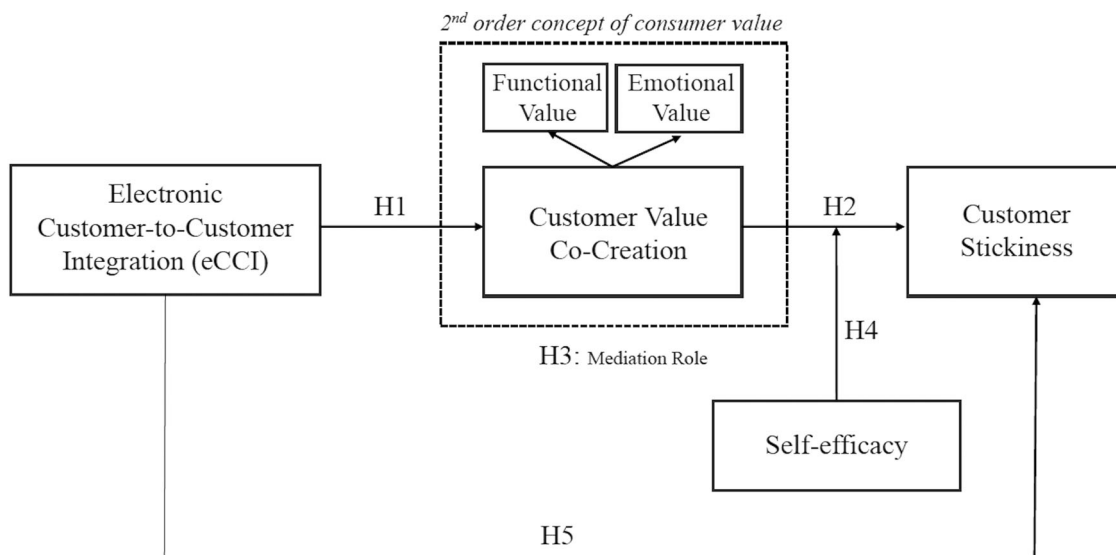
Fig. 1 A description of the relationship between variables in the present study.

The establishment of a closer relationship can help them overcome social and emotional loneliness and enhance their sense of fun, comfort, and pleasure in the process of purchasing (Rosenbaum, 2006).

According to the social network theory, friendship networks are formed by exchanging experiences, engaging in regular interaction, and building trust between people who are similar to one another (Zheng et al., 2017). eCCI, defined as a personal connection, may encourage positive product or service evaluations among customers. (Gremler and Gwinner, 2008); thus, eCCI promotes customer-created functional value. Furthermore, the presence of other customers on s-commerce sites encourages consumers, facilitates the development of friendships, and helps to maintain social ties. All these factors contribute to creating positive satisfaction and pleasure for the customer. Therefore, eCCI on s-commerce sites lets customers spend their time pleasantly and fosters a pleasant atmosphere. Similarly, authors such as Kuo and Feng (2013), Zhang et al. (2017), and Qu et al. (2023) highlight that co-creation is inherently based on interaction between participants. In light of this, the following hypotheses are put forth:

Hypothesis 1. eCCI has a direct and positive influence on customer value co-creation.

Customer value co-creation and customer stickiness. Customer value co-creation is a crucial factor in assessing stickiness(Ming-Sung Cheng et al., 2009; Kang et al., 2014). Customers engage with one another and discuss common issues relevant to society and their daily lives when engaging in s-commerce. (Zhang et al., 2017). In gaining useful information, customers regularly check for additional helpful messages. Customers are increasingly placing a higher priority on the convenience, enjoyment, and sense of self-fulfillment that a product offers. This can be seen as an embodiment of the emotional value of the product (Peng et al., 2019). As a result, high hedonic value levels enhance customers' happiness with s-commerce sites and promote their stickiness. Furthermore, previous studies have evaluated customer value as a factor in determining customer stickiness (Zhang et al., 2017; Liu et al., 2021). The following hypotheses are therefore proposed:

Hypothesis 2. Customer value co-creation has a direct and positive influence on customer stickiness.

Customer value co-creation as the mediator. Moreover, the influence of eCCI on s-commerce sites can be observed in the co-creation of both functional value (information) and hedonic value (emotional experience), which leads to increased customer stickiness to s-commerce sites. Customers with high levels of eCCI can network with one another more quickly and effectively, and they might acquire values such as life knowledge, product knowledge, and usage skills. This decreases the cost of information screening for customers and enhances the quality of their decisions, ultimately contributing to a better experience and increasing the likelihood of repeat visits. Apart from this, individuals interacting on s-commerce sites always play an active role (Bijmolt et al., 2010). Customers with a greater interaction level are more likely to initiate "interesting conversations" by uploading humorous content in vivid languages. This interaction will provide customers with positive emotional experiences, building a positive evaluation of s-commerce sites (Hollebeek, 2011). According to the process, customers are likely to establish a sense of community and identification with one another, and they may do so on s-commerce websites as well (Zhang et al., 2017). Then, the duration and frequency of visits will be maintained consistently (Ming-Sung Cheng et al., 2009). Consequently, eCCI can boost the amount of time and stickiness customers dedicate to s-commerce sites via the efficient techniques of value co-creation. Therefore, the following hypotheses are proposed:

Hypothesis 3. Customer value co-creation has a mediating effect between eCCI and customer stickiness.

Self-efficacy as the moderator. Self-efficacy within the context of s-commerce can be conceptualized as the individual's subjective perception of their own capability or competence to use s-commerce sites for placing orders, interacting with other customers, and dealing with unexpected problems (Zhou et al., 2022). According to Zhou et al. (2022), customers are more inclined to proficiently carry out complex duties when they possess advanced skills in using s-commerce sites. Furthermore, a positive assessment of s-commerce skills could reduce consumers' anxiety about adopting s-commerce services, enhance customer value, and ultimately impact customer revisit and purchase intentions. First-time users of s-commerce sites may encounter

challenges when shopping, but their self-efficacy will likely improve with repeated usage. When customers possess a strong sense of self-efficacy, they are more likely to engage in free browsing on s-commerce platforms (Zhou et al., 2016). This study suggests that self-efficacy is positively associated with increased customer value co-creation and eventually plays a significant role in fostering consumer stickiness on s-commerce platforms.

Furthermore, Chiu et al., (2011) have proposed that increased levels of multi-channel self-efficacy among consumers are associated with a greater likelihood of engaging in cross-channel free-riding behavior.This phenomenon stems from the fact that individuals possessing a heightened sense of multi-channel self-efficacy often perceive themselves as proficient decision-makers in the identification of the most suitable service provider at different junctures throughout the consumption process. Zhou et al. (2016) conducted a study to investigate the moderating influence of self-efficacy on the relationship between the flow experience and purchase intention within the context of online content services. This study proposed that the widespread availability of s-commerce sites contributes to increased effectiveness in s-commerce purchasing. According to Cheung and Lee (2012), Thakur (2018), and Bravo et al. (2020), people who have strong self-efficacy in knowledge sharing, who are assured in their capacity to offer informational value and problem-solving abilities, are likely to have greater intention to continue utilizing s-commerce websites. Conversely, individuals lacking technological competence may not have positive experiences on s-commerce websites, leading to depression and abandonment of the site (Liu-Thompkins, 2012). In summary, when customers have a better level of self-efficacy on s-commerce sites, they are more inclined to engage in information search activities, further creating customer value and seeing the s-commerce platform as appealing. Consequently, the subsequent hypothesis is posited:

Hypothesis 4. Self-efficacy moderates the mediation effect of customer value co-creation between eCCI and customer stickiness.

ECCI and customer stickiness. The concept of eCCI holds significant importance in computer-mediated communications since it is widely seen as a fundamental advantage of this medium (Li et al., 2014). S-commerce is an interactive online platform that facilitates bidirectional communication between users and visitors to the website. Harris and Goode (2010) suggest that interaction has a favorable impact on the online experience of customers. eCCI facilitates real-time two-way communication, assisting site visitors in making informed purchasing decisions. Thus, the present study conceptualizes eCCI as interactive communication facilitating and stimulating visitors' engagement. The s-commerce platform that promotes eCCI is widely regarded as being beneficial and highly responsive in catering to the distinct requirements of customers. According to Li et al. (2014), positive experiences with s-commerce websites can enhance customer engagement, increasing website usage and stickiness. Additionally, prior studies have indicated a clear positive correlation between customer involvement and user retention on s-commerce platforms (Zhang et al., 2017). Consequently, the subsequent hypothesis is proposed.

Hypothesis 5. eCCI has a direct and positive influence on customer stickiness.

Data and methodology

Measures. All the items in the proposed model were conducted using a Likert scale of 1 to 5, where 1 indicated strong disagreement, and 5 indicated strong agreement. The measurement of eCCI was based on five items, as suggested by Wu and Fang (2010) and Alden et al. (2016). The measurement of functional value is based on the research of Voss et al. (2003). The measurement of hedonic value refers to the study of Babin et al. (2007) and Kuo and Feng (2013), assessing this using seven items. After reviewing the work of McKee et al. (2006), the self-efficacy measure was created. We also used the adaptations of Lin (2007) and Hsu and Lin (2016) to measure customer stickiness with six items.

Our questionnaire has five components, the measuring of which is based on prior research, with slight modifications to meet our study's setting. In this study, the accuracy of all items originally written in English was ensured using the forward-backward translation method. Specifically, each item was translated into Chinese and then back into English. To establish consistency between the two versions, a team comprising two professors and five graduate students was involved. As a result of their comments and recommendations, the measuring items have been adjusted slightly.

Research setting and participants. China's s-commerce websites are the primary subject of this study. In particular, Dou yin.com (TikTok in English) and Wechat.com are regarded as the most popular s-commerce sites in China under this research. TikTok is a Chinese social networking platform that enables users to share videos and has quickly become a phenomenon worldwide. WeChat.com has emerged as the most extensively adopted social media platform in China, with an estimated 1.2 billion active users across the world and over 100 million installations beyond China. There are two reasons why we decided to include various websites in our study. First, these e-commerce websites give comparable services and customer interaction features, like enabling commenting, sharing, and customer communication, as well as giving shopping advice. They should all be considered. To enhance the comprehension of s-commerce sites, future research should incorporate data collection pertaining to the users of diverse sites, as suggested by Sarker et al. (2019). Furthermore, it is challenging to assess the impact of customer responses on one platform on their interactions on other platforms. As a result, the study's inclusion criteria specify that only individuals aged 18 years or above who have previously encountered eCCI on the websites mentioned above may participate.

Between August and September 2022 in China, a web-based survey was carried out to gather empirical data. On WeChat and TikTok, two s-commerce platforms, we chose users who had interacted with other users. To evaluate the eligibility of potential respondents, the survey included a pre-screening question asking respondents about s-commerce customer interactions. Only individuals who claimed to have experience with CCI were invited to complete the survey. Wenjuanxing website(like Qualtrics or Survey Monkey), which provides a professional data collection service, distributed the questionnaire. First, 50 customers who have interacted with others via s-commerce sites were chosen to determine the questionnaire's readability and to modify its language. The questionnaire was completed in person by 35 respondents, while the others completed it online. Additionally, 26 individuals had interacted with other consumers on TikTok, while 24 participants had done so on WeChat. Second, 280 customers participated in the final investigation. Forty-two answers were removed because they needed more detail. Thus, 238 valid questionnaires were received.

Table 2 presents the demographic information for respondents. Of the 238 respondents, 55.9% were male and 44.1% were female. Most responders were between the ages of 18 and 27 ($n = 104$, 44.1%). The largest respondents were business employees ($n = 98$,

Table 2 Demographics of the sample.

Gender	(%)	Sites	(%)	Age	(%)	Education	(%)
Male	55.9	Wechat	59.7	18–27	44.1	PHD	2.1
Female	44.1	Dou Yin	40.3	28–37	36.6	Master	9.7
				>38	19.3	Bachelor	47.1
						Junior college	38.7
						High School	2.1
						Junior secondary and below	0.4
Time of participation	(%)	Time of participation per day	(%)	Work status	(%)	Incomes (per year)	(%)
<6 month	18.5	< 30 min	12.2	Student	35.3	<10,000RMB	32.8
6month–1year	11.8	30 min–1 h	25.2	Employed	41.2	10,000–29,999 RMB	8.4
1–2years	8.8	1–2 h	24.8	Self-employed	18.9	30,000–59,999 RMB	11.3
3–4years	24.8	2–4 h	14.3	Unemployed	4.6	60,000–109,999 RMB	30.7
>4 years	36.1	>4 h	23.5			110,000–159,999 RMB	13.0
						>160,000	3.8

41.2%), followed by students ($n = 84$, 35.3%). Regarding user experience, 36 percent of respondents had more than four years of s-commerce site usage, while 25.2% frequent s-commerce sites for 30 min to 1 h daily.

Data analysis. The present study adopted a dual methodology approach of structural equation modeling (SEM) and smart partial least squares (PLS) to examine the interrelationships between multiple dependent and independent variables (Hair et al., 2006). The methodological innovations in Smart PLS, according to Hair et al. (2013), enable researchers to model relationships with greater flexibility, providing a more thorough understanding of theoretical concepts. Moreover, PLS permitted us to utilize Anderson and Gerbing's (1988) two-step technique for SEM analysis. In the initial analysis stage, the measurement model was formulated, considering the associations between the latent (unobserved) and indicator (observed) constructs. In the subsequent step, the structural model was established to examine the proposed hypotheses, establishing a link between the dependent and independent variables. Further, PLS could be applied in reflective, formative, and higher-order models (Hair et al., 2014). In doing so, we echo Nysveen and Pedersen's (2014) suggestion to conceptualize value creation as a higher-order variable composed of two first-order variables. Using the SmartPLS 4.0 software, we examined the measurement and the structural model. With 238 examples and 5000 sub-samples, the non-parametric bootstrapping technique was evaluated (Hair et al., 2014).

NCA is a theory development tool that employs necessity logic, which was used to complement PLS-SEM, a methodology that utilizes sufficiency logic for hypothesis testing (Dul et al., 2020; He and Ismail, 2023). The value that NCA contributes to data analysis is in its ability to provide a more sophisticated comprehension of evaluating necessary conditions, which might differ in terms of both their kind and degree (Dul, 2016).The study of Richter et al. (2020) highlights that PLS-SEM and NCA provide researchers with the ability to investigate and confirm hypotheses using sufficiency logic, as well as hypotheses based on necessity logic.Thus, in this study, the PLS-SEM approach is employed to determine the factors that significantly contribute to customer value co-creation and customer stickiness. Subsequently, the NCA method is utilized to discover the crucial factors that lead to the achievement of customer value co-creation and customer stickiness.

Results
Since all data in the study were obtained from self-reported questionnaires from a single source, the findings may be susceptible to common method variance (CMV). To confirm the quality of the data, an examination of non-response bias was conducted. Furthermore, to mitigate this potential bias, various techniques have been implemented. Specifically, a two-stage PLS methodology was employed, consisting of a measurement model and a structural model (Hair et al., 2014). The measurement model was designed to include both first-order and higher-order constructs, with reflective measures such as eCCI, customer stickiness, functional value, hedonic value, and self-efficacy being represented as first-order constructs and customer value creation being second-order constructs.

Common method variance. The presence of CMV raises doubts about the reliability of most of the findings. To determine the prevalence of CMV, following the procedure mentioned by Liang et al. (2007), we applied a common method factor to the structural model in the PLS. The findings showed no statistically significant indicator loadings on the common method factor. The variance of the indicators defined by the relevant construct of interest demonstrated an average variation of 66.7%, while the variance attributed to the employment of the average method was found to be 0.9%. This resulted in a ratio of 74:1 between the variance accounted for by the two methods. Thus, the current study can safely conclude that there are no significant concerns regarding the presence of CMV in the obtained data. In addition, a full collinearity test was conducted using the variance inflation factor (VIF) in SmartPLS 3.0, and the VIF values were between 1.343 and 2.921 below the recommended threshold of 3.3 (Kock, 2015) (See Table 3). Both results indicated that there was no evidence of CMV in this investigation.

Non-response bias test. Non-response bias is a form of bias that occurs due to differences between individuals who provide responses and those who do not (Berg, 2005). Conducting a non-response bias test is significant since non-response from other participants results in a reduction of the sample size, which in turn has a detrimental effect on the ability to draw accurate findings (Studer et al., 2013).To assess potential non-response bias in this study, the extrapolation approach was utilized. Armstrong and Overton (1977) argue that the extrapolation method is highly recommended for evaluating non-response bias in cross-sectional research. A t-test was conducted using SPSS to compare the mean values of the first 100 respondents with those of the last 100. The results indicated no statistically significant difference ($p < 0.05$) in the mean values between the two subgroups, namely the first 100 respondents and the last 100

Table 3 Measurement model assessment.

Scale items	Loading*	VIF
Electronic customer-to-customer interaction(eCCI) (Alpha = 0.906; CR = 0.930; AVE = 0.727)		
I exchanged a lot of information with other customers when interacting with other customers.	0.840	2.282
I spent a lot of time interacting with other customers about the products, consumption, services of this social commerce site and other related issues.	0.816	2.275
I had an in-depth discussion with other customers when interacting with other customers.	0.853	2.299
Interaction with other customers enabled me to exchange ideas about products, consumption and services of this social commerce site.	0.877	2.840
I have a high degree of participation when interacting with other customers.	0.875	2.769
Customer stickiness (CS) (Alpha = 0.928; CR = 0.944; AVE = 0.736)		
I would stay a longer time on this platform than other platforms.	0.871	2.921
I intend to prolong my stay on this platform.	0.830	2.333
I would visit this platform as often as I can.	0.860	2.801
I intend to link to this platform every time I am online.	0.858	2.774
I spend more money on this platform than on other comparable websites.	0.867	2.817
I use this platform every time I am online.	0.862	2.842
Functional Value (Alpha = 0.855; CR = 0.896; AVE = 0.633)		
Interaction with the other customers through this site is effective.	0.795	1.875
Interaction with the other customers through this site is helpful.	0.770	1.702
Interaction with the other customers through this site is functional.	0.830	2.067
Interaction with the other customers through this site is necessary.	0.803	1.882
Interaction with the other customers through this site is practical.	0.780	1.765
Hedonic Value (Alpha = 0.884; CR = 0.910; AVE = 0.590)		
Interaction with the other customers, I feel pleased and relaxed.	0.790	2.037
Interaction with the other customers, I gain joy and happiness.	0.768	2.016
Interaction with the other customers, I feel inspired.	0.794	2.237
I think it's interesting to interact with the other customers.	0.746	1.772
Interaction with the other customers is more joyful than other things I do.	0.735	1.860
I was immersed in the exciting issues that I interact with the other customers.	0.752	1.871
Interaction with the other customers, I can forget annoying things.	0.792	2.098
Self-efficacy (Alpha = 0.744; CR = 0.838; AVE = 0.564)		
When interacting the other customers, I feel comfortable dealing with interaction issues.	0.712	1.343
I know how to deal with the other customers on the social commerce site.	0.730	1.486
I know how to use the services of social e-commerce platform when I interact with the other customers.	0.813	1.484
I feel like I fit in with the other customers when I interactive with him/her.	0.745	1.419

Significant at *t > 3.29 at p < 0.001.
AVE Average variance extracted, *CR* Composite reliability.

respondents. The findings of this investigation confirm that non-response bias does not pose a significant concern.

PLS-SEM result
Measurement model
Measurement model stage one: analysis of reflective measurements: The initial step in the PLS path modeling approach involves comprehensively examining the measurement model. The primary purpose of this analysis is to establish the construct validity and reliability of the model. To assess the reliability and construct validity of the model, the study employed several measures, including item loadings, average variance extracted (AVE), composite reliability (CR), and Cronbach's alpha (α) values (Kaya et al., 2020).

A convergent validity test was performed at the start of the investigation. The loadings of items, the AVE, and the composite reliability (CR) were analyzed critically in this study. Table 3 demonstrates the results. The CR value ranged between 0.896 and 0.944, consistent with the value provided by Hair et al. (2014). Furthermore, the constructs examined in this study had satisfactory convergent validity, as indicated by the AVE values ranging between 0.564 and 0.736 and factor loadings greater than 0.6 for each variable (Fornell and Larcker, 1981).

After completing the convergent validity test, the discriminant validity test was performed. As indicated by the literature, Fornell

and Larcker (1981) and heterotrain-to-monotrain (HTMT) utilized this test. However, other scholars have challenged the Fornell-Larcker criterion, claiming that it is unjustified to discover the absence of discriminant validity in broad research scopes (Henseler et al., 2015). As shown in Table 4, the root mean square AVE of all the constructs was greater than the intercorrelations between the model's latent constructs, indicating that the constructs had sufficient discriminant validity (Fornell and Larcker, 1981). The HTMT ratio was then evaluated. Table 5 demonstrates that all variables are less than 0.85, validating the discriminant validity (Chen et al., 2022).In conclusion, the test results indicate that this survey has acceptable discriminant validity.

Measurement model stage two: analysis of customer value creation higher-order measurement: To evaluate our customer value creation constructions, we ran three tests and ensured that our second-order construct was represented by two first-order sub-scales (Maxwell-Stuart et al., 2018; Curran and Taheri, 2021). To establish that customer value creation is a second-order construct, we first employed principal component analysis with an oblique rotation. Under the two factors, the findings reveal that all item loading is above the minimum level (≥0.5). Second, we checked the CR, Cronbach's alpha, and AVE values for first-order constructs (i.e., functional and hedonic values). The values of CR, Cronbach's alpha, and AVE were all

Table 4 Descriptive statistics and discriminant validity analysis.

	(1)	(2)	(3)	(4)	(5)	(6)
Customer stickiness (1)	**0.858**					
Customer value co-creation (2)	0.733	**n/a**				
Electronic customer-to-customer interaction (3)	0.561	0.414	**0.852**			
Functional value (4)	0.666	0.831	0.304	**0.796**		
Hedonic value (5)	0.540	0.815	0.380	0.354	**0.768**	
Self-efficacy (6)	0.426	0.351	0.590	0.281	0.298	**0.751**

AVE value for customer co-creation value is absent as customer co-creation value was specified as a higher order model; the values in bold on the diagonal indicate the square root of AVE, whereas the other entries indicate the correlations. n/a = not applicable.

Table 5 Heterotrain-to-Monotrain (HTMT)ratio.

Latent Variables	1	2	3	4	5
1 Customer Stickiness					
2 eCCI	0.604				
3 Functional Value	0.744	0.341			
4 Hedonic Value	0.592	0.419	0.402		
5 Self-Efficacy	0.500	0.708	0.339	0.354	

more than the required thresholds (see Table 3). Finally, we estimated the hierarchal component models (HCMs) in PLS using the repeated measures approach (Becker et al., 2012). Using the manifest variables, we followed HCMs steps: (1) For first-order constructs, we assigned items reflectively to their respective first-order constructs, including five items for functional value and seven items for hedonic value; (2) For second-order constructs (twelve items), we assigned all items to the customer value creation construct. We discovered substantial relationships between the customer value co-creation construct and underlying variables, including such functional value (0.831; $t = 44.905$) and hedonic value (0.815; $t = 33.027$). The R^2 for each underlying component was greater than 0.5 (i.e., $R^2_{\text{functional value}} = 0.690$ and $R^2_{\text{hedonic value}} = 0.663$), indicating that customer value co-creation constructs account for greater than 50% of the variation in each single-order factor (Hair et al., 2014). Customer value co-creation is thus a second-order construct reflectively represented by two first-order dimensions.

Structural model. We conducted a goodness-of-fit (GoF) test after validating the measurement model utilizing Wetzels et al. (2009) techniques. The overall GoF value is 0.760, indicating an extremely strong model fit. Second, we assessed the effect size (f^2) and predictive relevance (Q^2) (Hair et al., 2018; Luxton et al., 2017). According to Khalilzadeh and Tasci (2017), the recommended effect sizes (f^2) for SEM are 0.01 for small effects, 0.06 for medium effects, and 0.14 for large effects. The effect sizes in Table 6 are for the significant paths in the inner model. Consequently, most direct paths have large impact sizes for direct relationships. Also, Q^2 shows the effectiveness of the model and PLS-SEM parameters based on the blindfolding technique for empirical data reconstruction. The value for Q^2 should be higher than zero. The predictive relevance of Q^2 for endogenous variables in our study is satisfactory.

Third, we measured the goodness of the structural model using the R^2 of our endogenous variables. The R^2 value, as recommended by Ramayah et al. (2016), measures the structural model's goodness. Similarly, according to Hair et al. (2011), the R^2 statistic can be used to estimate the coefficient of determination and the significance level of path coefficients. Following the

result from PLS, the R^2 values are 0.171 for customer value creation and 0.628 for customer stickiness. The model explains 17.1% of customer value creation and 62.8% of customer stickiness.

Fourth, we utilize a non-parametric bootstrapping procedure with 5000 subsamples to determine the significance of the path coefficients corresponding to hypotheses H1 to H2(Hair et al., 2014). According to the results, as shown in Table 6, all the hypotheses are empirically supported by the analysis findings. The impact of eCCI on customer value creation is positive and significant (H1: $\beta = 0.414$, $p < 0.001$). Customer value creation has a positive impact on customer stickiness (H2: $\beta = 0.587$, $p < 0.001$). The impact of eCCI on customer stickiness is positive and significant (H5: $\beta = 0.305$, $p < 0.001$).

In further analysis, the bootstrapping method was used to conduct mediation analyses, as recommended by Walsh et al. (2015) and Williams and MacKinnon (2008). The 95% confidence interval bias-corrected (CIBC) parameter estimations was calculated using 5000 times re-sampling. This approach demonstrates that when there is a significant direct influence between two constructs, partial mediation occurs. If, on the other hand, the direct influence of the two constructs is not significant, the results indicate full mediation. According to our research, eCCI indirectly affects customer stickiness by generating value creation (i.e., CIBC: 0.175–0.318; the indirect effect is 0.243, t-value = 6.624). Thus, H3 is supported.

To confirm H4, we also assessed the moderating effect of self-efficacy on the indirect relationship of eCCI on customer stickiness through customer value creation. To evaluate the effect of moderated mediation, the bootstrapping technique with 5000 re-samples using Hayes's (2013) PROCESS macro for SPSS with Model 14 was used. The conditional indirect influence of the CV x SE unit on customer stickiness is shown in Table 7 and is significant ($\beta = 0.142$, $p < 0.001$, $R^2 = 0.792$, $\triangle R^2 = 0.628$). That is, the relationship between customer value creation and eCCI was found to be moderated by self-efficacy. Also, the moderated mediation parameters ($\beta = 0.045$, 95% CI [0.011, 0.090]) supported H4, which postulated that self-efficacy would be required for the indirect effect of eCCI on customer stickiness through customer value creation. This outcome validated the presence of a moderated mediation. However, customer value creation was a significant mediator between eCCI and customer stickiness only when the self-efficacy level was one standard deviation less than the mean, 95% CI [0.472, 0.787] or when it was equal to the mean, 95% CI [0.635, 0.857]. When self-efficacy was one standard deviation above the mean, customer value creation was a mediator between eCCI and customer stickiness, 95% CI [0.724, 1.000]. Therefore, hypothesis 4 was supported.

NCA result. In this study, a post-hoc NCA was performed to examine the necessary effects of eCCI on customer value co-

Table 6 Estimates of paths.

Relationship	Path coefficient	Std error	t value	Confidence intervals bias corrected	f^2	Decision
H1: eCCI → customer value creation	0.414	0.059	7.007	[0.300,0.529]	0.206	Supported
H2: Customer value creation → customer stickiness	0.587	0.046	12.673	[0.492,0.670]	0.741	Supported
H3: eCCI → customer value creation → customer stickiness	0.243	0.037	6.624	[0.175,0.318]	_	Supported
H5: eCCI→customer stickiness	0.305	0.049	6.201	[0.207,0.400]	0.196	Supported

t-Values for the item loading to two-tailed test: $t > 1.96$ at $p < 0.05$, $t > 2.57$ at $p < 0.01$, $t > 3.29$ at $p < 0.001$.

Table 7 Testing the moderated meditation effect of customer value creation and customer stickiness.

Outcome variables	Parametric estimation				95%Bootstraping	
	β	SE	t	p	LLCI	ULCI
Y = CV						
Constant	−1.078	0.166	−6.502	0.000	−1.405	−0.751
X = eCCI	0.317	0.046	6.871	0.000	0.226	0.408
R^2	0.408					
Y = CS						
Constant	2.247	0.177	12.729	0.000	1.899 2.5942	2.5942.5942
X = eCCI	0.264	0.050	5.257	0.000	0.165	0.363
Mediator = CV	0.746	0.056	13.254	0.000	0.635	0.857
Moderator = SE	0.108	0.071	1.528	0.128	−0.031	0.247
Int_1 = CV x SE	0.142	0.061	2.339	0.020	0.022	0.262
R^2	0.792					
$\triangle R^2$	0.628					
Conditional indirect effects of SE	Effect	Boot SE	LLCI	ULCI		
−1SD (−0.8190)	0.629	0.0800	0.472	0.787		
M (0.000)	0.746	0.056	0.635	0.857		
+1 SD (0.8190)	0.862	0.070	0.724	1.000		
Index of moderated mediation	Index	Boot SE	Boot LLCI	Boot ULCI		
X = eCCI	0.045	0.020	0.011	0.090		
Mediator = CV						
Moderator = SE						
Y = CS						

Model = 14, Bootstrapping samples = 5000.
β unstandardized regression coefficient, SE standard error, LLCI lower limit confidence intervals, ULCI upper limit confidence intervals, SE Self-efficacy, CV customer value creation, eCCI electronic customer-to-customer interaction, CS customer stickiness, SD standard deviation, M Mean.

Table 8 NCA effect sizes.

Construct	Customer Value Creation		Customer Stickiness	
	d	p-value	d	p-value
eCCI	0.095	0.000		
Customer Value Creation			0.297	0.000

creation and the necessary effects of customer value co-creation on customer stickiness (Dul et al., 2020). The latent variable scores generated by the PLS algorithm for all constructs were utilized as inputs in SmartPls 4.0, and a recommended random sample size of 10,000 was employed to test the statistical significance of the effect sizes (d) of the latent variable scores (Dul et al., 2020). The relationships between the constructs were analyzed using the ceiling envelopment-free disposal hull (CE-FDH) line, which is a nondecreasing step-wise linear line that indicates the level of X needed to achieve a desired level of Y

(Richter et al., 2020). The comprehensive NCA analysis results are shown in Table 8. The findings indicated that eCCI was a meaningful ($d \geq 0$) and significant ($p < 0.001$) a necessary condition for customer value co-creation (Richter et al., 2020). Furthermore, customer value co-creation had a necessary effect on customer stickiness. To gain more insight, bottleneck analysis was conducted, and the results are presented in Table 9. The scatter plots for all relevant relationships can be found in Figs. 2 and 3. To achieve customer value co-creation at over 80%, eCCI must not be less than 5.462%. Furthermore, to attain an 80% level of customer stickiness, customer value co-creation should not fall below 42.857%.

Discussion

From an eCCI and customer value creation standpoint, this study provides the first effort to assess the factors influencing customers' tendency to "stick" on social commerce sites. The development and empirical examination of a research model using PLS-SEM and NCA. The outcomes give sufficient evidence to validate the stated assumptions and the underlying model. This

research contributes to the field of social commerce marketing by emphasizing key results in the Chinese context.

First, our study validates the eCCI-customer stickiness framework in the s-commerce context. This conclusion aligns with another study demonstrating a statistically significant positive association between eCCI and customer stickiness (Liu et al., 2021; Qu et al., 2023). The research conducted by Nandi et al. (2021) does not support this proposition. They contend that users are unlikely to stick on an s-commerce site based on its "mere" interactivity. However, with the popularity and rapid development of s-commerce, the innovation of diversified s-commerce marketing and website functions are also attracting customers. This paper expanded the applicability of customer logic to the field of social commerce by investigating the effect of eCCI on customer stickiness.

Secondly, eCCI has a direct and significant effect on the creation of customer value. eCCI can facilitate the co-creation of functional and hedonic consumer values. This result is consistent with prior studies (Zhang et al., 2017; Nandi et al., 2021). This

research supports Vivek's (2009) theory that a single variable, engagement, may influence customer value (functional and hedonic values). Prior literature has indicated that interaction between individuals is one of the interactive characteristics of s-commerce sites (Wei et al., 2015). As most s-commerce sites employ social aspects to create a feeling of community, our results partially coincide with those of Liu et al. (2021) in that eCCI is an environmental factor that impacts consumer value when engaging on s-commerce sites. This study extends previous research on s-commerce, which has primarily focused on technology concerns, and provides a conceptual framework for evaluating certain customer characteristics on s-commerce platforms.

Third, customer value co-co-creation demonstrates a positive correlation with customer stickiness. This result is consistent with prior studies(Chen and Shen, 2015; Qu et al., 2023). For example, Chen and Shen (2015) analyzed a variety of factors, including shopping values, and concluded that they have a positive impact on website user stickiness. However, the negative results of customer value co-creation, which have been a concern by previous researchers due to discontent (e.g., Zhang et al., 2017), reveal that customers can also benefit from the trend of customer value co-creation. It is not a new phenomenon that creating consumer value on an s-commerce site increases customer stickiness. As a director of consumer value co-creation, scholars have discovered that value identification can be a motivating factor in the s-commerce setting (Liu et al., 2021). It increases customers' functional value (information exchange) and hedonic value (enjoyment), contributing to their continuance behaviors. During the usage process of an s-commerce website, the greater the level of customer value co-creation, the greater the perception of the user's usage experience on the website. It can be regarded as a feeling that they have the same opportunities to improve their experience as others, and hence, are willing to continue using s-commerce sites.

Forth, self-efficacy contributes uniquely to forecasting the customer stickiness of s-commerce websites, and adding it to C-D logic increases its explanatory strength in this particular setting. More importantly, the findings indicated that customer value co-creation was a significant mediator between eCCI and customer

Table 9 Bottleneck.

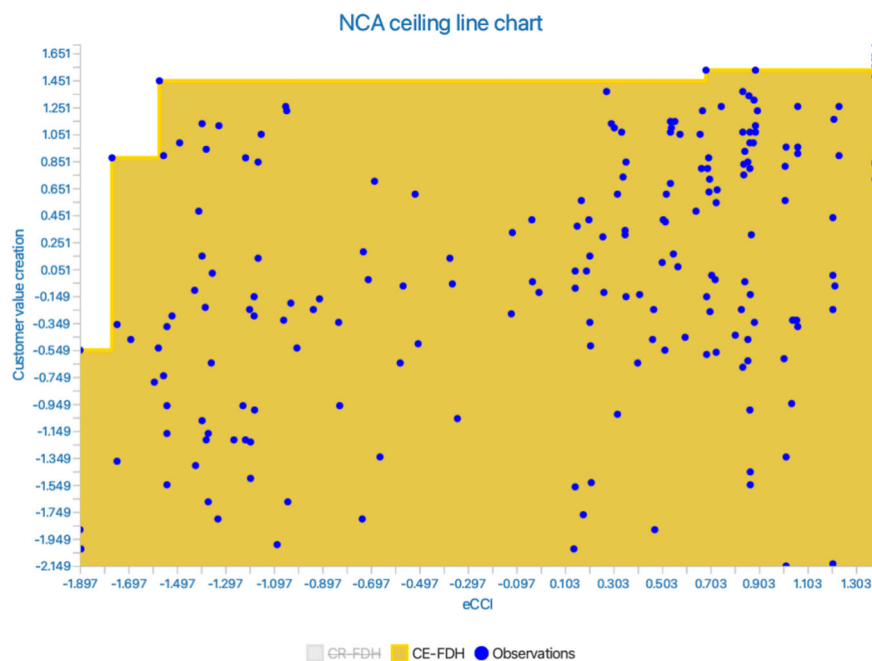| (a)Bottleneck (in percentages) for customer value creation		(b)Bottleneck (in percentages) for customer value creation	
Customer value creation	eCCI	Customer stickiness	Customer value creation
0	0.000	0	0.000
10	0.000	10	0.000
20	0.000	20	5.042
30	0.000	30	11.345
40	0.000	40	17.647
50	2.101	50	17.647
60	2.101	60	18.067
70	2.101	70	18.067
80	5.462	80	42.857
90	5.462	90	66.807
100	95.798	100	88.655

Fig. 2 A description of the scatterplot for the predictor variable between eCCI and customer value co-creation.
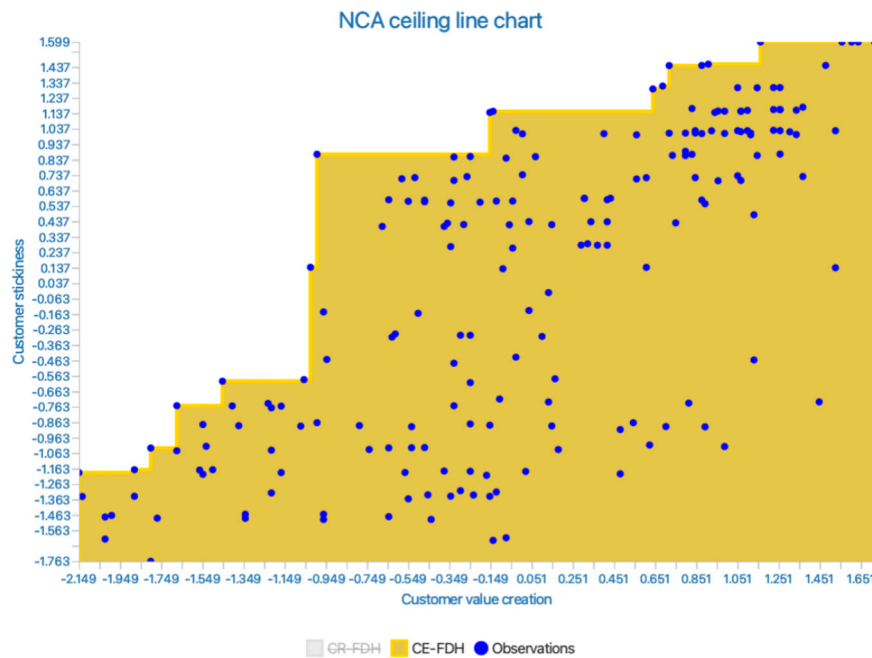
Fig. 3 A description of the scatterplot for the predictor variable between customer value co-creation and customer stickiness.

stickiness, and self-efficacy was a significant moderator of the mediation effect. Particularly, while deciding whether to be "stuck" on an s-commerce site, customers with high self-efficacy give value co-creation higher than customers with low self-efficacy.

Last,this study successfully broadens the scope of the method's application. While there are numerous papers that utilize PLS-SEM for analysis, PLS-SEM is still a relatively new method in the field of s-commerce marketing. On the other hand, the application of NCA in the s-commerce marketing field, particularly in investigating the factors that influence customer value co-creation and customer stickiness from a customer-to-customer perspective, has not been extensively explored. This study utilizes a combination of PLS-SEM and NCA to investigate the impact of eCCI on customer value co-creation and customer stickiness. Hence, the last contribution of this research work is to integrate PLS-SEM and NCA methodologies in the domain of consumer stickiness, specifically pinpointing the components that possess "must" features. The findings can assist policymakers and business executives in formulating more logical strategies and approaches.

Contributions and implications
Theoretical implications. The aforementioned empirical results have several theoretical implications. First, the current study reveals the mechanism underlying customers stickiness to use s-commerce sites and offers more support for the C-D logic. To investigate the process influencing customer stickiness, the relationships between eCCI and customer value co-creation have been investigated. The current paper adds eCCI as one of the most significant components in the s-commerce sector to the literature, whereas the existing studies neglected eCCI.Moreover, it enhances the technology acceptance model's research context, which was first created to explain why utilitarian systems were accepted and largely concentrated on perceived usefulness and ease of use (Davis, 1989; Wang and Goh, 2017). This study included the C-D logic to the original technology acceptance model in that interactive elements for s-commerce site users can trigger their value co-creation and behavior response to better

reveal individual factors in long-term s-commerce site acceptance. It offers a new angle for future research on users' post-adoption intentions and behaviors, particularly regarding stickiness.

Second, this study contributes to the understanding of the relationship between customer value co-creation and customer stickiness and introduces a novel explanation for the varying impacts of consumer-created value. In addition, our findings further confirm the existence of customer value co-creation in the usage process of an s-commerce website, including both functional and hedonic value. This research suggests that the stickiness of s-commerce websites mostly depends on individual-related characteristics. Moreover, this study investigated the co-creation of customer value and confirmed that customer value plays a significant role not only in an offline environment (An and Han, 2020) but also in an e-service context.

Practical implications. Our study findings give fresh insights into s-commerce websites and highlight several applicable strategies for practitioners. ECCI encourages users' long-term engagement with a specific social commerce platform (Qu et al., 2023). Moreover, diversifying forms of eCCI helps improve customer value. Multiple channels of communication expand the ability of users to express their emotions. Current interaction channels rely primarily on text or images, making it difficult for users to communicate deeply. Consequently, more innovative technologies, such as Virtual Reality, can be implemented in online interactions to improve the purchasing experience for users.

Second, placing greater emphasis on customer value co-creation, particularly functional value and hedonic value, is a crucial factor for s-commerce sites to attract customers (Qu et al., 2023). In the current era of socialized media, businesses must furnish substantial, pertinent, and beneficial information (i.e., functional value) on the internet, along with an enjoyable, interactive experience (i.e., hedonic value). This aligns with the view that providing functional and hedonic values enhances customer satisfaction and loyalty, thereby promoting business performance(Qu et al., 2023).

Third, developers of s-commerce may incorporate instruction provision and self-efficacy design to improve customer stickiness on s-commerce sites. The moderating effect of self-efficacy highlights the significance of incorporating appropriate elements into an s-commerce website to satisfy the various demands of users with varying degrees of self-efficacy. To specifically appeal to those with low self-efficacy, s-commerce developers may focus a higher emphasis on creating and optimizing important features that are directly tied to the functional value and hedonic value of consumers. In contrast, to attract people with high self-efficacy, s-commerce developers may update current interfaces and features to make them more user-friendly and add elements that make use more interesting, such as gamification features (Payne et al. 2015).

Limitations and future research. There are certain limitations to this study that should be kept in mind. First, data from Chinese customers are used. Further research may investigate and validate the results in different regions because the results differ in other nations. Second, researchers may broaden the model to incorporate additional factors like customer retention and repurchase intention. Researchers may also examine the moderating role that gender plays in the relationships, given the gender-based differences that are evident in the values of the model variables. The final limitation of this study is that variables were evaluated just once. In order to reinforce our findings, future studies should incorporate cross-lagged analysis and longitudinal data to predict the stickiness of s-commerce site users over time.

Data availability

In consideration of privacy and ethical considerations pertaining to the study participants, the data collected during the study cannot be publicly disclosed. For access to the dataset, interested parties are kindly requested to contact the corresponding author.

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Author contributions

The authors confirm their contribution to the paper as follows: YZ: conceptualization, tudy design, data collection, methodology, analysis and interpretation of results,writing original draft. SK: conceptualization, methodology, formal analysis, review and editing.FF:analysis and interpretation of results, language service.All authors reviewed the results and approved the final version of the manuscript.

Competing interests

The authors declare no competing interests.

Ethical approval

The study was conducted according to the guidelines of the Declaration of Helsinki. We collected primary data, including a written questionnaire, with the participant's permission, in accordance with the ethical principles governing the use of human participants for research purposes, and all research was conducted in accordance with applicable regulations. The author sought and got ethical approval from the Research Ethics Committee of a famous university.

Informed consent

Prior to the commencement of the study, informed consent was obtained from all participants, ensuring their voluntary participation and comprehension of the study's purpose, objectives, and data utilization methods. The participants were provided with detailed information regarding the nature and objectives of the study, and they voluntarily agreed to participate without any coercion or undue influence.

Additional information

Correspondence and requests for materials should be addressed to Sameer Kumar.

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