Understanding the Omnichannel Customer Journey: The Effect of Online and Offline Channel Interactivity on Consumer Value Co-creation Behavior

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Abstract: Building on the service dominant logic, this study explores the effect of online and offline channel interactivity on consumers' value co-creation behavior (VCB), the mediating effect of brand involvement, and the moderating effect of cross-channel consistency (CCC). We surveyed 387 customers who engage in omnichannel shopping. The relationship between online and offline channel interactivity and VCB was positive and partially mediated by brand involvement. The interaction effect of online channel interactivity (ONI) and offline channel interactivity (OFI) had a negative effect on brand involvement when CCC was low but a non-significant positive effect when CCC was high. These findings enrich the theoretical understanding of value co-creation and provide insights into omnichannel management.

Keywords: channel interactivity; brand involvement; value co-creation behavior; cross-channel consistency.

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1. Introduction

Interactions between businesses and consumers via different channels have attracted the increasing attention of researchers and practitioners. The internet and new digital technologies have brought about novel possibilities for firms, allowing them to interact with customers through online channels such as websites, social media, and mobile applications in addition to traditional offline channels (Gao and Huang, 2021). According to a survey conducted by Nandu (2018), 86.3% of brick-and-mortar retailers have deployed online channels, and more than 60% have four or more different online channels. Given that consumers prefer to use both online and offline channels when shopping, many retailers now use an omnichannel strategy that integrates both online and offline channels to improve customer satisfaction and increase value (Shopgate, 2019). With the rise in omnichannel strategies, consumers can now access product details and read online reviews before making a purchase in a brick-and-mortar store or experience offline after-sales and delivery services after purchasing a product online in an omnichannel journey (Bell et al., 2014). This means that firms, particularly retailers, have more opportunities to interact with customers to co-create value. However, little is known about how retailers utilize online and offline channels to promote consumer value co-creation behavior (VCB).

Prior research based on service-dominant logic (SDL) has demonstrated that consumers are co-creators of value, and effective customer–firm interactions are a prerequisite for value co-creation (Prahalad and Ramaswamy, 2004; Vargo and Lusch, 2008). According to SDL, value co-creation is also key to improving firm performance (Cossío-Silva et al., 2016; See-To et al., 2014; Tueanrat et al., 2021a). Prior research on the omnichannel customer journey has mainly focused on interaction choice (Barwitz and Maas, 2018), customer experience and satisfaction (Alexander and Kent, 2020; Tueanrat

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et al., 2021a), multichannel behaviors, and channel preferences (Nguyen et al., 2022). However, given that it is an important dimension of the consumer journey, VCB needs more attention (Tueanrat et al., 2021b). The existing literature suggests that firm–customer interactions via a single channel plays an important role in value co-creation (Shen et al., 2020; Zhang et al., 2018). However, the effect of these interactions on consumers' VCB in the omnichannel context is not well understood. Other unaddressed questions include the mechanisms by which the interactions between various channels affect consumers' VCB and whether these synergistic effects always contribute to value co-creation.

To address the above questions, we developed a conceptual framework and employed partial least squares structural equation modeling (PLS-SEM) for our analysis. Unlike previous work, we investigated not only the intermediate path between channel interactions and consumer VCB but also whether there is a synergistic relationship between online and offline channels. According to SDL, interactions initiated by firms (channel interactivity from the consumer perspective) are fundamental to value co-creation (Prahalad and Ramaswamy, 2004). Moreover, as an important cognitive and emotional medium, brand plays an important role in the process from interactions to co-creation (Shiue and Li, 2013). In the omnichannel context, cross-channel consistency (CCC) is a key factor in this process (Verhoef et al., 2015). Thus, this paper investigates the following research questions: (i) How does online and offline channel interactivity affect consumers' VCB? (ii) What role does brand involvement (BI) play in the process of transforming interactions into VCB? (iii) During the process of transforming interactions into VCB, how does CCC affect the synergy between online and offline channels?

This paper contributes to the literature in the following ways. First, we empirically

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test SDL in an omnichannel context to show that channel interactivity is an antecedent of VCB. Second, we demonstrate an underlying mechanism in the relationship between channel interactivity and VCB, namely the mediating role of BI. Third, we examine the three-way interaction effect between online channel interactivity (ONI), offline channel interactivity (OFI), and CCC to determine whether different synergies between online and offline channels exist in an omnichannel context. Specifically, when CCC is high, a positive synergy between ONI and OFI does not necessarily exist. Therefore, the findings contribute to the SDL literature by empirically demonstrating how firms can leverage online and offline channels in an omnichannel customer journey to promote VCB.

2. Theoretical Background

2.1. Omnichannel customer journey and interactions

Companies are making significant efforts to broaden the channels through which they can interact with their customers, who now move freely between channels and demand a seamless shopping experience (Barwitz and Maas, 2018). During customers' omnichannel journey, their interactions with service providers can favorably influence their satisfaction, loyalty, and engagement with the firm (Alexander and Kent, 2020; Tueanrat et al., 2021a). In omnichannel interactions, customers use multiple online and offline channels to conduct information gathering, communications, and transactions for a single purchase (Verhoef et al., 2015). Sousa and Voss (2006) categorize firm–customer interactions into online channels (those based on information technologies) and offline channels (those based on physical venues).

From the consumer perspective, the level of interaction initiated by firms is known as channel interactivity (Florenthal and Shoham, 2010). With respect to online channels, interactivity is the extent to which two or more parties can interact through communications media, which is believed to influence consumers' behavioral intentions

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(Ye et al., 2019). Interactivity refers to interactions with both information technologies and humans (Florenthal and Shoham, 2010). For example, face-to-face communication at a physical venue is more frequent and direct than communications through electronic media. Thus, interactivity can be defined as the extent to which one or more individuals respond to specific resources, including objects and content.

2.2. Consumer value co-creation behavior

According to SDL, value is cocreated by both the firm and its consumers (Vargo and Lusch, 2004) via their interactions (Prahalad and Ramaswamy, 2004). Two common factors in value co-creation are coproduction and value-in-use (Ranjan and Read, 2016). However, the specific behaviors of consumers in this process are still not fully understood. Yi and Gong (2013) measured customer VCB based on two dimensions: (i) customer participation (in-role) behaviors, which were further subdivided into information seeking, information sharing, responsible behaviors, and personal interactions, and (ii) customer citizenship (extra-role) behaviors, which were further subdivided into feedback, advocacy, helping, and tolerance. Although the structure of VCB has been investigated in various contexts, including hospitality and tourism, business-to-business transactions, and healthcare services (Hau et al., 2017; Luu, 2019; Xie et al., 2020), it is still not fully compliant with SDL principles (Tommasetti et al., 2017). Based on SDL, Tommasetti et al. (2017) posit that VCB comprise cognitive activities, cooperation, information research and collation, complementary activities, changes in habits, coproduction, co-learning, and connections. However, they do not specify a context for use or propose a concrete measuring scheme. The extant literature actually tends to blur the boundaries between interactions and VCB. In view of this, based on the SDL perspective that value cocreators are the actors of resource integration (Vargo and Lusch, 2008), we regard VCB as the conscious, active, and continuous sharing and devotion of personal resources (e.g.,

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information, knowledge, personal energy and tolerance) to the service process that creates unique value for customers.

In addition, VCB have been widely investigated as antecedents of firm benefits and customer satisfaction and as mediating and moderating factors in firm performance (Kim et al., 2020; Tueanrat et al., 2021a). However, research on the antecedents of VCB, especially in the omnichannel interaction context, is relatively limited. Thus, determining the mechanisms underlying the effect of interactions on VCB makes an important contribution to the literature.

2.3. Brand involvement

As a relational asset, brand (e.g., service brand, firm brand, or product brand) has gradually become a fundamental and central concept in SDL (Brodie et al., 2006; Carlson et al., 2019). BI reflects a consumer's level of interest in a firm or product and has attracted significant attention from the academic community (Bian and Haque, 2020; Shiue and Li, 2013). BI emerges from customers' cognitive and emotional processes, which affect their interest in, preference for, and participation with a certain product or a firm (Franke et al., 2009). Previous studies have found that increasing consumers' BI improves organizational performance in terms of sales and profitability and enhances consumer enthusiasm for collaborative product or service development (Bian and Haque, 2020; Bijmolt et al., 2010). Therefore, consumers' BI with a particular firm may provide a bridge between interactions and VCB.

2.4. Cross-channel consistency in omnichannel interactions

The consistency of interactions with a service provider is important for customers in omnichannel service settings (Sousa and Voss, 2006). CCC arises from cross-channel integration, differentiating it from multichannel interactions, and ensures a seamless shopping experience (Frasquet and Miquel, 2017). Researchers have called for empirical

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studies of the effects of the synergistic interactions between online and offline channels (Verhoef et al., 2015). CCC can moderate the effect of multiple channels on consumer behaviors such as patronage intentions, commitment, satisfaction, and loyalty (Goraya et al., 2020; Hammerschmidt et al., 2016). Hsu and Lin (2015) also verify that customers perceptions of the service meeting their expectations can affect their perceived value of the business. Therefore, we expect that the degree of CCC will moderate the synergistic effect of channel interactivity on consumers' BI, thus impacting VCB.

3. Theoretical Framework and Hypothesis Development

3.1. Impact of channel interactivity on consumer value co-creation

During the service encounter, effective interactive channels can promote a mutual understanding between firms and customers (Jouny-Rivier et al., 2017; Ranjan and Read, 2016), facilitating customers' value co-creation intentions. In the online context, effective channel interactivity means that the provider can offer customized content and diversify the presentation of its messages (Kim et al., 2015). Customized content may increase customers' understanding of the provider and reduce uncertainty about transactions. Similarly, a variety of presentation methods encourages customers to share information or ideas, promoting VCB.

In contrast, in the offline context, consumers interact with sales representatives or each other in a physical store and experience products directly through touch, taste, and smell. According to social exchange theory, physical interactivity increases individuals' sense of social presence and leads to positive emotions, which may drive customers to actively cooperate with firms. Perceived interactivity could also enhance customers' self-efficacy and willingness to participate in the value co-creation process (See-To and Ho, 2014). Thus, we propose the following hypothesis:

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H1. (a) Online and (b) offline channel interactivities positively affect consumers' VCB.

3.2. Effect of channel interactivity on brand involvement

The value co-creation literature shows that interactivity is an important prerequisite for improving the brand relationship (Tajvidi et al., 2021; Voorveld et al., 2013). By interacting with websites or other online media, customers can make choices by matching the provided information with their needs and demands (Ariely, 2000). For example, if a firm provides smooth two-way communications and promptly responds to customer queries, the resulting positive interaction experience will enhance the customer's perceived value and interest in the firm and its products (Lee, 2005; Merrilees, 2016), thus increasing BI.

Similarly, the interactivity perceived by consumers in a physical venue reflects the quality of the service process (Brady and Cronin, 2001). High-quality service interaction improves customer satisfaction and perceived value, promoting the relationship between the firm and its customers (Ekinci and Dawes, 2009). A friendly attitude, appropriate behaviors, and professionalism during interactions are also conducive to customer involvement. Involved consumers are more likely to form positive thoughts and emotions about the firm brand (Martín-Consuegra et al., 2019). Thus, we propose the following hypothesis:

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H2. (a) Online and (b) offline channel interactivities positively affect consumer BI.

3.3. Effect of consumer brand involvement on value co-creation

The higher the level of consumer BI, the greater the frequency and intensity of active participation behaviors, such as active searches for firm information and more positive information processing (Miquel et al., 2002). Similarly, consumers with a high level of BI show greater firm satisfaction and loyalty (Prayag and Ryan, 2012), are more willing to participate in service processes, and are more likely to tolerate service faults, consequently engaging in citizenship behaviors such as recommendations, promotions, and suggestions (Balaji, 2014; Groth, 2005). When consumers are satisfied with a brand, they develop an emotional tie to that brand, resulting in greater firm commitment and loyalty (Rezaei and Valaei, 2017). Consumers who invest more strongly in a brand are more loyal to the brand and more willing to participate in VCB.

Similarly, ONI and OFI not only increase a firm's appeal but also stimulate consumers' emotional and cognitive involvement in the brand. If consumers sense that a brand is applicable to themselves, they will actively engage in VCB. Drawing on the stimulus–organism–response model, online and offline interactivity can produce a positive psychological state in consumers, who then respond by engaging in VCB. Thus, we propose the following hypotheses:

H3. Consumers' BI positively affects VCB.

H4. Consumers' BI mediates the relationship between online–offline interactivity and VCB.

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3.4. Effects of cross-channel consistency

CCC is the degree of content and process consistency between online and offline channels (Sousa and Voss, 2006). A highly integrated cross-channel setting will give rise to the halo effect (Herhausen et al., 2015), mutually enhancing the positive perception of the interactivity of different channels. For instance, in an omnichannel system with a high degree of CCC, ONI can positively influence customer experiences of the offline channel (Bhargave et al., 2016). Similarly, perceived OFI efficiency may increase customers' interest in online channels (Kim et al., 2019). This synergistic effect will improve overall attitudes toward the firm brand, which is an important antecedent of consumer BI. In these cases, ONI and OFI are complementary and synergistic, consequently strengthening consumer involvement in the firm brand.

Conversely, if CCC is low, the inconsistent services offered by different channels will increase customers' perceived risk, reducing their willingness to interact with the provider. For example, if a customer needs to return goods to a retailer, they may receive different returns policies and procedures from the online and offline channels. In this situation, even if the customer has previously experienced positive interactivity with both channels, they would form a negative view of the retailer's ability and brand. From this perspective, when CCC is low, the synergistic effect of online and offline channels is weakened, decreasing customer involvement in the firm's brand. Taken together, the following hypothesis is proposed:

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H5. The positive interaction effect of ONI and OFI on BI is moderated by CCC such that the effect is strengthened (weakened) when CCC is high (low).

According to SDL, in the omnichannel customer journey, CCC moderates the effect of perceived online and offline channel interactivity on customers' VCB. Combining this with the findings of omnichannel interaction research, BI, as an important experiential medium, may play an important role in this process. Fig. 1 shows our conceptual model.

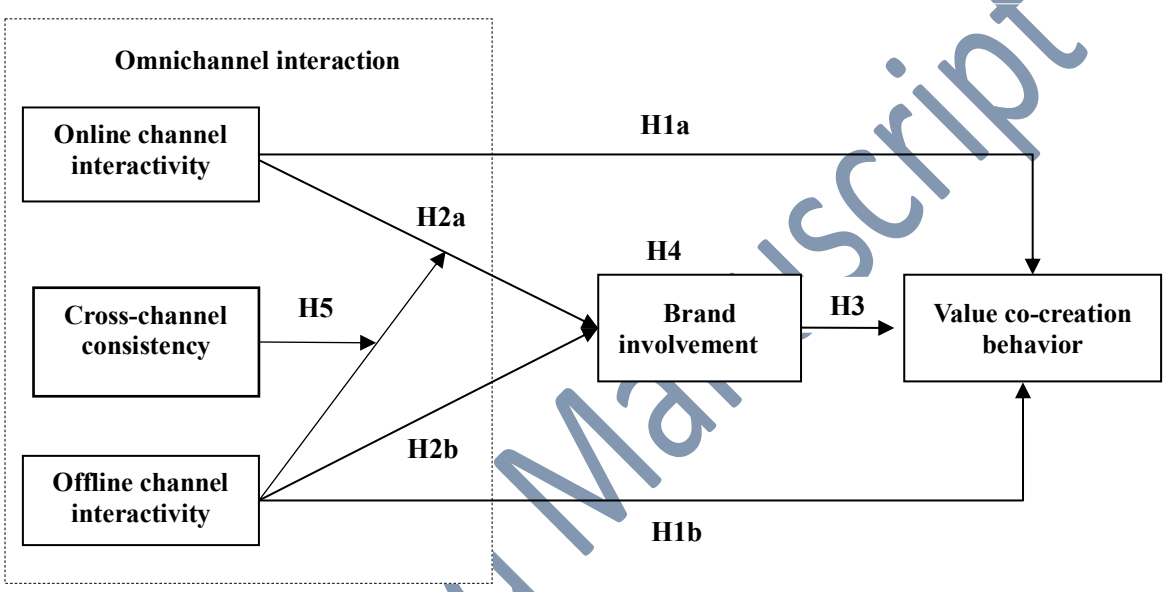

Fig. 1. Theoretical framework.

4. Methods

4.1. Sample and procedure

We used a survey to examine our theoretical framework and proposed hypotheses. Data were collected in China in July 2019 with the assistance of an independent market research company that specializes in consumer psychology and behavior surveys and has generated a vast database of consumers with diverse occupations and ages from different regions. Using a random sampling technique, we selected 3,000 respondents over the age of 18 years. Questionnaires were sent out via the company's internal survey system. Data collection took place over 3 weeks, during which reminder messages were sent after the

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fourth and seventh days to those who had not responded to the survey. We excluded unanswered and incomplete responses, retaining 921 questionnaires.

As suggested by Lee and Kim (2010), a screening question was asked at the start of the survey to identify consumers who engaged in omnichannel interactions. The question was, "Have you interacted with the same firm across its online and offline channels frequently in the last month?" Those who responded "Yes" were permitted to continue with the rest of the survey. Among the 921 original respondents selected, 387 were identified as customers who typically interact with both online and offline channels. Data from these 387 consumers were used in formal analysis and hypotheses testing. Of these, 144 were male (37.2%), and 243 were female (62.8%). The fact that more women than men responded is in accord with the real-life demographics of multichannel shopping. Table 1 reports the descriptive statistics.

Table 1

Sample characteristics.

Sample characteristics		Number	Percent (%)
Sex	Male	144	37.2
	Female	243	62.8
Age (years)	18–20	41	10.6
	21–30	196	50.6
	31–40	119	30.7
	40 and above	31	8.1
Education level	High school or below	24	6.2
	Bachelor's degree	286	73.9
	Master's degree	77	19.9
N		387	

4.2. Measures

To develop our measures of latent variables, we relied primarily on validated scales and adapted them to this study. ONI was based on three dimensions—perceived online

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communication (OCM), perceived online control (OCL), and perceived online responsiveness (ORP)—and was measured using eight items adapted from Liu (2003) and Song and Zinkhan (2008). OFI was also based on three dimensions—perceived offline attitude (FAT), perceived offline behavior (FBH), and perceived offline expertise (FEP)—adapted from Brady and Cronin (2001). BI was adapted from Zaichkowsky (1994) and Obilo et al. (2021). CCC was adapted from Sousa and Voss (2006) and Oh et al. (2012).

The measure of VCB could not be fully based on either Yi and Gong's (2013) scale, which blurs the boundary between interactions and VCB, nor Tommasetti et al.'s (2017) proposal, which has not been empirically verified. Therefore, we adapted three items from Yi and Gong (2013) and four items from Tommasetti et al. (2017), making seven items in total for this construct.

Several professors, doctoral students, and consumers with interactive omnichannel experiences reviewed the first draft of the questionnaire and provided feedback on the quality and clarity of the instructions. Based on their input, we refined the wording, assessed its logical consistency and ease of understanding, and defined areas for improvement to verify the face validity of the survey instrument. Overall, we found the questionnaire to be straightforward and simple to complete. A seven-point Likert scale was employed for all items. All constructs and their measurement items are provided in Appendix 1. Table 2 presents the means, standard deviations, and correlations of ONI (OCM, OCL, ORP), OFI (FAT, FBH, FEP), BI, and VCB.

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Table 2

Descriptive statistics and intercorrelations.

Construct	Mean	STD	OCM	OCL	ORP	FAT	FBH	FEP	BI	CCC	VCB
OCM	4.742	1.381	**0.921**								
OCL	5.448	1.174	0.511	**0.880**							
ORP	4.687	1.342	0.600	0.459	**0.900**						
FAT	5.109	1.247	0.431	0.477	0.422	**0.857**					
FBH	4.914	1.212	0.257	0.291	0.290	0.527	**0.871**				
FEP	5.052	1.194	0.316	0.381	0.312	0.577	0.685	**0.909**			
BI	4.756	1.144	0.443	0.405	0.482	0.546	0.485	0.524	**0.782**		
CCC	4.521	1.307	0.501	0.354	0.434	0.411	0.305	0.327	0.402	**0.826**	
VCB	4.894	1.098	0.450	0.468	0.443	0.573	0.477	0.587	0.732	0.393	**0.744**

Note: Values in bold represent the square root of the average variance extracted. OCM: perceived online communication; OCL: perceived online control; ORP: perceived online responsiveness; FAT: perceived offline attitude; FBH: perceived offline behavior; FEP: perceived offline expertise; BI: brand involvement; CCC: cross-channel consistency; VCB: value co-creation behavior.

5. Analysis and Results

5.1. Measurement model

To confirm the adequacy of the measurement models, composite reliability, convergent validity, and discriminant validity were examined. According to Hair et al. (2009), the internal consistency (Cronbach's alpha) and composite reliability (CR) values are all above 0.7, the average variance extracted (AVE) should be greater than 0.5, thus establishing composite reliability and convergent validity. As shown in Table 3, all necessary statistical measures met the criteria of composite reliability and convergent validity.

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Table 3

Constructs' reliability and validity.

Construct	Cronbach's α	CR	AVE
OCM	0.909	0.943	0.848
OCL	0.855	0.912	0.775
ORP	0.766	0.895	0.810
FAT	0.820	0.893	0.735
FBH	0.837	0.903	0.758
FEP	0.789	0.905	0.826
BI	0.894	0.917	0.612
CCC	0.845	0.896	0.683
VCB	0.866	0.897	0.554

Note: CR: Composite Reliability; AVE: Average Variance Extracted.

The evidence for discriminant validity was established traditionally as the square root of average variance extracted (AVE) for each indicator was above the inter-indicator correlations (refer to table 2). Moreover, the Heterotrait–monotrait (HTMT) ratio of the correlations with a maximum threshold of 0.85 (Henseler et al., 2015) was also checked. The results of the HTMT0.85 ratio (Table 4) showed that all the values of employed measures are not more than 0.85. Therefore, discriminant validity was also well established.

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Table 4

Discriminant validity (HTMT0.85).

Constructs	OCM	OCL	ORP	FAT	FBH	FEP	BI	CCC	VCB
OCM	-								
OCL	0.572	-							
ORP	0.718	0.556	-						
FAT	0.500	0.573	0.531	-					
FBH	0.296	0.349	0.363	0.637	-				
FEP	0.373	0.466	0.400	0.718	0.843	-			
BI	0.491	0.453	0.579	0.631	0.557	0.619	-		
CCC	0.568	0.413	0.537	0.489	0.361	0.399	0.457	-	
VCB	0.506	0.539	0.541	0.676	0.560	0.707	0.830	0.455	-

Furthermore, the correlation between independent latent variables is high, multicollinearity may exist. We checked the variance inflation factor (VIF) among latent variables; the results of our assessment show the VIF of each construct is between 1.621 and 2.102, much less than 10, so the multicollinearity of the sample is not significant. In addition, each sample was collected from the same questionnaire, which might cause a common method bias problem. Harman's one-factor test was conducted to assess common method variance (CMV); five common factors without rotation were extracted. The first factor explained 31.49% of the variance which predicts that a single method factor doesn't explain a majority of the variance. Therefore, the common method bias is not a serious concern in this study.

5.2. Hypothesis testing

We tested H1–H4 by assessing the significance of the path coefficients between the constructs in the structural model (see Fig. 2).

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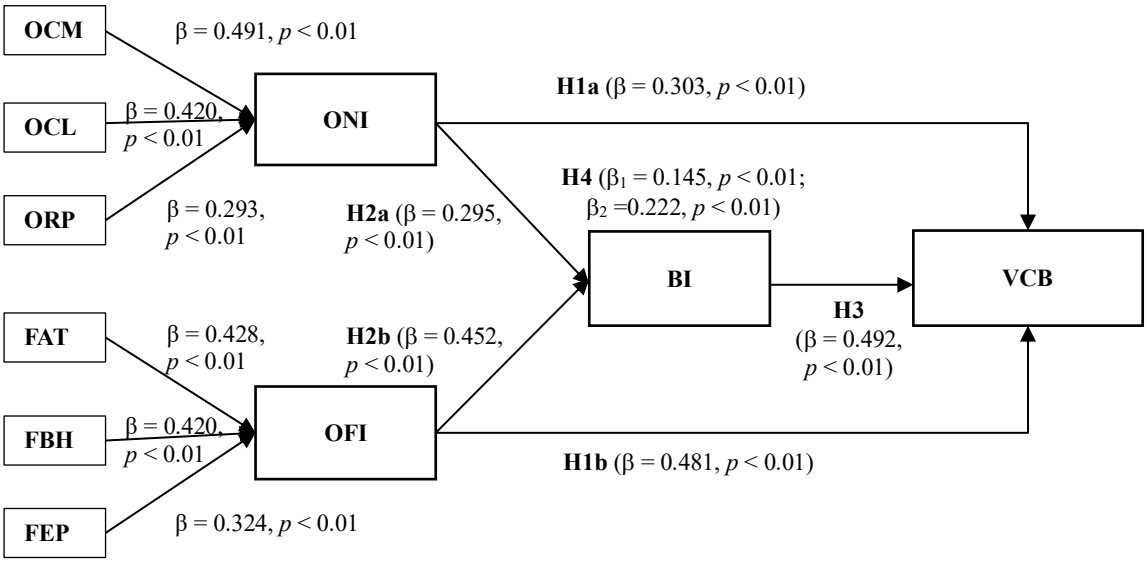

Note: The coefficient (β) for H1a indicates the total effect of ONI on VCB. β for H1b indicates the total effect of OFI on VCB. β_1 and β_2 for H4 indicate the indirect effects of ONI and OFI, respectively, on VCB.

Fig. 2. Schematic diagram of path significance (H1-H4).

The results presented in Table 5 indicate that both ONI (β = 0.303, $p < 0.01$) and OFI (β = 0.481, $p < 0.01$) had an overall significant positive effect on VCB, supporting H1a and H1b. Moreover, both ONI (β = 0.295, $p < 0.01$) and OFI (β = 0.452, $p < 0.01$) had an overall significant positive effect on BI, supporting H2a and H2b. We also found that BI had a significant and positive association with VCB (β = 0.492, $p < 0.01$), supporting H3. BI also had a mediating effect on the relationship between both ONI (β = 0.145, $p < 0.01$) and OFI (β = 0.222, $p < 0.01$) and VCB, supporting H4. However, the mediating role of BI was only partial given that the direct effects of ONI (β = 0.158, $p < 0.01$) and OFI (β = 0.258, $p < 0.01$) on VCB were still significant.

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Table 5

Hypothesized structural model.

Hypotheses	Coefficients	T value	BCCI	Supported
H1a: ONI → VCB				Yes
Total effect	0.303***	6.933	[0.219, 0.390]	
Direct effect	0.158***	3.992	[0.082, 0.235]	
H1b: OFI → VCB				Yes
Total effect	0.481***	11.627	[0.396, 0.558]	
Direct effect	0.258***	5.371	[0.161, 0.351]	
H2a: ONI → BI	0.295***	5.224	[0.183, 0.403]	Yes
H2b: OFI → BI	0.452***	8.610	[0.348, 0.557]	Yes
H3: BI → VCB	0.492***	9.718	[0.389, 0.586]	Yes
H4: Mediating effects				Yes
ONI → BI → VCB	0.145***	5.018	[0.090, 0.203]	
OFI → BI → VCB	0.222***	5.936	[0.154, 0.301]	

Note: BCCI: Bias Corrected Confidence Interval. *** $p < 0.01$.

5.3. Three-way interaction analysis

H5 predicted a three-way interaction effect of ONI, OFI, and CCC on BI. Because ONI and OFI were based on multidimensional scales, we first conducted confirmatory factor analysis to assess the validity of ONI and OFI modeled as second-order factors. A five-construct (ONI, OFI, BI, CCC, and VCB) model was examined. All standardized first-order factor loadings were significant and substantial ($p < 0.01$), suggesting that ONI and OFI as first-order constructs were well defined. Further, the second-order loadings to all six first-order factors were significant and of high magnitude (OCM: 0.869; OCL: 0.774; ORP: 0.828; FAT: 0.804; FBH: 0.858; FEP: 0.896), surpassing the suggested cutoff of 0.70 (Chin et al, 1997) (see Appendix 1). This confirms that ONI and OFI can be treated as reflective second-order factors with good convergent validity.

We tested the three-way interaction effect of ONI, OFI, and CCC on BI based on the methods of Song et al. (2019) and Tao et al. (2019) through step by step regression in

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SPSS. The results are displayed in Table 6. In Step 1, the model contained the control variables, independent variables (ONI and OFI), and moderator variable (CCC) to reflect the main effects on BI. In Step 2, we entered the three possible two-way interaction effects. In Step 3, the model contained all of the main effects, both two-way and three-way interactions. The model in Step 3 produced a better fit to the data than that in Steps 1 and 2. As shown in Table 6, the three-way interaction was statistically significant ($\beta = 0.105$, $p < 0.1$), while the two-way interaction between ONI and OFI was not ($\beta = -0.084$, ns).

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Table 6

Regression results for 3-way interaction on BI.

BI	Step 1			Step 2			Step 3		
	B	SE	T	B	SE	T	β	SE	T
Control variables									
Sex	0.005	0.074	0.127	0.009	0.074	0.223	0.009	0.074	0.216
Age	-0.011	0.047	-0.253	-0.016	0.047	-0.394	-0.017	0.047	-0.417
Education level	0.019	0.071	0.473	0.017	0.071	0.434	0.026	0.071	0.662
Main effects									
ONI	0.216	0.049	4.148***	0.218	0.050	4.105***	0.202	0.050	3.757***
OFI	0.435	0.048	8.823***	0.415	0.048	8.297***	0.384	0.051	7.280***
CCC	0.084	0.032	1.755*	0.092	0.032	1.915*	0.078	0.033	1.604
2-way interaction									
ONI × CCC				0.114	0.034	2.238**	0.128	0.034	2.501**
OFI × CCC				-0.010	0.036	-0.196	-0.009	0.036	-0.180
ONI ×OFI				-0.123	0.044	-2.199**	-0.084	0.047	-1.411
3-way interaction									
ONI × OFI × CCC							0.105	0.022	1.765*
R2	0.397			0.409			0.414		
ΔR2	0.388			0.395			0.399		
F	41.730***			29.033***			26.588***		

Note: N = 387, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

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To assess the moderating role of CCC, we plotted the three-way interaction effects in Fig. 3. The slopes of Lines (1) and (2) are similar, indicating that when CCC is high, the positive relationship between ONI and OFI is not strengthened. In contrast, the slopes of Lines (3) and (4) differ, indicating that when CCC is low, there is a negative relationship between ONI and OFI. Hence, H5 is not fully supported. To determine the direction of the significant three-way interaction effect, we executed a further analysis.

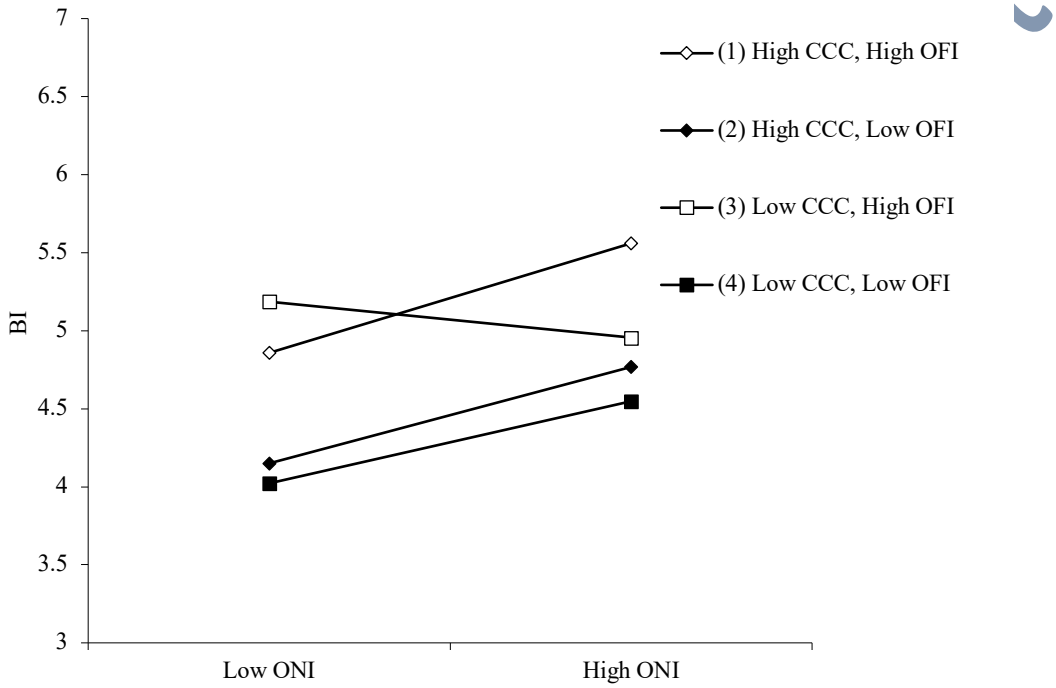

Fig. 3. Three-way interaction effects of ONI, OFI, and CCC on BI.

5.4. Multigroup analysis

To further assess the moderating effect of CCC, we grouped the sample into high-CCC and low-CCC groups using a k-means clustering algorithm with two clustering centers: 5.52 and 3.32, respectively ($F = 906.242$, $p < 0.01$). Using Smart PLS 3.0, we conducted a two-step multigroup analysis procedure. In the first step, we used the measurement invariance of composite models (MICOM) method (Henseler et al., 2016) to examine the invariance of the measurement models of the subsamples. We used the same measurement model for both high-CCC and low-CCC groups based on identical

algorithm settings. We conducted Steps 2 and 3 of the MICOM method, running the permutation procedure (5,000 permutations) and setting a 5% significance level for both groups. In Step 2, we established the compositional invariance between the two groups by comparing the original composite score correlations (C_o) with the composite score correlations obtained from the permutation procedure (C_u). In Step 3, the equality of means and variance between the two groups was evaluated. The results are presented in Table 7.

Table 7

Measurement invariance of the hypothesized model (5,000 permutations).

Construct	Step 1	Step 2		Result 1	Step 3				Result 2
		C_o	5% quantile of C_u		MD	CI	VD	CI	
OCM	Yes	1	1	Yes	−0.848	[−0.201, 0.199]	0.259	[−0.262, 0.264]	Yes
OCL	Yes	1	0.999	Yes	−0.588	[−0.203, 0.193]	0.479	[−0.296, 0.296]	No
ORP	Yes	0.999	0.999	Yes	−0.754	[−0.198, 0.205]	0.319	[−0.277, 0.277]	No
FAT	Yes	0.999	0.999	Yes	−0.723	[−0.202, 0.199]	0.486	[−0.274, 0.277]	No
FBH	Yes	1	0.999	Yes	−0.542	[−0.196, 0.199]	0.086	[−0.279, 0.267]	Yes
FEP	Yes	1	1	Yes	−0.581	[−0.195, 0.194]	0.067	[−0.281, 0.267]	Yes
BI	Yes	0.999	0.998	Yes	−0.592	[−0.194, 0.193]	−0.061	[−0.284, 0.282]	Yes
VCB	Yes	0.995	0.997	No	−0.696	[−0.198, 0.193]	0.246	[−0.313, 0.311]	Yes

Note: Step 1: Configural invariance (same algorithms for both groups). Step 2: Compositional invariance (correlation = 1). Step 3: Equality of means and variance between groups. C_o: original composite score correlation; C_u: permutation; Result 1: partial measurement invariance established (the value of C_o exceeding the 5% quantile of C_u); MD: mean difference; VD: logarithm of variance difference; CI: confidence interval; Result 2: full measurement invariance established (CI of MD and VD, including the obtained value of MD and VD).

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As shown in Table 7 (using Smart PLS 3.0), we established the configural invariances of all constructs in Step 1 because we used the same algorithms for both groups. In Step 2, permutation-based confidence intervals were used to determine whether a construct had a correlation in both groups that was significantly lower than 1. In Step 3, the permutation-based confidence intervals of the mean values of variances were used to assess whether a construct's mean value and variance differed between groups. The results show that OCM, FBH, FEP, BI, and VCB had full measurement invariance, while OCL, ORP, and FAT had partial measurement invariance. According to Henseler et al. (2016), it is appropriate to assess the invariance of structural models and examine whether the path coefficients of groups differ to establish partial or full measurement invariance for all constructs.

We then assessed the path coefficients of the structural models of the two groups to confirm the differences between them. We employed the bootstrapping method, which is the most conservative multigroup analysis method in PLS-SEM (Rasoolimanesh et al., 2017). As shown in Table 8, there was a significant negative synergistic effect of ONI and OFI on VCB for the low-CCC subgroup (ONI*OFI → BI: −0.109, $p < 0.05$; ONI*OFI → BI → VCB: −0.058, $p < 0.05$). However, the positive synergistic effect of ONI and OFI on VCB for the high-CCC subgroup was not supported (ONI*OFI → BI: 0.034, $p > 0.1$; ONI*OFI → BI → VCB: 0.016, $p > 0.1$). Additionally, the path coefficients between the two groups were significantly different (ONI*OFI → BI: −0.143, $p < 0.1$; ONI*OFI → BI → VCB: −0.074, $p < 0.1$).

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Table 8

Multigroup analysis of the hypothesized model.

Hypothesis 5	High CCC (n = 211)		Low CCC (n = 176)		Diff.	p
	Coefficient	BCCI	Coefficient	BCCI		
ONI*OFI → BI	0.034	[−0.030, 0.066]	−0.109**	[−0.192, −0.034]	−0.143*	0.062
ONI*OFI → BI → VCB	0.016	[−0.063, 0.128]	−0.058**	[−0.109, −0.018]	−0.074*	0.059

Note: BCCI: bias-corrected confidence interval. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

6. Discussion and Conclusion

Based on SDL and an omnichannel context, this study explored the effect of omnichannel interaction on consumers' VCB. We revealed not only the mechanisms underlying the effect of perceived online and offline channel interactivity on consumers' VCB but also the synergistic relationships between online and offline channels, demonstrating the generation process of VCB.

Consistent with SDL, the interactions between firms and their customers drive value co-creation (Prahalad and Ramaswamy, 2004). The empirical findings of this study confirm consumers' positive VCB intentions in highly interactive online and offline channels in the omnichannel era. Unlike previous research, which is focused on the positive consequences of value co-creation (Cossío-Silva et al., 2016; Kim et al., 2020), this study explored the antecedents of value co-creation based on SDL.

Addressing the lack of research on the intermediate mechanisms between customer–firm interactions and value co-creation (Ranjan and Read, 2016; Yi and Gong, 2013), our results affirm the partial mediating role of BI. In the SDL literature on omnichannel interactions, scholars have theorized the key role of brand in value co-creation (Brodie, 2006; Verhoef et al., 2015) but have not empirically confirmed it. Our findings show that the effect of channel interactivity on consumer VCB is partly realized through consumer BI. This indicates that consumers' perceived ONI and OFI may enhance their emotional

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and cognitive attachment to the firm. Therefore, the effect of channel interactivity on consumer VCB is improved via psychological mechanisms.

In addition, the extant literature recognizes the important role of CCC (Barwitz and Maas, 2018), verifying that the integration and synergistic effects of different channels can promote positive customer experiences and behaviors (Goraya et al., 2020; Li et al., 2018). Our results confirm that CCC, as a critical factor in omnichannel interaction, plays a significant moderating role in the synergistic effect of online and offline channels. That is, when CCC is low, the synergistic effect of online and offline interactions on BI is negative, in turn negatively affects consumer' VCB.

Surprisingly, however, when CCC is high, the positive synergistic effect of online and offline interactions on BI is not significant. This differs from previous findings that cross-channel integration ensures multichannel complementarity (Frasquet and Miquel, 2017; Herhausen et al., 2015). Such a result is worth further exploring. With the popularization of the internet and the development of mobile applications, multichannel communications and transactions are common. As a result, CCC is a fundamental extrinsic motivator in customers' omnichannel journey. According to Herzberg's two-factor theory (Herzberg et al., 1959), extrinsic motivators are "hygiene" factors that only maintain, rather than motivate, existing employee or customer satisfaction. That is, improving CCC will not necessarily bring about positive results, but decreasing CCC will bring about negative results. This may be the reason for the positive synergistic effect being non-significant under high CCC. These findings have important implications for multichannel business and customer relationship management.

6.1. Theoretical implications

This study offers key theoretical implications on the antecedents of value co-creation in an omnichannel context. First, it provides a holistic theoretical framework of the

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positive effect of channel interactivity on consumers' VCB. While previous SDL research has shown that customer–firm interactions are the foundation of value co-creation, the underlying mechanisms have been overlooked. This study addresses that gap by highlighting the mediating role of BI and verifying the influence of channel interactivity on consumer VCB. The findings confirm that channel interactivity serves as an antecedent of VCB and can make a difference through BI. Further, the study provides novel insights from a consumer psychology perspective; that is, online and offline interactivity promote consumer interest in and relevance of firms, increasing their VCB.

Moreover, this study extends the value co-creation literature by taking an omnichannel interaction perspective. Although existing research recognizes the relationships between online (e.g., web and social media) interactivities and consumer behaviors (Zafar et al., 2021; Shen et al., 2020), few researchers have considered how offline interactivity fosters the firm–consumer relationship. Specifically, this study explored the simultaneous synergistic effects of both online and offline interactivities.

Finally, this study pays renewed attention to the synergistic effect of online and offline channels on the firm–consumer relationship. While previous research has confirmed the positive synergistic effects of multiple channels on business relationships (Goraya et al., 2020; Zhu et al., 2018), our study focuses on the value co-creation relationship, which is more sustainable. In contrast to previous conclusions, we confirm that positive synergies do not always occur when CCC is high. This provides a new topic for future researchers.

6.2. Managerial insights

The findings also have implications for retail managers. In the service economy, firms should enhance channel interactivity to promote the value co-creation relationship with their customers. Improving the interactivity level of online or offline channels and

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stimulating consumer VCB is important for enterprises, especially retailers, to create value.

Moreover, in the process of increasing channel type and quantity, firms should pay attention to the brand experience of customers. This study found that multichannel interactions can improve customers' BI, thus promoting the co-creation relationship. Contemporary retailers should make effective use of online and offline channels to enhance customer awareness of and emotional reactions to their brands. Given that the interface between retailers and customers is gradually increasing, retailers can improve customers' interest in, awareness of, and emotional reactions to their brands and enhance customer reliance on the firm through both online (e.g., website design, company microblogs, and brand communities) and offline (e.g., physical stores or experience venues) channels.

Additionally, the results of this study suggest that an increase in interaction channels does not necessarily enhance the firm–consumer relationship. When CCC is low, omnichannel interactions may lower customer BI. With the internet economy booming, an increasing number of traditional firms have implemented online sales and communication channels; however, this increase in channel types does not necessarily enhance firm–customer relationships. Managers should take care to ensure consistency across different channels through cross-channel integration.

Finally, CCC should be kept at an appropriate level. The findings of this study confirm that high CCC does not necessarily ensure the positive synergistic effect of multichannel interactions. In response to the rise in the omnichannel model, many firms are willing to integrate multiple channels at any cost, and the degree of integration is increasing. Our findings show that high integration does not contribute to the expected

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benefits. Therefore, managers should focus on the appropriateness of CCC in the process of omnichannel interaction.

6.3. Limitations and future research

This study explored the mechanisms underlying the positive effect of channel interactivity on consumers VCB; however, it has some limitations. First, while we attempted to capture the main characteristics of online and offline interactivities, this does not necessarily provide the only or complete picture of omnichannel interactions. Ideally, there should be as many channels or touch points as possible in an omnichannel customer journey. Future researchers may consider other integrated channels or touch points, such as mobile applications, live streaming, in-store advertising, and face-to-face communication. Second, our data were self-reported and derived from consumers rather than retailers. Although common method bias was within the allowable range, the quality of the cross-sectional survey data may have been affected. Therefore, other survey methods and research designs are recommended for future research. For example, quasi-experimental methods may be adopted to create more realistic scenarios. Third, we found that in the case of high CCC, there was no complementary effect between online and offline channels. Although a preliminary explanation is provided and discussed, the underlying reasons have not been explored. Therefore, we call on scholars to adopt richer methods to explore new evidence, such as the characteristics of omnichannel journeys in different market segments. Finally, because the survey data were collected from Chinese consumers, the findings may not be generalizable to other countries because of social and cultural differences. Future researchers could collect cross-national data and further analyze the influence of cultural differences.

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Appendix 1 The Constructs and Measurement Items

Construct items	Std. loading	Second-order factor loading
Online Channel Interactivity (ONI; Liu, 2003; Song and Zinkhan, 2008)		
Perceived online communication (OCM)		0.869
OCM1: The online channels facilitate two-way communication between me and the firm.	0.960	
OCM2: The online channels facilitate concurrent communication.	0.954	
OCM3: The online channels make me feel that the firm wants to listen to its customers.	0.844	
Perceived online control (OCL)		0.774
OCL1: I felt that I had a lot of control over my visiting experiences at firms' online channels.	0.906	
OCL2: I was delighted and able to choose the type of online channel (Web site, App, etc.) whenever I visit.	0.874	
OCL3: While surfing firm's online channels, my actions decided the kind of experiences I got.	0.860	
Perceived online responsiveness (ORP)		0.828
ORP1: The firm's online channels answer my question immediately.	0.912	
ORP2: I was able to obtain the information I want without any delay at firm's online channels.	0.887	
Offline Channel Interactivity (OFI; Brady and Cronin, 2001)		
Perceived offline attitude (FAT)		0.804
FAT1: You can count on the employees at the firm being friendly.	0.837	
FAT2: The attitude of the firm's employees demonstrates their willingness to help me.	0.878	
FAT3: The attitude of the firm's employees shows that they understand my needs.	0.858	
Perceived offline behavior (FBH)		0.858
FBH1: I can count on the firm's employees taking actions to address my needs.	0.798	

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Construct items	Std. loading	Second-order factor loading
FBH2: The firm's employees respond quickly to my needs.	0.938	
FBH3: The behavior of the firm's employees indicates that they understand my needs.	0.869	
Perceived offline expertise (FEP)		0.896
FEP1: The firm's employees are able to answer my questions quickly.	0.907	
FEP2: The employees understand that I rely on their knowledge to meet my needs.	0.911	
Brand Involvement (BI; Obilo *et al.,* 2021; Zaichkowsky, 1994)		
BI1: I think this firm's brand is important in my shopping journey.	0.776	–
BI2: I am interested in this firm's brand.	0.822	
BI3: I consider this firm's brand to be a relevant part of my life.	0.792	
BI4: I am excited to patronize the channels with this firm's brand.	0.808	
BI5: I feel very positive when I visit the channels of this firm's brand.	0.754	
BI6: Visiting the channels with this firm's brand makes me happy.	0.784	
BI7: I feel it's worthwhile to visit the channels with this firm's brand.	0.738	
Value Co-creation Behavior (VCB; Tommasetti *et al*., 2017; Yi and Gong, 2013)		
VCB1: I usually search for information about what the firm offers.	0.742	–
VCB2: I let the firm know if I have a useful idea on how to improve service.	0.735	
VCB3: I usually recommend this firm to my family and others.	0.700	
VCB4: I am willing to accept it, if the firm makes a mistake during service delivery.	0.799	
VCB5: I am able to adapt to the limitations derived from the firm.	0.739	
VCB6: I usually contribute to resolving potential problems arising during service provision.	0.748	

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Construct items	Std. loading	Second-order factor loading
VCB7: I usually help other customers of the firm.	0.740	
Cross-channel Consistency (CCC; Oh *et al.*, 2012; Sousa and Voss, 2006)		
CCC1: I can get the same product and promotion information from both the online channels and offline channels of this firm.	0.792	–
CCC2: I can get the same quality of products and service from both the online channels and offline channels of this firm.	0.863	
CCC3: I can get the same price for products and service from both the online channels and offline channels of this firm.	0.814	
CCC4: I can get the same assurance of reliability from both the online channels and offline channels of this firm.	0.835	

Note: Second-order factor loading from second-order factor (i.e. ONI, OFI) to first-order factors (i.e. OCM, OCL, ORP, FAT, FBH, FEP).

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