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Person-environment fit, commitment, and customer contribution in online brand community: A nonlinear model

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ABSTRACT

Online brand community is often regarded as a value co-creation platform where customers' active contributions are most important to the success of the community. Previous studies on the potential drivers of users' contributions placed a great emphasis on either users or the community itself, and most of these studies primarily focused on linear relationships. Drawing upon person-environment fit theory, this study develops a research model to explore the nonlinear effects of person-environment fit, i.e., needs-supplies fit and demands-abilities fit, on community commitment, as well as the nonlinear effect of community commitment on users' knowledge contribution intention. Using 480 online survey responses, the results indicate that needs-supplies fit has a decreasing incremental effect, while demands-abilities fit has an increasing incremental effect on community commitment. Community commitment has an increasing incremental effect on willingness to contribute. Implications for both research and practice are also discussed.

1. Introduction

In the Web 2.0 era, the popularity of value co-creation has increased the importance of knowledge generated by customers. Online brand community acts as an important platform in which customers can share their experiences and feelings about particular products or services, and express their support and passion for a brand (Muñiz & O'Guinn, 2001). As a result, online brand community becomes a crucial source of customer needs and information that will provide valuable insights into firm's market research (Füller, Bartl, Ernst, & Mühlbacher, 2006; Kozinets, De Valck, Wojnicki, & Wilner, 2010; Shen, Zhang, & Zhao, 2016). Online brand community therefore evolves into a strategic resource for companies (Baldus, Voorhees, & Calantone, 2015; Wirtz et al., 2013). Some leading brands, such as SAP, P&G, and XiaoMi, are pouring significant money into building their own online brand communities to engage customers in the value co-creation process, and to harness customer knowledge. However, in the absence of mandatory requirements or monetary incentives, people are prone to withhold their efforts in knowledge contribution, particularly in online spaces where contribution is a completely voluntary action (Lin & Huang, 2010; Ren et al., 2012). In this regard, identifying the potential drivers of customer contribution is of increasing importance in both research and practice for brand management.

Scholars have devoted considerable efforts to this issue from different perspectives, such as motivational drivers and personalities, community features, and firms' efforts (Brodie, Ilic, Juric, & Hollebeek, 2013; Casaló, Flavián, & Guinalíu, 2010; Füller, 2010; Jang, Olfman, Ko, Koh, & Kim, 2008; Liao, Huang, & Xiao, 2017). Most of these studies largely examined the separate impacts of a community or customers, but often ignored the synergistic effects exerted by both of them. Since people will spontaneously evaluate how well the community fits with their needs and how well their abilities may fit with the community's demands, their decisions to contribute are likely to be a joint result of factors from both themselves and the community. The person-environment (P-E) fit framework, derived from organizational behavior research (Caplan, 1987), is thus used to explore the joint effects of brand community and community members. In addition, due to the open nature of online brand communities, there are no explicit norms or bonds that can restrict users' leaving or switching behavior (Hemetsberger & Reinhardt, 2009). In this sense, the real success of an online brand community may lie in users' commitment, which is extensively believed to result from high P-E fit in previous studies (Astakhova, 2016; Greguras & Diefendorff, 2009). In this regard, the first research question of this study is that, to what extent the effects of P-E fit on customer contribution act through community commitment.

Previous studies regarding how P-E fit affects customer behavior through commitment have generated some ambiguous results. Some scholars suggested that P-E fit was positively related to commitment

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(Astakhova, 2016), whereas some others argued the relationship between P-E fit and commitment was not always positive (Livingstone, Nelson, & Barr, 1997). If individuals' needs are highly fulfilled, improvement in P-E fit by increasing environmental supplies will not necessarily promote their commitment because the arousal motive in regard to commitment remains constant in this case, and therefore, a nonlinear model is believed to better describe such behavior (Livingstone et al., 1997; Pee & Min, 2017). However, most of these studies measured the P-E fit indirectly by comparing environmental and personal features. It is necessary to notice that when environmental supplies extremely exceed personal preferences, it suggests a misfit rather than a high level of fit (Ostroff, Shin, & Kinicki, 2005). As a result, measuring fit in an indirect way may lead to a misunderstanding of the concept of fit, especially when investigating its nonlinear effect. In this regard, the second research question of this study is that, how the nonlinear effects of P-E fit are exerted on commitment when P-E fit is measured in a direct way.

Likewise, prior studies have also demonstrated that a nonlinear relationship may be more in line with the reality of the effect of commitment on behavioral intention, but largely focusing on either normative or continuance commitment (Morin, Vandenberghe, Turmel, Madore, & Maïano, 2013; Siegrist et al., 2004). These studies, primarily from organizational settings, have argued that high commitment required considerable personal investments. If people feel an imbalance between their exerted efforts and the received reward, or they hold too many duties, they will experience burnout and strain, suggesting an inverted U-shape relationship between commitment and work performance (Siegrist et al., 2004). However, in the online community context, if users feel imbalance or strain, they tend to leave the focal community directly because of no explicit norms and no financial pressure. As a result, over-commitment has no chance to damage their mental health and community performance. Instead, people choose to stay in the community mainly because they like the brand and the associated community (Muñiz & O'Guinn, 2001), wherein affective commitment should be at the heart of online contribution. In this regard, the third research question of this study is that, whether affective commitment exerts a nonlinear effect on contribution intention in online brand communities.

We can understand the contributions of this study to the literature in the following three ways. First, while prior studies have investigated customer contributions in online communities from the perspective of customers or communities, this study tries to investigate the combined effects of customers and the community based on the P-E fit theory derived from organizational research. As such, this study introduces the fit perspective to enrich customer behavior research in online communities, and P-E fit theory itself is also extended to an online setting. Second, in contrast to prior research that measured P-E fit indirectly when exploring the nonlinear effects of P-E fit, this study considers P-E fit directly and further demonstrates that different nonlinear relationships exist between P-E fit and commitment. Therefore, this study enriches current research regarding nonlinear effects of P-E fit. Third, different from previous research on the nonlinear effects of continuance and normative commitment, this study highlights the nonlinear effect of affective commitment and confirms the increasing incremental effect of affective commitment on customer behavior. In this regard, this study contributes to customer commitment research by revealing the nonlinear effect of affective commitment.

In what follows, we review the relevant research on P-E fit and commitment and then develop the associated hypotheses. Next, we introduce our research method, including research setting, instrument scales, and data collection procedure. The results of data analysis are reported in the following section. We conclude this study by discussing the findings and the implications for theory and practice.

2. Literature review and hypothesis development

2.1. Community commitment and customer contribution intention

The concept of "commitment" originally comes from organizational behavior research, which is defined as a force that binds a person to an organization (O'Reilly & Chatman, 1986). Commitment is generally believed to be positively related to various pro-social work outcomes, such as attendance, well-being, and organizational citizenship behavior (Allen & Meyer, 1990; O'Reilly & Chatman, 1986). In general, commitment is conceptualized into three components: affective commitment, continuance commitment, and normative commitment (Allen & Meyer, 1990). Affective commitment is concerned with the attitudinal component of commitment, which refers to "an affective or emotional attachment to the organization such that the strongly committed individual identifies with, is involved in, and enjoys membership in, the organization" (Allen & Meyer, 1990, p. 2). Continuance commitment involves the cognitive component of commitment, which occurs when there is "a profit associated with continued participation and a cost associated with leaving" (Allen & Meyer, 1990, p. 3). Normative commitment refers to "a belief about one's responsibility to the organization" (Allen & Meyer, 1990, p. 3). In marketing research, commitment is regarded as a key factor for relationship marketing, and it reflects individuals' desires to maintain a valued relationship with others (Gustafsson, Johnson, & Roos, 2005; Morgan & Hunt, 1994).

Most of commitment studies suggest a positive relationship between commitment and pro-social behavior (Allen & Meyer, 1990; Raïes, Mühlbacher, & Gavard-Perret, 2015; Shen, Lee, & Cheung, 2014). However, some other scholars also believe that a nonlinear relationship might better explain the effects of commitment on work performance (Luchak & Gellatly, 2007; Morin et al., 2013). In particular, the effort-reward imbalance model suggests that people with high commitment are more productive and are more involved in work, requiring a significant investment of time, efforts and other resources (Morin et al., 2013; Siegrist et al., 2004). As a result, people are likely to suffer from strain, and their organizational citizenship behavior will be reduced if the organization does not reciprocate the efforts they pour into the job or other work-related tasks (Siegrist et al., 2004). Notably, the effort-reward imbalance model is based on transactional exchanges and echoes the cognitive nature of continuance commitment (Allen & Meyer, 1990). On the other hand, normative commitment is driven by obligation, duty, or guilt-avoidance, which are externally controlled and prevention-focused (Meyer, Becker, & Vandenberghe, 2004). Over-normative-commitment is likely to result in heavy workloads and job burnout, since over-duty also needs a huge amount of personal resource investment, and most people do not hold adequate intrinsic motivation (Meyer et al., 2004).

However, these negative consequences of over-commitment are not the case for affective commitment. People with high affective commitment are less likely to suffer from strain and burnout even though they have to invest lots of personal resources, since affective commitment is internally driven and intrinsically motivated (Luchak & Gellatly, 2007; Meyer et al., 2004). That is, people with higher affective commitment will show higher intrinsic motivation and experience a stronger promotion-typed focus in pursuit of goals, so they tend to set more difficult goals with more autonomous regulation in order to obtain a higher sense of achievement (Meyer et al., 2004). In this sense, affective commitment can be conceptualized as consistent with a growth role, a higher-order need in need-gratification theories. Based on need-gratification and dual-factor motivation theories, once personal lower-order needs are met by the environment, increasing fulfilment of higher-order needs has an increasing incremental effect on personal performance (Agustin & Singh, 2005; Herzberg, 1966; Vargo & Lusch, 2004). With this point of view, affective commitment may fail to motivate people to contribute in online brand communities until their lower-order needs, such as information support, membership security

and stability, are satisfied. Beyond the point of the fulfilment of lower-needs, affective commitment will motivate people to make more contributions in the focal community in order to achieve the maximum level of accomplishment in the contribution process. Therefore, we have the following hypothesis.

H1. Community commitment has an increasing incremental effect, such that it has (a) a positive linear effect and (b) a positive quadratic effect, on customer willingness to contribute in online brand communities.

2.2. P-E fit and community commitment

P-E fit refers to the degree of congruence between individual and environmental attributes, and it examines the joint influence of individual and environmental factors on human attitude and behavior (Caplan, 1987; Kristof-Brown, Barrick, & Kay Stevens, 2005). When a fit exists between people and their environment, people are likely to develop pro-social attitude and behavior (i.e., community commitment in this study) (Astakhova, 2016). Based on the desires-supplies perspective (Tinsley, 2000), individual attributes include knowledge, skills, and abilities, while environmental attributes include supplies and resources. Accordingly, this study identifies two forms of P-E fit: needs-supplies fit and demands-abilities fit. Needs-supplies fit refers to "a result of an environment adequately meeting individual's needs", and demands-abilities fit represents the fit that is "determined by an individual's ability to meet the demands her/his environment" (Beasley, Jason, & Miller, 2012, p. 65). As such, P-E fit is determined by the complementary abilities of the customer and the community in addressing one-another's demands in this study.

Although there is considerable research on the effects of P-E fit on commitment, empirical findings are mixed. Some studies indicate that when people perceive a match between their preferences and the actual environment, they will develop a sense of commitment (Astakhova, 2016; Greguras & Diefendorff, 2009). Some other studies believe the increasing P-E fit will enhance commitment only when environmental supplies fall short of personal preferences (Livingstone et al., 1997; Pee & Min, 2017). Once actual supplies exceed individuals' preferred levels, the growth of personal performance will continue, begin to turn negative, or keep constant (Edwards, Cable, Williamson, Lambert, & Shipp, 2006; Pee & Min, 2017). In particular, personal performance will keep on developing positively when the excess is able to satisfy other potential or future personal needs, and however will develop negatively if the excess threatens the fulfilment of other needs or creates strain. If the excess cannot meet future needs but does not have any negative impacts, personal performance will remain constant. These studies support the idea that there exists a nonlinear relationship between P-E fit and personal performance. However, these studies measure the degree of P-E fit in an indirect way, which may misunderstand the concept of fit because the excess reflects a poor fit rather than a good fit. Consequently, continuing to grow, starting to drop, or remaining constant cannot result from the level of high P-E fit, but as a result of the poor fit.

This study measures P-E fit in a direct way to explore whether the perceived P-E fit will exert a nonlinear effect on community commitment, and such measures have been validated in prior studies (Beasley et al., 2012; Greguras & Diefendorff, 2009). The concept of needs-supplies fit emphasizes that environmental supplies, resources, and opportunities can satisfy personal needs and preferences, and it involves a person's evaluation about the environment based on their personal preferences (Caplan, 1987). When the actual environment falls short of individual needs, increasing needs-supplies fit by improving environmental supports will motivate people to exert maximum efforts to maintain their membership, and feel emotionally attached to the community (Chen & Shen, 2015; Liang, Ho, Li, & Turban, 2011). When environmental supports increase approaching to individuals' preferred levels of needs, implying a high level of needs-supplies fit, personal evaluation about the value of extra environmental supplies will display diminishing sensitivity (Mittal, Ross, & Baldasare, 1998; Streukens & De Ruyter, 2004). This is because a high level of needs-supplies fit suggests a high level of need-gratification, at which point personal motivation arousal is expected to decrease or remain constant (Livingstone et al., 1997; Vargo & Lusch, 2004). Prior studies have also indicated that the marginal value of each additional supply decreases as the total supplies increase in online communities (Gu, Konana, Rajagopalan, & Chen, 2007). Based on these arguments, the improvement in needs-supplies fit will exert a positive effect on community commitment when there is a misfit, such as when the focal community fails to satisfy customer needs. As supplies increase to the customer's preferred level, his or her desire to maintain their membership in the community will remain constant because he or she is at a high level of need gratification. Thus, we have the following hypothesis.

H2a. Needs-supplies fit has a decreasing incremental effect, such that it has (a) a positive linear effect and (b) a negative quadratic effect, on community commitment in online brand communities.

Demands-abilities fit examines the extent to which a person's abilities, knowledge, and skills can meet the demands of the surroundings, and as such, it concerns personal evaluation of his or her abilities to satisfy environmental demands (Beasley et al., 2012). Having abilities to accomplish work tasks will strengthen individual role identities and reduce personal distress, thus enhancing organizational commitment (Greguras & Diefendorff, 2009). This study predicts that demands-abilities fit will exert different effects on commitment in different phases. When people believe that their abilities are far from meeting the demands of the environment, people will be less likely to maintain their membership because people will not even try if success is unachievable (Vancouver, More, & Yoder, 2008). People usually use their capacity beliefs (i.e., demands-abilities fit) to determine whether they should pursue a goal, and they will not pour energy into a goal which requires their abilities to exceed some threshold (Carver & Scheier, 2001). This phase is called "the different zone", where personal motivations are not activated, and any increase in perceived fit between personal abilities and environmental demands will not necessarily lead to an increase in users' desires to maintain their membership (Beck & Schmidt, 2012; Sun, Wang, Yin, & Zhang, 2015). As personal abilities grow beyond the activation point, suggesting improvements in demands-abilities fit, the perceived probabilities of success will increase and maintaining membership will cost less time, which justifies additional efforts towards pursuing goals (Sun et al., 2015). Based on these arguments, demands-abilities fit will have a negligible effect on community commitment when customers perceive a poor fit, such as when their abilities fall behind the community's demands, because their motivations are not activated. Beyond the activation point, increase in demands-abilities fit will motivate customers to exert efforts to maintain a lasting relationship with the focal brand community, because their beliefs about the probabilities of success increase. Thus, we have the following hypothesis.

H2b. Demands-abilities fit has an increasing incremental effect, such that it has (a) a positive linear effect and (b) a positive quadratic effect, on community commitment in online brand communities.

2.3. Control variables

This study further incorporates several control variables in the research model to exclude alternative explanations. First, in addition to the desires-supplies perspective that involves the complementary fit, there is another corresponding P-E fit paradigm, supplementary fit, which occurs when people share similar value beliefs with the surroundings (Cable & Edwards, 2004; Matzler, Pichler, Füller, & Mooradian, 2011). Since we cannot expect that environmental value orientation will be less or greater than that of personal value beliefs

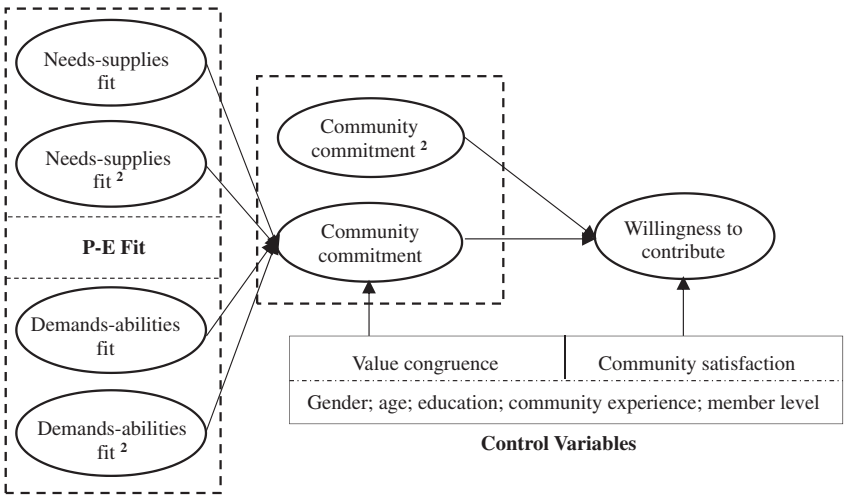


Fig. 1. Research model.

(Ostroff et al., 2005), the current study only controls the linear impact of value congruence in the model. Second, since satisfaction has been widely regarded as a crucial driver of human behavioral decisions, this study also controls for the effect of community satisfaction in the model (Liang et al., 2011; Morgan & Hunt, 1994). In addition, we control for several demographic characteristics, such as age, gender, education, community experience, and member level to ensure the robustness of the research model. Fig. 1 depicts the research model in this study.

3. Method

3.1. Research setting

This study chooses the XiaoMi Community (http://bbs.xiaomi.cn/), one of the most famous online brand communities in mainland China, as the research setting, and the target population is XiaoMi Community users. As a leading mobile internet company in China, XiaoMi was founded on April 2010, and after a five-year rapid development, XiaoMi sold 70 million smartphones and generated over $12.5 billion in 2015, accounting for approximately 15% of the Chinese smartphone market. XiaoMi has repeatedly underscored the importance of customers' knowledge contribution in its online brand community (i.e., XiaoMi Community) to its rapid growth and great success. Motivated by the quick success of XiaoMi, Chinese mobile phone brands such as Huawei, Vivo and Meizu have invested substantially in building and managing their online brand communities. XiaoMi Community is made up of product users and brand fans, and community users can discuss a variety of topics around the brand and the product usage experience. In addition, community users can participate in various community activities regularly sponsored by XiaoMi, such as fan festivals and local meetups, which will help tie customers to the brand and the community. As of July 2016, there are over 300 million of posts in XiaoMi Community, and these posts are not only concerned about solving problems and sharing usage experience but also about discussing various activities in the community. Therefore, XiaoMi Community is believed to be an appropriate online brand community to investigate users' commitment and knowledge contribution behavior.

3.2. Measure development

All the major constructs in the model were measured with items adapted from previous studies with some modifications to fit the current context. Demands-abilities fit, needs-supplies fit, and value congruence were measured with scales adapted from Beasley et al. (2012). Scales of community commitment were adapted from Liang et al. (2011) and Bateman, Gray, and Butler (2011). Willingness to contribute was measured with scales adapted from Tong, Wang, Tan, and Teo (2013). Community satisfaction was measured with items adapted from Bhattacherjee (2001). All the items were designed as closed-ended structured questions and were phrased on a seven-point Likert scale. The instruments were then pre-tested with fifteen doctoral students who majored in business and were familiar with the XiaoMi Community as well. Participants were asked to comment on the clarity, understandability, and organization of the scales at the end of the questionnaire, and their suggestions regarding the format, layout, and wordings of the questions were incorporated in the revised questionnaire.

3.3. Data collection and sample characteristics

Since the emailing list of all registered XiaoMi Community users was unavailable, we collected thousands of the IDs of users who had posted in the community and randomly sent them invitation messages with a URL to the online questionnaire. To balance the active and the inactive contributors, we also published a public post in the community, including a brief introduction of the survey, the targeted respondents of this study, and the lucky draw coupons for the successful respondents. To maximize the possible responses, we further stuck the post to the front page of various boards in XiaoMi Community with the help of community managers. Finally, we received 480 valid responses. Table 1 presents their demographic characteristics.

3.4. Common method bias

Since all the constructs were measured using a self-report survey where the same respondent subjectively responded to the questions in a single survey at the same time, the potential common method bias should be a concern. We performed Harman's single-factor test, a widely employed method to assess the degree of common method bias (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Results indicated the first primary component failed to explain most of the variance, and therefore, the common method bias in this study is not a serious concern. Following the guideline proposed by Liang, Saraf, Hu, and Xue (2007), we further included a common method factor in the proposed model, and measured it reflectively with all indicators of constructs in the proposed model. The results indicated the common method factor explained 0.34% of the variance, while the substantive factors explained 73.12% of the variance. Therefore, the common method bias would be less likely to compromise the credibility of the data analysis results.

Table 1
Demographic characteristics of respondents (N = 480).

Characteristics	Frequency	Percentage	Characteristics	Frequency	Percentage
Gender			Duration of per visiting (min)		
Male	246	51.3	≤ 10	114	23.8
Female	234	48.7	10–20	154	32.0
Education			20–40	132	27.5
≤ Junior College	120	25.0	> 40	80	16.7
Undergraduate	336	70.0	Experience with XiaoMi Community		
≥ Postgraduate	24	5.0	< 3 months	66	13.8
Age			3–6 months	95	19.8
< 22	189	39.3	7–12 months	106	22.1
22–30	225	46.9	1-2 years	137	28.5
> 30	66	13.8	> 2 years	76	15.8
Member level (Note: the highest member level in XiaoMi Community is Lv. 7)					
Lv. 1	126	26.3	Lv. 4	54	11.3
Lv. 2	72	15.0	Lv. 5	47	9.8
Lv. 3	103	21.4	> Lv. 5	78	16.2

4. Data analysis and results

We followed traditional psychometric procedures to conduct data analysis, and structural equation modeling (SEM) technique was used to test the research model and the associated hypotheses. There are two modeling approaches, i.e., covariance-based SEM with LISREL and component-based SEM with Partial Least Squares (PLS). However, statistical power of PLS approach in analyzing interaction and quadratic effects has been questioned in the literature (Ping, 1995; Goodhue, Lewis, & Thompson, 2007). Accordingly, we used the covariance-based SEM approach, and the two-step technique of single-indicant estimation method as proposed by Ping (1998) to conduct the nonlinear model analysis.

4.1. Measurement model

We performed a confirmatory factor analysis in LISREL 8.7 to assess the measurement model, generating satisfactory results for the data (χ^2 [174] = 330.704; χ^2/df = 1.901; $p < 0.001$; GFI = 0.938; CFI = 0.989; NFI = 0.979; RMSEA = 0.043; SRMR = 0.040). In addition, construct reliability can be evaluated by checking the composite reliability (CR) and the average variance extracted (AVE). A CR value of more than 0.70 and an AVE value of more than 0.50 are satisfactory (Fornell & Larcker, 1981). Cronbach's α (CA) values were calculated to evaluate the construct reliability as well, whose recommended threshold was 0.7 (Fornell & Larcker, 1981). Table 2 showed all indicators exceeded the recommended thresholds, suggesting good reliability for all constructs.

Convergent validity refers to the degree to which theoretically related measures of a given construct in fact are related, and thus, the loadings of items on their theoretically related constructs should be higher than 0.7 (Fornell & Larcker, 1981). Table 2 indicated that loadings of all items exceeded the recommended threshold, suggesting that all of the constructs had acceptable convergent validity. Discriminant validity measures the extent to which one construct differs from others, and it can be evaluated by checking whether the square root of AVE for a construct is greater than the correlation coefficients between this construct and all others. Table 3 showed all the constructs exhibited satisfactory discriminant validity. This study also calculated the variance inflation factor (VIF) values of all the major constructs to assess the potential degree of multicollinearity. Results indicated the VIF values for demands-abilities fit, needs-supplies fit, value congruence, community commitment, community satisfaction, and willingness to contribute were 1.522, 2.173, 2.244, 1.958, 1.320, and 1.593, respectively. Thus, the VIF values for all of the constructs were below the suggested criteria threshold of 10 and the more stringent threshold of 3 (Diamantopoulos, 2011), suggesting that multicollinearity is not a serious problem in our analysis.

Table 2
Construct reliability and validity (N = 480).

Measures	Loadings
Community commitment, (AVE = 0.584, CR = 0.849, CA = 0.848)	
I feel a sense of belonging to XiaoMi Community	0.794
I have a real emotional attachment to XiaoMi Community	0.791
I am proud to belong to the membership of XiaoMi Community	0.753
I care about the long-term success of XiaoMi Community	0.717
Demands-abilities fit, (AVE = 0.638, CR = 0.875, CA = 0.874)	
My education and abilities are a good match for the demands XiaoMi Community places on me	0.768
I have the ability to meet the demands of XiaoMi Community	0.761
The match is very good between the demands of XiaoMi Community and my personal skills	0.810
I am able to meet the demands of XiaoMi Community	0.852
Needs-supplies fit, (AVE = 0.643, CR = 0.844, CA = 0.843)	
XiaoMi Community fulfills my needs	0.830
There is a good fit between what XiaoMi Community offers me and what I need in the community	0.807
XiaoMi Community that I action in has the attributes that I need in the XiaoMi Community	0.768
Willingness to contribute, (AVE = 0.627, CR = 0.835, CA = 0.834)	
I would like to answer the questions posted by other members in XiaoMi Community	0.788
It is likely for me to answer the questions posted by other members in XiaoMi Community	0.778
I am willing to answer the questions posted by other members in XiaoMi Community	0.810
Community satisfaction, (AVE = 0.646, CR = 0.878, CA = 0.873)	
How do you feel about your overall experience of using XiaoMi Community:	
Very displeased/very pleased	0.791
Very frustrated/very content	0.907
Absolutely terrible/absolutely delighted	0.841
Value congruence, (AVE = 0.649, CR = 0.847, CA = 0.846)	
My personal values are similar to those of XiaoMi Community.	0.821
My values prompt me to fit in with XiaoMi Community.	0.810
The values of XiaoMi Community reflects my own values.	0.786

4.2. Hypothesis testing

Following the procedure of Ping (1998) that has been widely used to examine interaction and nonlinear effects in prior studies (Agustin & Singh, 2005; Bhuian, Menguc, & Borsboom, 2005; Titah & Barki, 2009), we first created three quadratic latent variables, needs-supplies fit^2, demands-abilities fit^2, and community commitment^2, which all were measured with a single indicator. The single indicator was achieved by calculating the product of the sum of all of the construct's indicators. All

Table 3
Descriptive statistics of constructs (N = 480).

	Mean	S.D.	GEN	AGE	EDU	COE	ML	VC	NSF	DAF	COC	COS	WTC
GEN	1.487	0.500	–										
AGE	3.156	1.124	0.417***	–									
EDU	2.746	0.631	0.307***	0.109*	–								
COE	3.129	1.286	0.129**	0.398**	0.046	–							
ML	4.560	2.639	0.082	0.281***	0.053	0.480***	–						
VC	5.303	0.995	0.129**	0.070	0.018	0.190***	0.220***	**0.806**					
NSF	5.453	0.957	0.077	0.089	0.017	0.188***	0.227***	0.669***	**0.802**				
DAF	5.369	0.890	0.149**	0.115*	0.158**	0.165***	0.197***	0.514***	0.487***	**0.799**			
COC	5.547	0.956	0.013	0.095*	− 0.093*	0.212***	0.235***	0.617***	0.6040***	0.437***	**0.764**		
COS	5.745	0.997	− 0.010	− 0.056	− 0.070	0.080	0.151**	0.412***	0.391***	0.378***	0.388***	**0.804**	
WTC	5.811	0.827	0.008	0.151**	− 0.076	0.235***	0.216***	0.488***	0.516***	0.427***	0.523***	0.367***	**0.792**

Notes: 1. $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$; 2. The square root of AVE is reported along the diagonal in bold. 3. GEN = gender; AGE = age; EDU = education; COE = community experience; ML = member level; VC = value congruence; NSF = needs-supplies fit; DAF = demands-abilities fit; COC = community commitment; COS = community satisfaction; WTC = willingness to contribute.

indicators were mean-centered in order to eliminate potential multicollinearity problems and to avoid biased estimates of coefficients (Bhuian et al., 2005; Ping, 1995; Titah & Barki, 2009). The loadings $\lambda_{x:x}$ and error variances $\varepsilon_{x:x}$ of the product indicators were calculated based on Agustin and Singh (2005) using the following equations:

$$\lambda_{x:x} = \Gamma_x \Gamma_{x,} \text{ where } \Gamma_x = (\sum \lambda_{xi})/n_{x,} \text{ and } n_x \text{ is the number of X indicators} \quad (1)$$

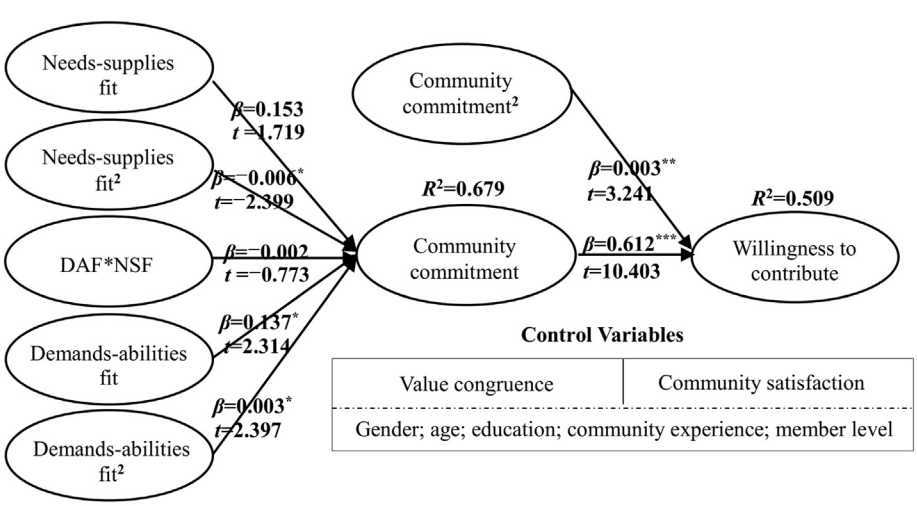
$$\varepsilon_{x:x} = 4\Gamma_x^2 \mathrm{Var}(X)\theta_x + 2\theta_{x,}^2 \text{ where } \theta_x = (\sum \varepsilon_{xi})/n_x^2 \quad (2)$$

In particular, λ_{xi} and ε_{xi} were the loadings and errors of the indicators of the linear variables, respectively, which were obtained in the measurement model analysis. The structural model with quadratic and interaction variables was then examined in LISREL 8.7, in which the loadings and error variances for each single product indicator were fixed with the calculated values obtained from Eqs. (1) and (2). SEM results indicated an excellent fit of the research model to the data, with χ^2 [317] = 688.635; χ^2/df = 2.172; $p < 0.001$; GFI = 0.913; CFI = 0.979; NFI = 0.963; RMSEA = 0.050; SRMR = 0.046.

Fig. 2 depicts the SEM results of unstandardized solutions. Specifically, community commitment has a positive quadratic effect ($\beta = 0.003$; $t = 3.241$), and a positive linear effect ($\beta = 0.612$; $t = 10.403$) on willingness to contribute. It is necessary to check whether the turning point is located within the data range before we claim the shape of the relationship (Haans, Pieters, & He, 2016). The turning point is obtained by calculating $-\beta_1/2\beta_2$, where β_1 is the coefficient of the linear term and β_2 is the coefficient of the quadratic term. The value of $-\beta_1/2\beta_2$ should be de-normalized to achieve the original turning point. In this study, the turning point of the relationship between community commitment and willingness to contribute is located at the left side of the data range, suggesting a U-shape merely on the right-side. In this regard, community commitment imposes an increasing incremental effect on willingness to contribute, supporting H1.

Needs-supplies fit has a negative quadratic effect ($\beta = -0.006$; $t = -2.399$), but no linear effect ($\beta = 0.153$; $t = 1.719$) on community commitment. The turning point of the inverse U-shape is located at the right side of data range, suggesting an inverted-U shape, but only on the left side. As such, needs-supplies fit has a decreasing incremental effect on community commitment, which supports H2a. Demands-abilities fit exerts a positive quadratic effect ($\beta = 0.003$; $t = 2.397$) and a positive linear effect ($\beta = 0.137$; $t = 2.314$) on community commitment, with the turning point at the left side of the data range, suggesting a just right-half U-shaped relationship. This observation supports H2b. The interaction effect of needs-supplies fit and demands-abilities fit on community commitment is insignificant, with path coefficient at -0.002 ($t = -0.773$).

Furthermore, value congruence is positively associated with community commitment ($\beta = 0.544$; $t = 6.096$), and community satisfaction exerts a positive effect on willingness to contribute ($\beta = 0.164$; $t = 3.481$). Demographic variables, such as age ($\beta = 0.048$; $t = 1.303$), community experience ($\beta = 0.024$; $t = 0.732$), and member level ($\beta = 0.011$; $t = 0.737$), have no effects on community commitment,



1. *p<0.05, **p<0.01, ***p<0.001;
2. NSF=needs-supplies fit; DAF=demands-abilities fit.

Fig. 2. Results of SEM.

Table 4
Results of multiple regression analysis.

	Model 1		Model 2		Model 3		Model 4	
	COC		COC		WTC		WTC	
	β	S.E.	β	S.E.	β	S.E.	β	S.E.
(Constant)	0.000	0.127	0.111	0.173	0.000	0.093	− 0.175	0.111
Gender	− 0.483	0.295	− 0.453	0.294	− 0.217	0.215	− 0.145	0.215
Age	0.125	0.136	0.088	0.134	0.231*	0.100	0.224*	0.100
Education	− 0.683**	0.214	− 0.710***	0.212	− 0.106	0.157	− 0.103	0.156
Community experience	0.141	0.119	0.112	0.118	0.166	0.088	0.169	0.087
Member level	0.067	0.056	0.070	0.056	0.022	0.041	0.011	0.041
Demands-abilities fit	0.130**	0.044	0.198***	0.047	–	–	–	–
Needs-supplies fit	0.401***	0.061	0.314***	0.065	–	–	–	–
Value congruence	0.438***	0.060	0.423***	0.060	–	–	–	–
Demands-abilities fit^2	–	–	0.020**	0.007	–	–	–	–
Needs-supplies fit^2	–	–	− 0.037**	0.014	–	–	–	–
DAF*NSF	–	–	− 0.012	0.013	–	–	–	–
Community commitment	–	–	–	–	0.266***	0.027	0.307***	0.031
Community satisfaction	–	–	–	–	0.125***	0.026	0.117***	0.026
Community commitment^2	–	–	–	–	–	–	0.012**	0.004
R^2	0.480	–	0.499	–	0.331	–	0.342	–
ΔR^2	–	–	0.019	–	–	–	0.011	–
ΔF^2	–	–	6.205***	–	–	–	8.293**	–

Notes: $^*p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$; NSF = needs-supplies fit; DAF = demands-abilities fit; COC = community commitment; WTC = willingness to contribute; S.E. = standard errors.

while gender and education have a negative effect on community commitment, with path coefficients at − 0.166 ($t = -2.022$) and − 0.180 ($t = -3.044$), respectively. Age has a positive effect on willingness to contribute ($\beta = 0.091$; $t = 2.112$), while gender, education, community experience, and member level have no influences on willingness to contribute with path coefficients at − 0.062 ($t = -0.680$), − 0.028 ($t = -0.419$), 0.058 ($t = 1.557$), and − 0.003 ($t = -0.143$), respectively. All exogenous variables have explained 67.9% of the variance in community commitment and 50.9% of the variance in willingness to contribute.

4.3. Multiple regression analysis

After mean centering the data, we conducted a multiple regression analysis using the unstandardized coefficient estimates to ensure the robustness of the findings. As shown in Table 4, demands-abilities fit exerts a positive linear effect ($\beta = 0.198$; $t = 4.199$) and a positive nonlinear effect ($\beta = 0.020$; $t = 3.021$) on community commitment. Needs-supplies fit has a positive linear effect ($\beta = 0.314$; $t = 4.856$) and a negative nonlinear effect ($\beta = -0.037$; $t = -2.720$) on community commitment. After entering the nonlinear and interaction terms, the nonlinear Model 2 elevates the R^2 from 48.0% to 49.9%, indicating a great improvement in explaining the research model, compared with the linear Model 1. Considering the turning points, H2a and H2b are also confirmed. In addition, community commitment exerts a positive linear effect ($\beta = 0.307$; $t = 9.987$) and a positive nonlinear effect ($\beta = 0.012$; $t = 2.880$) on willingness to contribute, wherein the turning point is at the left side of the data range. Model 4 yields a R^2 variation of 1.1%, compared with Model 3, and H1 is confirmed.

4.4. Interpreting and visualizing nonlinear effects

Following Ping (1998), we further analyzed the factored coefficients or partial derivatives of the variables to interpret the nonlinear effects. Based on the SEM results, we can draw the following structural equations where control variables are omitted for clarity:

$$\text{WTC} = 0.003\text{COC}*\text{COC} + 0.612\text{COC} \tag{3}$$

$$\text{COC} = -0.006\text{NSF}*\text{NSF} + 0.153\text{NSF} + 0.003\text{DAF}*\text{DAF} + 0.137\text{DAF} - 0.002\text{DAF}*\text{NSF} \tag{4}$$

where "COC = community commitment", "NSF = needs-supplies fit", "WTC = willingness to contribute", and "DAF = demands-abilities fit". In particular, the factored coefficient of the quadratic can measure the slope of the regression line, keeping other variables constant (Ping, 1998). That is, "$\text{Coef.}_{\text{COC}} = (0.612 + 0.006\text{COC})$" represents the partial derivative of WTC with regard to COC. "$\text{Coef.}_{\text{NSF}} = (0.153 - 0.012\text{NSF})$" suggests the partial derivative of COC with regard to NSF, with DAF constant. "$\text{Coef.}_{\text{DAF}} = (0.137 + 0.006\text{DAF})$" shows the derivative of COC with regard to DAF, with NSF constant. Interaction term is disregarded in analysis since its coefficient is insignificant. As shown in Table 5, the factored coefficient of COC increases as COC increases, suggesting that community commitment exerts an increasing incremental positive effect on willingness to contribute. Likewise, the factored coefficient of DAF increases as DAF increases, whereas the factored coefficient of NSF decreases as NSF increases. In this regard, needs-supplies fit has a decreasing incremental effect, while demands-abilities fit has an increasing incremental effect on community commitment. Furthermore, we use the response surface methodology to visualize surface characteristics of Eq. (4), as illustrated in Fig. 3. The nonlinear relationship between community commitment and willingness to contribute as described in Eq. (3) is depicted in Fig. 4.

Table 5
Factored coefficients of community commitment and P-E fit factors.

COC	Coef. COC	NSF	Coef. NSF	DAF	Coef. DAF
1	0.618	1	0.206	1	0.111
2	0.624	2	0.194	2	0.117
3	0.630	3	0.182	3	0.123
4	0.636	4	0.170	4	0.129
5	0.642	5	0.158	5	0.135
5.547	0.645	5.453	0.153	5.369	0.137
6	0.648	6	0.146	6	0.141
7	0.654	7	0.134	7	0.147

Notes: 1. COC, NSF, and DAF are all standardized before analysis. 2. NSF = needs-supplies fit; DAF = demands-abilities fit; COC = community commitment.

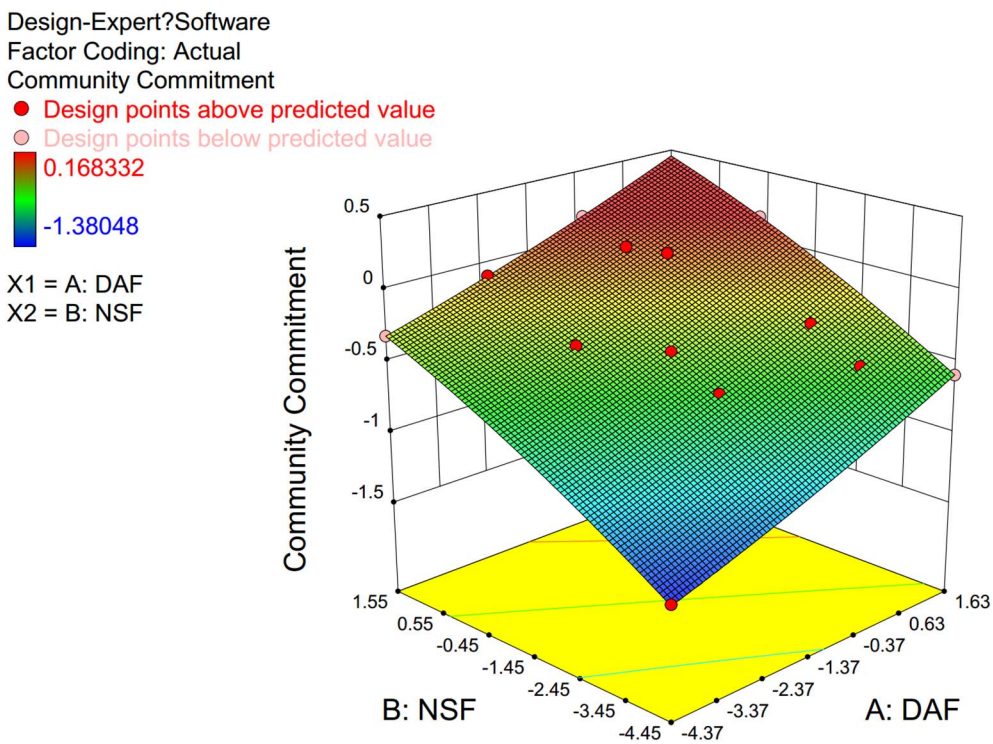


Fig. 3. The nonlinear effects of NSF and DAF on COC.

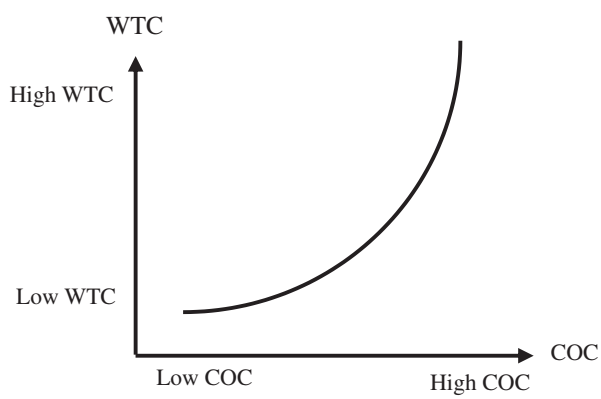


Fig. 4. The nonlinear effect of COC on WTC.

5. Conclusion and discussion

Along with the popularity of value co-creation, online brand communities have emerged as an important channel for firms to cultivate and enhance the brand-customer relationships. The success of online brand communities is inseparable from users' active contributions, such as sharing their consumption experience, discussing usage problems, and making comments on newly listed products. In this study, we developed a research model based on person-environment fit theory to investigate customer contribution in online brand communities. We further unraveled the nonlinear mechanism through which P-E fit factors affected customers' contribution intention in the community through community commitment. We identified two types of P-E fit factors, needs-supplies fit and demands-abilities fit. We evaluated data from 480 surveys and found that needs-supplies fit had a decreasing incremental effect, whereas demands-abilities fit had an increasing incremental effect on community commitment. These findings confirmed the diminishing sensitivity of positive effect that needs-supplies fit exerted on community commitment, and that demands-abilities fit would exert an increasing positive effect on community commitment. We also found that community commitment had an increasing incremental effect on willingness to contribute in online brand communities. It suggested unit changes in community commitment in a high level would have a greater positive effect on contribution intention.

5.1. Theoretical implications

This study contributes to current research in following ways. First, this study explores the effects of interaction between the customer and the community from a P-E fit angle, thus enriching current research on customer behavior in online communities. Existing research on customer behavior in virtual communities is either focused on identifying motivational drivers of customer behavior at the customer level, or investigating the effects of community features and firms' efforts at the environment level. Since P-E fit measures the congruity between the person and the environment and it has been well established in the organizational context, an analysis that focuses on fit will combine the joint influences of the customer and the community on customer behavior in online brand communities. Thus, this study extends P-E fit theory to the online setting, contributing to the application of P-E fit theory itself, and further suggests that the P-E fit framework is a novel and solid theoretical framework to guide future research on customer behavior in online brand communities.

Second, this study elaborates on the mechanism of how directly measured P-E fit affects community commitment in online brand communities. Previous studies on the nonlinear effects of P-E fit mainly measure the fit indirectly and justify the nonlinear effects of P-E fit by stressing the negative influences of the excess of environmental supplies. This study measures P-E fit with people's direct perceptions of the extent to which personal and environmental attributes match. Using these direct measures of P-E fit, this study confirms that a high level of P-E fit will not have a negative influence and that an excess of environmental supplies implies a poor fit instead of a good fit. Hence, this study contributes to current P-E fit research by measuring fit directly when investigating the nonlinear effects of P-E fit.

Third, this study shows that a nonlinear relationship exists between community commitment and contribution intention. Although there are a few studies investigating the nonlinear effects of commitment, these

studies mainly highlight the negative consequences of over-commitment and suggest a ceiling to the positive influences of commitment. With reference to commitment literature, this study differentiates the nonlinear effects of commitment in terms of the continuance, normative, and affective dimensions of commitment. In particular, this study focuses on the nonlinear effect of affective commitment and further reveals the increasing incremental effect of affective commitment, which is different from that of normative and continuance commitment. Therefore, this study suggests that a nonlinear model can be used to investigate the effect of affective commitment and that the results of a nonlinear relationship may differ depending on whether commitment is measured by its continuance, normative or affective components.

5.2. Managerial implications

This study also offers suggestions for online brand community management. First, we find community commitment has an increasing increment effect on willingness to contribute in online brand communities. It suggests that unit changes at a high level of community commitment will motivate customers to make more contribution than if those same changes are to occur at the low level of community commitment. Thus, a same level of efforts at customer relationship maintenance will attract customers with higher community commitment to contribute more than those with lower community commitment. Accordingly, brand managers should segment customers according to their level of affective commitment. Managers can obtain this information by doing customer research using surveys in the community, and they should allocate more resources to highly committed customers to promote their contributions.

Second, the results indicate that a good fit between the customer and the community will enhance customers' community commitment. If brand managers merely pay attention to factors from either the customer or the community, but ignore the fit between them, their efforts at increasing customers' community commitment will likely be ineffective. In this regard, managers should manage the community by paying attention to customer-community fit. In terms of needs-supplies fit, managers should offer adequate resources, such as purchasing opportunities, the latest product information, and coupons, to meet customers' needs in the community. In terms of demands-abilities fit, managers should make members feel competent enough to perform community tasks. Managers can segment users based on education, community experience, and product usage experience of customers and invite different users to conduct different tasks in the focal community. In addition, managers can also issue clear instructions on how to participate in the community.

Third, our results suggest that needs-supplies fit exerts a decreasing incremental effect, while demands-abilities fit has an increasing incremental effect on community commitment. It will be unfortunate and inappropriate if brand managers take our results to imply that needs-supplies fit is not important for enhancing community commitment. Rather, our results indicate that needs-supplies fit involves the fulfilment of customers' needs and that community commitment won't work to motivate customers to contribute until customers' lower-needs are satisfied. Thus, managers can use a two-stage strategy to enhance community commitment; that is, managers should focus on the needs-supplies fit at the beginning and then pay attention to the demands-abilities fit.

5.3. Limitations and future research

This study also has several limitations that need further research to address. First, although this study suggests there exists a nonlinear relationship between community commitment and contribution intention in online brand communities, some other crucial factors such as trust and loyalty are ignored in the proposed model. Hence, future studies can explore other potential nonlinear relationships in online brand communities. Second, although this study explores how P-E fit affects customer contribution via community commitment, a possible question is whether P-E fit factors and community commitment can interact to affect customers' intentions to contribute in online brand communities. Thus, we invite scholars to use fuzzy-set qualitative comparative analysis to further explore potential combinations of P-E fit factors and community commitment that can facilitate customer contribution in online brand communities. Third, the self-selected nature of the online survey method may result in some unavoidable bias problems, which impose a potential threat to the validity of the findings. Future research could collect observable data such as participants' posting frequency, coupled with their subjective data, to better understand customers' contribution behavior in online brand communities. Last but not least, all the constructs in the research model were measured using seven-point Likert scales, and the respondents were asked to choose one category to express their perceptions about the investigated questions. Notably, measuring the constructs using an interval scale will be more informative than using an ordinal scale, and this study conveniently assumed interval scales. Future research should certainly delve into the assumptions behind interval scales in the context of customer contribution.

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