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The structural equation analysis of perceived product innovativeness upon brand loyalty based on the computation of reliability and validity analysis

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Abstract Based on the theory of perceived product innovativeness and brand value, this study divides perceived product innovativeness into perceived newness and perceived meaningfulness, while introducing brand image and customer perceived value as mediators and consumer innovativeness as moderator to study the influence mechanism of consumer perceived product innovativeness on brand loyalty. Our research results show that: perceived product innovativeness will not only have a significant positive impact on brand loyalty, but will also have an indirect positive impact on brand loyalty through brand image and customer perceived value; furthermore, consumer innovativeness positively regulates the impact of perceived product innovation on brand image, but has no significant moderating effect on the relationship of perceived product innovativeness and brand loyalty. These findings also provide a theoretical basis for enterprises to improve consumer brand loyalty, excavate potential customers, and focus on brand experience.

1 Introduction

Recently, Chinese people have been keen to make "overseas purchases," with their purchasing patterns. On the one hand, this trend reflects the fact that Chinese enterprises cannot meet the needs of consumers; on the other hand, it also highlights the shortcomings of Chinese enterprises in the realm of brand building. Therefore, the academic community has taken a great interest in how to help enterprises improve their ability to develop new products, enhance brand competitiveness, and gain a competitive advantage.

More literature studies how to improve the brand competitiveness of enterprises through scientific and technological innovation from the perspective of enterprise. Technological innovation is one of the most important factors to enhance brand value. Wang quantifies the influence of technological innovation on enterprise brand value by factor analysis and linear regression analysis, showing that there is a significant positive correlation between technological innovation and brand value [1]. Tang makes a comparative study of the technology innovation drive and brand relationship influence, concluding that the driving force of technological innovation is obviously higher than that of consumer brand relationship [2].

New product development is one of the most important issues in business research and Product innovation is an important driving force enabling enterprises to gain a competitive advantage [3]. However, more than one of every three new product will fail in the market introduction period [4]. Prior innovation studies focus on the perspective of enterprise and how product innovation can influence marketing performance [5], but consumer awareness and judgment of product innovation are seldom considered. Some scholars have studied product innovation from the consumer perspective, and promoted the concept of perceived product innovativeness. Rogers first proposed the concept of perceived product innovation, and defined as a product which differs from other similar products in terms of novelty and practical purpose to a subjective degree based on the judgment of consumers. Although most scholars treat perceived product innovativeness as a multidimensional variable, Rogers divides it into

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two dimensions: perceived newness and perceived meaningfulness. The existing research mainly focuses on the impact of perceived product innovativeness on the attitude and purchasing behaviour of consumers. Perception of product innovativeness will indirectly affect consumer purchase intention toward new products through its influence upon product likeability [6].

This leads us to query: what impact does perceived product innovativeness have on brand loyalty? Under what conditions will these effects occur? The existing studies do not answer these questions. Therefore, the purpose of this study is to discover the relationship among perceived product innovativeness and brand loyalty, and the study's organization is as follows: Sect. 2 presents the conceptual framework and research hypotheses. Sections 3 and 4 describe the research methodology, including the variable measures, the data collection, and the data analysis and results. Following the presentation of results, Sect. 5 discusses the theoretical contributions, the managerial implications, and the limitation of this study.

2 Literature review and research hypotheses

2.1 Perceived product innovativeness and brand loyalty

Perceived product innovativeness is a comprehensive reflection of uniqueness, diversity, and newness which consumers can feel; this combined set of feelings can prompt impulse buying in consumers. Innovative products have symbolic social value, can highlight personality and identity, and are more likely to produce brand loyalty. Technological innovations can effectively enhance the brand value of enterprises, especially in technology-intensive industries. The more consumers perceive innovations, the more potential to prompt purchases innovative products have. On the basis of full investigation of the market brand assets, Charles Gemma found that technology innovation enterprises can bring more value for their own interests [7]. Olutayo Otubanj took Sony Corp as an example, and proposed that technological innovation can effectively enhance the brand value of enterprises, especially in technology intensive industries [8]. The highly consumers value innovations, the more potential to prompt purchases innovative products have [9], and some scholars find that perceived product innovativeness positively influences consumers' attitudes toward products [10], and buying intentions [11]. Finally, repeat purchase behavior will form the brand loyalty. Therefore, this study makes the following assumptions:

H1 perceived product innovativeness has a positive effect on brand loyalty.
H1a perceived newness has a positive effect on brand loyalty.

H1b perceived meaningfulness has a positive effect on brand loyalty.

2.2 Perceived product innovativeness and brand image

Brand image is composed of the concepts, feelings, and attitudes about a brand held by consumers [12]. Scholars define the brand image for the overall perception of brand based on product attributes and advertising and other marketing activities after that. From the company's point of view, enterprise innovation behavior can help create a good brand image [13]. Therefore, the following assumptions are presented in this study:

H2 perceived product innovativeness has a positive effect on brand image.
H2a perceived newness has a positive effect on brand image.
H2b perceived meaningfulness has a positive effect on brand image.

2.3 Brand image and brand loyalty

The relationship between brand image and brand loyalty has been tested and verified by some scholars from different angles. Through the empirical research of e-commerce enterprises, a study has proved the positive correlation between brand image and brand loyalty, moreover, it concludes that brand image has an impact on brand loyalty through the mediating effect of customer satisfaction [14]. When brand image is defined with the following dimensions: brand personality, brand performance, and corporate image, empirical analysis shows that brand personality and brand performance have a positive impact on brand loyalty, but corporate image has no significant direct impact on brand loyalty [15]. Therefore, the following assumption is presented:

H3 brand image has a positive effect on brand loyalty

2.4 Perceived product innovativeness and customer perceived value

The customer perceived value is the customer's overall evaluation of product utility, that is, the difference between customer perceived benefits and perceived pay [16]. Chinese customer perceived value research started late, with the reform and opening up and the introduction of western consumer behavior theory, China's academic research on customer perceived value began to increase significantly. Such as, an empirical research finds that the innovation behavior has a significant positive impact on customer perception [17]. Thus, the following additional hypotheses are specified:

H4 perceived product innovativeness has a positive effect on customer perceived value.

H4a perceived newness has a positive effect on customer perceived value.

H4b perceived meaningfulness has a positive effect on customer perceived value.

2.5 Brand image and customer perceived value

From the perspective of brand awareness, a study finds that brand awareness plays a key role in the consumer purchase decision-making process, prompting consumers to have a higher willingness to buy [18]. In addition, Brand image is a hint of consumers' buying information, and consumer perception of a particular brand will vary for different purchase experience [19]. Based on the study of the relationship between perceived value of brand image, customer satisfaction and brand trust, it is found that brand image has a significant positive impact on customer purchase value and customer satisfaction. The above discussions frame the following hypotheses:

H5 brand image has a positive effect on customer perceived value.

2.6 Customer perceived value and brand loyalty

For the relationship between customer perceived value and brand loyalty, the general conclusion is that customer perceived value is an important driver of customer brand loyalty, and it plays an important role in customers' high frequency repetition purchases, thus strengthening customer brand loyalty. Customer perceived value will affect purchase intention, commitment, and brand loyalty [20]. In the study of how the restaurant industry can better improve customer perceived value and maintain brand loyalty, it is shown that customer perceived value has a significant impact on brand loyalty [21]. This study assumes the following:

H6 customer perceived value has a positive effect on brand loyalty.

2.7 Consumer innovativeness as a moderator

Consumer innovativeness is a potential personal characteristic that will drive consumers to seek exposure to new things and accept change [22]. Compared to other consumers, innovative consumers pay more attention to the value of product innovation for its value to them based on their strong desire to express their unique needs [23]. At the same time, innovative consumers regard owning new products as an important way to show their individuality and win respect from others [24]. When Ma Yuanyuan published research which showed

the relationship between brand experience and customer purchase intention, it revealed that there are significant differences in the perception and evaluation of brand experience, brand attitude, and purchase intention [25]. The following hypotheses are therefore proposed:

H7 consumer innovativeness strengthens the relationship between perceived product innovativeness and brand loyalty.

H8 consumer innovativeness strengthens the relationship between perceived product innovativeness and brand image.

H9 consumer innovativeness strengthens the relationship between perceived product innovativeness and customer perceived value.
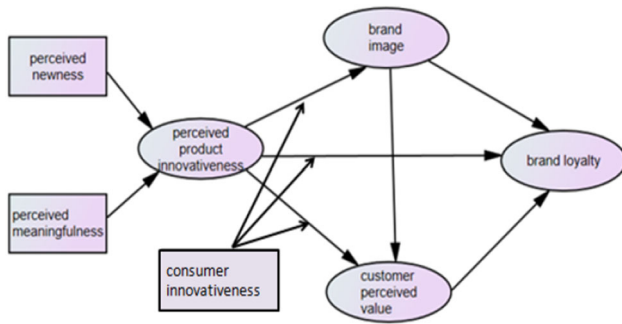
3 Research methodology

3.1 Variable measures

Perceived product innovativeness is a subjective assessment of consumers, which comes from consumers' perception of products. That is to say, the innovative products of enterprises are not necessarily the innovative products that consumers think, and the innovation that enterprises consider to be valuable is not necessarily what consumers consider to be valuable. Scholars have put forward all kinds of methods to measure perceived product innovativeness, but this article chooses the following two factors: the innovative awareness of a product different from other products (perceived newness) and the role and significance of product innovation to consumers (perceived meaningfulness) [26]. Different from perceived product value, perceived meaningfulness focus on the role and meaning of perceived products. Brand image was divided into brand performance, brand personality, and corporate image which was borrowed from Gwinner and Eaton [27]. In terms of customer perceived value, the study measured total value from a single dimension learning from Nikhashemi et al. [20]. Six scales borrowed from Shu et al. [6] was used to measure consumer innovativeness; eight scales [28] was used to measure brand loyalty. Appendix records the sources of the observed measures in the study (Fig. 1).

3.2 Data collection

This research mainly took the mobile phone as the research object and opened to the Chinese people through the questionnaire star website. The questionnaire has three parts. First, it requests the demographic information of respondents (gender, age, income, and education). Next, it asks respondents to indicate which brand of mobile phone they currently

Fig. 1 Concept model of the study

Table 1 Demographic profile respondents (N = 339)

	N	%
Gender		
Male	152	44.8
Female	187	55.2
Age		
0–20	18	5.3
21–25	58	17.1
26–30	75	22.1
31–35	70	20.6
36–40	50	14.7
41–45	34	10
46–55	21	6.2
56–above	13	3.8
Income		
0–1500	28	8.3
1500–3000	36	10.6
3000–4500	110	32.4
4500–6000	98	28.9
6000–above	67	19.8
Level of education		
Diploma	122	36
Undergraduate	152	44.8
Postgraduate or above	65	19.2

buy, and also measures the perceived product innovativeness and consumer innovativeness. The third part let respondents report the extent of their agreement with statements designed to measure customer perceived value, brand image, and brand loyalty; the respondents express agreement by using a five-point Likert-type scale which is from fully disagree (1) to fully agree (5).

In order to ensure the validity and usability of the questionnaire, a small sample test was carried out on the initial sample before the release of the formal questionnaire. Small sample test was used to make a quantitative analysis of the initial questionnaire through exploratory factor analysis, reliability analysis, and CITC and other methods; and according to the test results, the study modified or eliminated the latent variable which cannot be measured from the initial questionnaire, and ultimately a formal questionnaire was formed. The formal questionnaire was put as close as possible to the real consumer to ensure the diversity of the survey. The study collected a total of 396 questionnaires, but excluded 57 for missing large amounts of data. After trying everything possible to increase the response rate, the study got and analyzed a total of 339 questionnaires which are usable and completed. Table 1 illustrates the respondent characteristics in more detail.

4 Data analysis and results

4.1 Reliability and validity analysis

Reliability analysis was conducted to analyze the level of consistency before and after the collection of the scale, and this paper mainly uses the Alpha Cronbach's coefficient method. Cronbach's alphas in Table 2 ranged from 0.831 to 0.90, apparently, they are all higher than the 0.70 threshold suggested by Nunnally [29], thus demonstrating adequate internal consistency. In addition, the composite reliability (CR) of each of the constructs was higher than 0.70, showing that the combined reliability of each dimension was better. The average variance extracted (AVE) for each construct,

ranging from a minimum of 0.75 to a maximum of 0.93, indicated adequate construct convergent validity [30], and the squared correlation estimates were larger than each construct's AVE, showing good discriminate validity for each construct. According to the literature, these results are highly suited to most research purposes.

4.2 Structural equation analysis

According to the theoretical model, the study put perceived newness and perceived meaningfulness as independent variables, brand image and customer perceived value as mediators, and brand loyalty as the dependent variable to establish a structural equation model by using amos21.

In Fig. 2, there are five potential variables, namely, perceived newness, perceived meaningfulness, brand image, customer perceived value, and brand loyalty. Thereinto, perceived newness has four observed variables from XY1–XY4 and four Error variance of observation variables from e1–e4; perceived meaningfulness has four observed variables from YY1–YY4 and four error variance of observation variables from e5–e8; brand image has six observed variables from PX1–PX6 and six error variance of observation variables from e41–e46; customer perceived value has four observed variables from JZ1–JZ4 and four error variance of observa-

Table 2 Reliability analysis and validity analysis

	Cronbach's alpha	AVE	CR	Consumer innovativeness	Brand loyalty	Brand image	Customer perceived value	Perceived meaningfulness	Perceived newness
Consumer innovativeness	0.898	0.5575	0.8336	0.75					
Brand loyalty	0.869	0.6405	0.8763	0.289***	0.8				
Brand image	0.862	0.5517	0.831	0.361***	0.756***	0.74			
Customer perceived value	0.873	0.5583	0.8827	0.234***	0.704***	0.447***	0.75		
Perceived meaningfulness	0.831	0.5513	0.8782	0.254***	0.633***	0.465***	0.499***	0.74	
Perceived newness	0.900	0.5408	0.8755	0.210***	0.674***	0.539***	0.475***	0.605***	0.73

Below the diagonal is the correlation coefficient, the diagonal is extraction value of AVE

AVE average variance extracted, *CR* composite reliability

*** p < 0.001
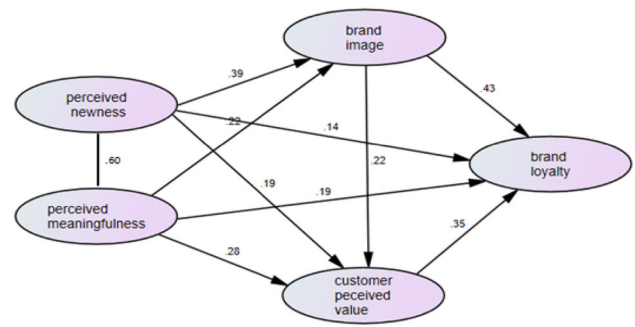
Fig. 2 Standardization way estimate of SEM

tion variables from e26–e29; brand loyalty has six observed variables from ZC1–ZC6 and six error variance of observation variables from e47–e52. The estimated parameters have 9 Standardized Path coefficient value, 24 factor loading value of observed variables and 24 error variance of observed variables.

When judging whether the structural equation model is established, it is most common to measure some fitting indexes. we can see that the structural model revealed a good fitting degree from Table 3. The ratio between the chi-square value and the degrees of freedom was within an acceptable range (x^2/df = 1.858 < 3); goodness of fit index (GFI = 0.899),adjusted goodness of fit index (AGFI = 0.874), normed fit index (NFI = 0.909),and comparative fit index (CFI = 0.956) were all above 0.85 showing that the model can be accepted; the root mean square error of approximation was below 0.08, with the recommended thresholds (RMSEA = 0.05). Therefore, the test results show that we can accept the goodness of fit of the model.

In Table 3, the standardized path coefficient of perceived newness to the brand image is 0.394 (t = 5.148, p = 0.000 < 0.05) and the standardized path coefficient of perceived meaningfulness to the brand image is 0.218 (t = 2.869, p = 0.004 < 0.05), revealing that both perceived newness and perceived meaningfulness are positively and significantly related to brand image. Thus, H2a and H2b are supported. Moreover, the perceived newness (the standardized path coefficient is 0.189, t = 2.478, p = 0.013 < 0.05) and perceived meaningfulness (the standardized path coefficient is 0.343, t = 3.744, p = 0.000 < 0.05) are positively and significantly related to customer perceived value. Therefore, hypotheses H4a and H4b are also supported.

Regarding the relationships among perceived newness, perceived meaningfulness and brand loyalty, the path analysis revealed that the influence of perceived newness on brand loyalty is positively and significantly (the standardized path coefficient is 0.133, t = 2.548, p = 0.011 < 0.05). Therefore, H1a is supported. The hypothesis of the relationship between perceived meaningfulness and brand loyalty is also

Table 3 Between the variable estimate path coefficient and the supposition check result

	Unstandardized path coefficient	Standardized path coefficient	SE	t-value	p
Brand image ⟵ perceived newness	0.333	0.394	0.065	5.148	***
Brand image ⟵ perceived meaningfulness	0.222	0.218	0.077	2.869	0.004
Customer perceived value ⟵ brand image	0.259	0.219	0.081	3.209	0.001
Customer perceived value ⟵ perceived newness	0.189	0.189	0.076	2.478	0.013
Customer perceived value ⟵ perceived meaningfulness	0.343	0.285	0.092	3.744	***
Brand loyalty ⟵ perceived newness	0.133	.0138	0.052	2.548	0.011
Brand loyalty ⟵ perceived meaningfulness	0.214	0.185	0.064	3.330	***
Brand loyalty ⟵ brand image	0.491	0.433	0.065	7.557	***
Brand loyalty ⟵ customer perceived value	0.349	0.364	0.050	6.998	***

$x^2/df = 1.858$, GFI = 0.899, AGFI = 0.874, NFI = 0.909, CFI = 0.956, RMSEA = 0.05

Table 4 Standardized effects estimates

	Perceived meaningfulness	Perceived newness	Brand image	Customer perceived value	Brand loyalty
Standardized total effect					
Brand image	0.218	0.394	–	–	–
Customer perceived value	0.333	0.275	0.219	–	–
Brand loyalty	0.401	0.409	0.513	0.364	–
Standardized direct effect					
Brand image	0.218	0.394	–	–	–
Customer perceived value	0.285	0.189	0.219	0.000	–
Brand loyalty	0.185	0.138	0.433	0.364	–
Standardized indirect effect					
Brand image	–	–	–	–	–
Customer perceived value	0.048	0.086	–	–	–
Brand loyalty	0.216	0.271	–	–	–

supported (H1b) (the standardized path coefficient is 0.214, t = 3.33, p = 0.000 < 0.05).

The standardized path coefficient of brand image to customer perceived value is 0.259 (t = 3.209, p = 0.001 < 0.05), so brand image is positively and significantly related to customer perceived value; therefore, H5 is also supported.

Finally, H3 and H6 are supported because brand image (the standardized path coefficient is 0.491, t = 7.557, p = 0.000 < 0.05) and customer perceived value (the standardized path coefficient is 0.349, t = 6.998, p = 0.000 < 0.05) are positively and significantly related to brand loyalty.

From Table 4, the total effect of perceived meaningfulness on brand loyalty is 0.401; the direct impact on brand loyalty is 0.185; the indirect effect through brand image and customer perceived value (as mediators) to brand loyalty is 0.216; the total impact of perceived newness on brand loyalty is 0.409; the direct impact on brand loyalty is 0.138; and the indirect effect through brand image and customer perceived value (as mediators) to brand loyalty is 0.271.

4.3 Moderating role of consumer innovativeness (H7–H9)

The moderating effect analysis was was conducted using the regression model, and we can see the results in Table 5. In order to improve the interpretability of the model, we use the demographic variables as control variables. Model 1 uses gender, age, and level of education as independent variables, and brand image as the dependent variable to establish a multiple regression model; model 2 adds another independent variable (perceived product innovativeness)on the basis of model 1; model 3 adds perceived product innovativeness × consumer innovativeness (the interaction term) as an independent variable on the basis of model 2. As is shown in Table 5, the regression coefficient of the control variables are not significant in model 1, revealing that gender, age, and level of education have no significant effect on brand image; perceived product innovativeness has a significant positive effect on brand image (β = 0.51, t = 10.18) in model 2; the interaction term has a significant effect on brand

Table 5 Moderating effect test results

	Brand image			Customer perceived value			Brand loyalty		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Control variable									
Gender	-0.053 (-0.734)	-0.004 (-0.071)	-0.010 (-0.157)	-0.104 (-1.438)	-0.056 (-0.886)	-0.057 (-0.907)	-0.088 (-1.206)	-0.025 (-0.458)	-0.027 (-0.480)
Age	-0.079 (-1.192)	-0.068 (-1.183)	-0.076 (-1.351)	-0.098 (-1.470)	-0.086 (-1.506)	-0.088 (-1.541)	-0.097 (-1.458)	-0.082 (-1.625)	-0.084 (-1.662)
Level of education	-0.015 (-0.227)	-0.075 (-1.320)	-0.085 (-1.515)	0.029 (0.447)	-0.031 (-0.540)	-0.033 (-0.582)	0.061 (0.931)	-0.015 (-0.307)	-0.018 (-0.350)
Independent variable									
Perceived product innovativeness		0.51*** (10.810)	0.490*** (10.53)		0.509*** (10.798)	0.504*** (10.622)		0.649*** (15.543)	0.645*** (15.335)
Interactive item									
Perceived product innovativeness × consumer innovativeness			0.178 (3.832)***			0.045 (0.952)			0.042 (0.992)
R^2	0.007	0.264	0.295	0.009	0.265	0.267	0.007	0.424	0.426
Ad R^2	-0.002	0.255	0.285	0	0.256	0.256	-0.002	0.417	0.417
F-value	0.741 (0.528)	29.962 (0.000)	27.888 (0.000)	0.994 (0.396)	30.150 (0.000)	24.295(0.000)	0.794 (0.498)	61.421 (0.000)	49.331 (0.000)

image($\beta = 0.178$, t = 3.832) in model 3, and $R^2 = 0.264$ in model 3, but $R^2 = 0.295$, significantly improved, showing the enhancement of the interpretability in this model. Thus, consumer innovativeness has significant moderating effect on the relationship between perceived product innovativeness and brand image; therefore, H8 is supported.

Next, models 4, 5, and 6 use customer perceived value as the dependent variable compared to models 1, 2, and 3. The regression coefficient of the control variables are not significant in model 4, revealing that gender, age, and level of education have no significant effect on customer perceived value. Perceived product innovativeness has a significant positive effect on customer perceived value ($\beta = 0.509$, t = 10.798) in model 5; but the interaction term has no significant effect on customer perceived value ($\beta = 0.045$, t = 0.952) in model 6, and there is no great change in the value of R^2 ($R^2 = 0.267$)compared to model 5($R^2 = 0.265$). Therefore, consumer innovativeness has no significant moderating effect on the relationship between Perceived product innovativeness and customer perceived value (H9 rejected).

Finally, models 7, 8, and 9 use brand loyalty as a dependent variable compared to model 1, 2, and 3. Once again, the regression coefficients of the control variables are not significant in model 7, revealing that gender, age, and level of education have no significant effect on brand loyalty. Perceived product innovativeness has a significant positive effect on brand loyalty ($\beta = 0.649$, t = 15.543) in model 8; but the interaction term has no significant effect on brand loyalty ($\beta = 0.042$, t = 0.992) in model 9,and there is no change in the value of R2 compared to model 8 ($R^2 = 0.417$). The results demonstrate that consumer innovativeness has no significant moderating effect on the relationship between perceived product innovativeness and brand loyalty (H7 rejected).

4.4 The discussion of the experimental results

The empirical test results are in line with our expectations, other hypotheses have been established except H7 and H9, which shows that consumers' innovative assessment of new products will translate into consumers' loyalty to the brand. IPHONE is a good example. With its full touch-screen operation, unique features and constant updates, IPHONE keeps consumers' brand loyalty by keeping consumers' innovative perception of the product. Perceived newness is different from previous product experience, which can attract consumers' attention and make consumers pay more attention to the brand and form consumer brand loyalty; for a new product or product upgrading, consumers will evaluate the practicability of the the innovations according to the collected information. If a particular product makes consumers perceive more meaningfulness of innovations, consumers will be loyal to the brand.

Consumer innovativeness as a trait of consumers, is the difference in accepting new ideas and trying new things. The empirical results of this paper shows that perceived product innovativeness has a strong positive impact on brand image in high innovative groups, but has a weak positive impact in low innovative groups. The reasons for the failure of H8 and H9 are in the following aspects: (1) Highly innovative consumers have a more rational understanding of the brand, and their loyalty to a brand is influenced by many factors; (2) The validity of the measurement questions about consumer innovativeness is worthy further study; (3) The difficult of judging the value of a new products may lead to a lack of significant adjustment between perceived product innovativeness and perceived customer value; (4) High innovative groups tend to experience the diversification of products, so they probably won't repeat purchase a particular brand, but try more innovative products, which may lead to the non-significant regulation between perceived consumer innovativeness and brand loyalty.

5 Conclusion

Through structural equations and multiple regression models, this study verifies the influence mechanism of perceived product innovativeness on brand loyalty and the moderating effect of consumer innovativeness on it. The main results are as follows: (1) perceived product innovativeness will not only have a significant positive impact on brand loyalty, but will also have a positive effect on brand loyalty indirectly through the mediating variables of brand image and customer perceived value. The influence paths are as follows: "perceived newness → brand loyalty","perceived meaningfulness → brand loyalty", "perceived newness → brand image → brand loyalty", "perceived meaningfulness → brand image → brand loyalty", "perceived newness → customer perceived value → brand loyalty", "perceived meaningfulness → customer perceived value → brand loyalty", "perceived newness → brand image → customer perceived value → brand loyalty", "perceived meaningfulness → brand image → customer perceived value → brand loyalty". (2) Consumer innovativeness positively regulates the impact of perceived product innovation on brand image; this conclusion may be because brand image is directly influenced by the factors of perceived product innovativeness, or, alternatively, it may be that higher consumer innovativeness means understanding the significance of product innovativeness more easily. In any event, consumer innovativeness has no significant moderating effect on perceived product innovation and brand loyalty.

This article has reference value for enterprises. (1) Enterprises should not only increase R&D investment and accelerate the development of new products, but also should

increase marketing efforts to ensure that consumers can subjectively feel the product innovativeness. The coordination of these two tactics, not only lead to the development of enterprise products favored by consumers, but also can effectively increase the utilization efficiency of enterprise resources. (2) Enterprises should pay more attention to the user experience of products in brand building. The product can allow consumers to experience products' newness, enable consumers to understand the real value of purchasing the products, and effectively enhance the corporate brand image. An innovative image of the brand will enhance its position in the hearts of consumers, leading to consumers loyal to the brand. (3) Highly innovative consumers have a higher perception of product innovativeness compared to low- innovative consumers; therefore, enterprises should be concerned about the high innovation group when choosing appropriate target markets, because this group is more likely to improve brand loyalty through subjective experience of product innovativeness.

Due to the influence of the author's theoretical level and empirical research ability, there are many deficiencies in the research process of this paper and the research on the relationship between product innovation and brand loyalty is worth further discussion from other factors. The limitation and prospect of this study lie in: first of all, it mainly verifies the consumer perception of mobile phone innovativeness, and the research objects are representative, but the applicability to other products such as cars, cosmetics etc. needs to be further tested. In the future studies, we need to expand the industry categories, enlarge the sample size, and sample in a broader range to test the conceptual model proposed in this study, which can make the results more universal; secondly, the moderating effect of consumer innovativeness on brand image, customer perceived value and brand loyalty does not satisfy the hypothesis. The reason is that the measure of consumer innovativeness is influenced by many factors and consumer innovativeness is as dynamic as perceived risk, which has different subjective reflection on different scenarios, so it needs to further improve consumer innovativeness measurement; thirdly, in terms of the measurement of perceived product innovativeness and brand image, this paper draws on the results of related literature, but does not represent all viewpoints. Therefore they deserve further study and discussion. Finally, there are other variables need to be included in the model to study the impact of perceived product innovativeness on brand loyalty for further study.

Appendix: Constructs, scale items and sources of measurement scales

Constructs	Scale items	Sources of measurements scales
Perceived product innovativeness	I feel this phone is interesting.	Stock and Zacharias [26]
	I feel this phone is ordinary	
	I feel this phone is unique	
	I feel this phone provides a different using experience	
	This kind of mobile phone corresponds with my needs and expectations	
	This phone is closely related to my needs and expectations	
	The innovativeness of this phone is useful	
	The innovativeness of this phone is necessary	
Consumer innovativeness	I seldom change the mobile phone	Shu et al. [6]
	I know the latest phone of this brand lately	
	I am the first people to purchase phone of this brand	
	When the phone has the latest version, I would like to buy it immediately	
	I would like to buy the latest version immediately before I know more about it	
	Compared with my friends, I would know this kind of phone sooner	
Customer perceived value	This brand of mobile phone can satisfy my needs	Nikhashemi et al. [20]
	It is worth to buy, because I get more	
	The value of the brand is higher than I expected	
	Overall, I think this brand has more value	
Brand image	This brand has advanced technology	Gwinner and Eaton [27]
	This brand has different Appearance	
	This brand makes me feel confident	
	Using this brand let me have identity and status	
	This brand makes me feel happy	
	This brand makes me feel great taste	

Constructs	Scale items	Sources of measurements scales
	The company of this brand is big	
	The company of this brand has strong scientific research ability and innovation ability	
	The company's reputation in the industry is good	
	The company of this brand has a strong sense of social responsibility	
Brand loyalty	I love this brand	Laroche et al. [28]
	Compared to other brand, I have more interest in this brand	
	I am willing to pay higher price to buy this brand	
	I would be happy to recommend this brand to my friend	
	I will actively search more information of this brand	
	When I buy mobile phones, this brand is the first choice for me	
	If have the opportunity to change other brand mobile phone, I will think seriously	
	I have a friendly feeling, when see the same brand of mobile phone	

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