

RESEARCH ARTICLE

Mechanism of brand authenticity on customer value co-creation: Mediating effect of brand trust

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ABSTRACT

This study investigates the impact mechanism of brand authenticity on the importance of customers co-creation, highlighting how brand trust acts as a mediator and the moderating influence of perceived behavioral control. Utilizing quantitative research methodologies, 368 valid samples were gathered via questionnaire surveys, and statistical techniques, including Structural Equation Modeling (SEM), were used to analyze the data. The results indicate that brand authenticity positively influences brand trust, which acts as a powerful mediator in the connection between authenticity and customer value co-creation. Perceived behavioral control serves in the role of moderator in these relationships, enhancing the positive impact when consumers perceive higher control over their behavior. Brand authenticity directly affects customer value co-creation, highlighting its role as a key driver. The study contributes theoretically by providing an in-depth analysis of the mediating role of brand trust and exploring the moderating effect of perceived behavioral control. Practically, it offers strategies for brand managers to enhance customer value co-creation by strengthening brand authenticity and trust, providing significant guidance for brand management in the digital and globalized era.

Keywords: Brand authenticity; brand trust; customer value co creation; perceived behavioral control; influence mechanism

1. Introduction

1.1. Research background

In the contemporary digital and globalized business landscape, brand authenticity has become a crucial element in establishing consumer trust and fostering customer value co creation. Brand authenticity refers to the consistency between the values, history, and personality conveyed by a brand and the actual perceptions of consumers. This consistency is crucial for building a robust and enduring relationship between consumers and brands. With the proliferation of information dissemination channels, consumers' expectations for brands have escalated, necessitating higher levels of transparency and sincerity from brands to meet these demands. Brand authenticity not only enhances consumer trust but also stimulates their active participation in brand activities, thereby facilitating customer value co-creation.

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1.2. Research questions

The research questions that this study attempts to answer are:

How does brand authenticity influence brand trust?

How does brand trust influence customer value co creation?

Does brand trust mediate a connection between brand authenticity and customer value co creation?

Does perceived behavioural control moderate the connection between brand authenticity and brand trust, as well as between brand trust and customer value co-creation?

1.3. Research significance

1.3.1. Theoretical significance

This study provides a comprehensive analysis of the mediating role of brand trust and explores the moderating effect of perceived behavioural control, offering new insights for the advancement of brand management theory. The study integrates brand authenticity, brand trust, customer value co-creation, and perceived behavioural control into a unified analytical framework, promoting the development of brand management theory.

1.3.2. Practical significance

The findings offer practical guidance for brand managers on how to enhance customer value co-creation by strengthening brand authenticity and trust. The study suggests strategies for brand managers to leverage brand authenticity and trust to encourage brand loyalty and consumer involvement in the digital sphere.

2. Literature review and research hypotheses

2.1. The relationship between brand authenticity and brand trust

Brand authenticity is considered a key factor influencing consumer trust. Schouten and McAlexander^[1] pointed out that brand authenticity is the foundation of customer confidence formation. Beverland and Farrelly^[2] emphasized the role that brand authenticity plays in building consumer trust. Chen et al.^[3] verified by empirical investigation that brand authenticity has a substantial and favourable impact on brand trust. Aaker^[4] examined how brand personality and authenticity affect brand trust, while James and Brett^[5] analyzed the impact of brand authenticity on confidence in the digital world. Yang et al.^[6] investigated how the genuineness of brand story material sources on consumer brand attitudes, including their influence on brand trust. Zhao and Li^[7] explored the dimensions of authenticity of local catering brands and their impact on recommendation intention, which indirectly reflects the influence on brand trust. Luo^[8] studied the relationship between community e-commerce identity, brand trust, and consumer loyalty, providing new insights into the impact of brand trust. Based on these studies, hypotheses are proposed:

H1: Brand authenticity has a favorable effect on brand trust, meaning that the higher the brand authenticity, the more the brand is trusted by the customer.

2.2. The relationship between brand authenticity and value co creation

Prahalad and Ramaswamy^[9] proposed the concept of value co creation and emphasized the role of brand authenticity in it. Wu and Du^[10] studied the development path and implementation the process of value co-creation in the current platform e-commerce enterprise ecosystem in China, and found that brand authenticity is a key factor. Ren et al.^[11] explored the co creation strategy of platform ecological value under the "sharing+" model, and pointed out the importance of brand authenticity. Yu^[12] discussed the mechanism of

value co creation in agricultural socialized services, including the role of brand authenticity. Qian^[13] studied the impact of nostalgic advertising types on the brand of the customer attitudes, emphasizing the mediating effect of brand authenticity. Wang et al.^[14] investigated the influencing factors of users' value co-creation actions on metaverse platforms based on a mixed research method, including brand authenticity. Tao^[15] studied the relationship between consumer fit, value co creation, and innovation performance of cross-border e-commerce enterprises, and found that brand authenticity is an important factor. Wang and Zhang^[16] studied the impact mechanism of co creating value in product experience sharing communities from a resource perspective, emphasizing the role of brand authenticity. Therefore, the proposition is as follows:

H2: Brand authenticity has a positive impact on customer value co creation, meaning that brand authenticity may directly affect customer value co creation.

2.3. The mediating role of brand trust

Zheng and Zhou^[17] studied user participation in interactive film and television experiences based on the theory of value co creation, and found that brand trust is a key mediator. Dong et al.^[18] explored the relationship between innovation capability redundancy and value creation from the viewpoint of social exchange theory, emphasizing the mediating role of brand trust. In their study of the relationship between dynamic capacities, value co-creation, and service dominant logic in innovative firms, Yao et al.^[19] discovered that brand trust is a crucial mediating factor. Li^[20] analyzed tourist value under the service led logic, providing a new perspective for understanding the application of service led logic in the tourism industry. Zhang and Zhou^[21] studied the channel innovation strategies of small and medium-sized foreign trade enterprise brands in the digital age from the perspective of service-oriented logic, providing new insights into the application of service-oriented logic in brand management. A novel theoretical framework for comprehending the value co-creation mechanism in entrepreneurial activities was developed by Gong et al.^[22] through their study of the value co-creation path of fission entrepreneurship from the standpoint of opportunity resource integration. In light of this, the following hypothesis is put forth:

H3: Brand trust plays a mediating role between brand authenticity and customer value co creation, that is, brand authenticity promotes customer value co creation by enhancing brand trust.

2.4. The regulatory role of perceived behavioral control

Wang and Chen^[23] explored the impact of perceived platform sellers' pro organizational unethical behaviour on consumers' participation in value co creation, and found that perceived behavioural control played a moderating role. Zhang et al.^[24] studied the impact of job autonomy among gig workers on sustained value co creation behaviour, which involves the moderating effect of perceived behavioural control. Liu and Wu^[25] analyzed the regulatory dilemma and path optimization of online consumer trajectory information exchange from social exchange theory standpoint, emphasizing the moderating role of perceived behavioural control. In their study of businesses' digital transformation from product-led to service-led logic, Chen and Qiu^[26] discovered that perceived behavioural control is crucial to value co-creation. Sun^[27] investigated how scenario services affected value co-creation in an intelligent interconnected environment, including the role of perceived behavioural control. Zhang^[28] studied pricing strategies for shared platforms that consider user participation in value creation and found that perceived behavioural control significantly affects the co-creation of value. Dong et al.^[29] explored the relationship between innovation capability redundancy and value creation from social exchange theory standpoint, emphasizing the mediating role of perceived behavioural control. Based on this, this study puts forward the following hypothesis:

H4: Perceived behavioural control has a moderating effect on brand trust and customer value co creation.

H5: Perceived behavioural control moderates the relationship between brand authenticity and co creation of customer value.

The above assumptions constitute the theoretical model of this study, which will be validated by conducting empirical investigations. By analyzing the association between brand authenticity, brand trust, and customer value co creation, as well as the moderating effect of perceived behavioural control, the present research endeavours to clarify how brand authenticity influences customer value co-creation through the mediating role of brand trust and to investigate the moderating effect of perceived behavioural control in this pathway. This not only helps fill the gaps in existing research, but also provides new insights and strategies for brand management practices.

2.5. Conceptual framework

The conceptual framework within this investigation aims to explore the interaction between brand authenticity, brand trust, and customer value co creation, as well as their impact on consumer behaviour. This framework is based on social exchange theory, cognitive consistency theory, and service driven logic (S-D Logic), with brand authenticity as the starting point, brand trust as the mediating variable, customer value co creation as the final result, and perceived behavioural control as the moderating variable.

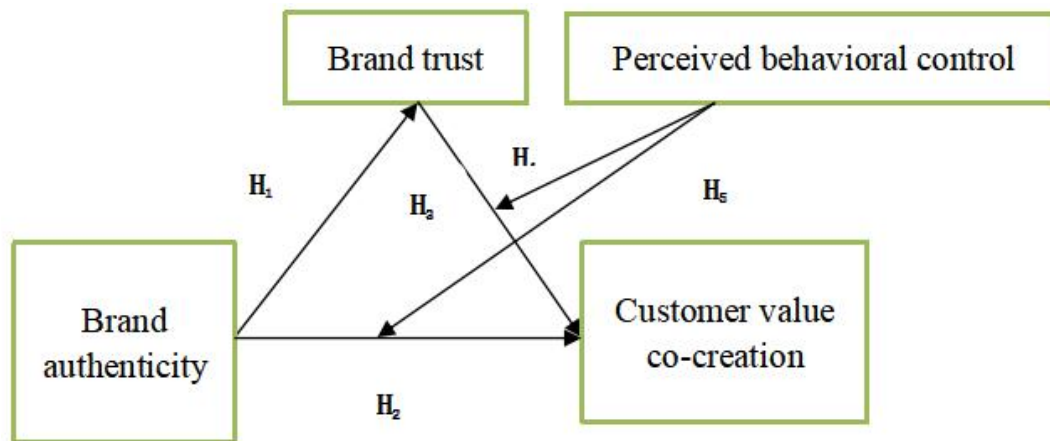


Figure 1. Conceptual framework diagram

3. Research methodology and design

3.1. Research type

A quantitative research method is adopted in this study, utilizing questionnaire surveys to collect data and SEM for data analysis.

3.2. Population and sampling

3.2.1. Research population

The intended sample group consists of consumers who interact with and co-create value for brands. This includes direct purchasers and users of brand products, as well as those who participate in brand activities and share brand experiences.

3.2.2. Sampling method

It combines convenience sampling with stratified random sampling. For the purpose of ensuring diversity, stratification is based on demographic traits including age, gender, income, and education.

Convenience sampling is employed to collect data through online platforms, brand websites, and physical stores.

3.2.3. Sampling implementation

Pre-testing is conducted to assess the questionnaire's understandability and reliability. The final questionnaire is distributed online and offline, with data collection monitored to ensure diversity and representation. Data is cleaned to exclude invalid responses.

3.3. Research instruments

3.3.1. Questionnaire design

The survey instrument contains sections on brand authenticity, brand trust, customer value co-creation, perceived behavioural control, and demographic information. Each section uses 7-point Likert scales to quantify responses.

3.3.2. Pre-testing and revision

Pre-testing involves a small sample to assess the questionnaire's clarity and logic. Feedback is used to revise and finalize the questionnaire.

3.3.3. Data collection

Data is gathered using online questionnaires and offline questionnaires distributed at brand events and stores. Incentives are provided to enhance response rates.

3.3.4. Data processing plan

Data is monitored during collection, cleaned to exclude invalid responses, and encoded for analysis. Statistical software is used for descriptive analyses, tests of reliability and validity, correlation examinations, and SEM.

3.4. Variables

3.4.1. Independent variable

Brand authenticity, measured through dimensions such as brand history, values consistency, and image match with consumer expectations.

3.4.2. Dependent variable

Customer value co-creation, measured through consumer participation in product innovation, service improvement, and brand promotion.

3.4.3. Mediating variable

Brand trust, measured through dimensions such as brand reliability, honesty, and capability.

3.4.4. Moderating variable

Perceived behavioural control, measured through consumer perceptions of control over brand interactions and participation.

4. Data analysis

4.1. Descriptive statistics analysis

This study collected 368 valid questionnaires and processed the data using SPSS24 and MPLUS 8.3.

4.1.1. Population demographic characteristics

The sample includes 368 respondents with diverse demographic characteristics, including gender, age, education, and income levels.

Table 1. Description of demographic variables

Variable	Type	Frequency	Percentage (%)
Gender	Male	176	47.83
	Female	192	52.17
Age	Under 18 years old	17	4.62
	19-25 years old	151	41.03
	26-40 years old	114	30.98
	41-60 years old	77	20.92
	Over 60 years old	9	2.45
	High school or below	74	20.11
Educational level	Specialty	117	31.79
	Undergraduate	151	41.03
	Master	23	6.25
	PhD or above	3	0.82
Income	Below 3000 yuan	15	4.08
	3000-5000 yuan	96	26.09
	5001-8000 yuan	133	36.14
	8001-12000 yuan	106	28.80
	Above 12000 yuan	18	4.89

Divided by gender, there were 176 males, accounting for 47.83%; There are 192 females, accounting for 52.17%.

Divided by age, there are 17 people under 18 years old, accounting for 4.62%; 151 people aged 19-25, accounting for 41.03%; 114 people aged 26-40, accounting for 30.98%; 77 people aged 41-60, accounting for 20.92%; Nine people are over 60 years old, accounting for 2.45%.

Divided by education level, there are 74 people with high school or below, accounting for 20.11%; There are 117 specialists, accounting for 31.79%; 151 undergraduate students, accounting for 41.03%; There are 23 master's degree holders, accounting for 6.25%; There are 3 people with a doctoral degree or above, accounting for 0.82%.

Divided by income, there are 15 people below 3000 yuan, accounting for 4.08%; 96 people are priced between 3000-5000 yuan, accounting for 26.09%; 5001-8000 yuan for 133 people, accounting for 36.14%; 8001-12000 yuan for 106 people, accounting for 28.8%; 18 people are priced above 12000 yuan, accounting for 4.89%.

4.1.2. Descriptive statistics

Descriptive statistical analysis is the initial step in data preprocessing, which provides the basic characteristics of a dataset, including central trends, dispersion, and distribution patterns. Descriptive statistical analysis was conducted on various measurement items of brand authenticity, brand trust, and customer value co creation. Table 4.2 provides a detailed explanation of summary statistics for each variable under investigation.

Table 2. Descriptive statistical analysis results

Variable	Number	Min	Max	Average	S.d	Skewnes	Kurtosis
R1	368	1	7	5.530	1.578	-0.949	0.130
R2	368	1	7	4.204	1.979	-0.152	-1.159
R3	368	1	7	4.984	1.848	-0.554	-0.737
R4	368	1	7	4.527	1.836	-0.350	-0.823
R5	368	1	7	4.030	1.881	-0.066	-1.039
R6	368	1	7	4.489	1.734	-0.316	-0.819
T1	368	1	7	4.864	1.662	-0.378	-0.674
T2	368	1	7	5.185	1.637	-0.476	-0.793
T3	368	1	7	5.372	1.654	-0.833	-0.287
T4	368	1	7	5.068	1.662	-0.478	-0.691
T5	368	1	7	5.658	1.380	-0.956	0.364
C1	368	1	7	5.128	1.765	-0.638	-0.616
C2	368	1	7	5.364	1.598	-0.682	-0.452
C3	368	1	7	3.837	1.887	0.225	-1.033
C4	368	1	7	5.334	1.728	-0.834	-0.314
C5	368	1	7	4.533	1.779	-0.172	-0.888
C6	368	1	7	4.948	1.561	-0.446	-0.461
C7	368	1	7	5.035	1.561	-0.396	-0.683
P1	368	1	7	4.359	1.840	-0.226	-0.895
P2	368	1	7	5.288	1.678	-0.795	-0.253
P3	368	1	7	4.780	1.849	-0.509	-0.750
P4	368	1	7	4.636	1.890	-0.442	-0.940
P5	368	1	7	5.057	1.622	-0.570	-0.357
P6	368	1	7	4.185	1.903	-0.081	-1.030
Customer value co creation	368	1	7	4.717	1.444	-0.408	-0.673
Brand authenticity	368	1	7	4.627	1.459	-0.348	-0.628
Brand trust	368	1.20	7	5.229	1.261	-0.688	0.028
Customer value co creation	368	1	7	4.883	1.293	-0.324	-0.513

The number of cases for all variables in Table 2 is 368, indicating that the data is complete and there are no missing values. In this study, The values of all the variables ranged from 1 to 7, meaning that the scoring range of the scale is from 1 to 7. The average of the dataset reflects the central position of each variable. If the average value of the brand authenticity variable R1 is 5.530, it indicates that the sample has a relatively positive perception of brand authenticity. A standard deviation is a measure of how dispersed data is, or how

far a number deviates from its mean. The more widely distributed the data distribution, the higher the standard deviation. The skewness values of each variable in this study range from -0.956 to 0.225, suggesting a slightly skewed or mainly symmetrical data distribution. The kurtosis values of each variable in this study ranged from -1.159 to 0.364, with absolute values less than 2.

The results from Table 2 show that brand authenticity (R) ranges from R1 to R6, with average values ranging from 4.030 to 5.530, indicating that the sample's perception of brand authenticity is generally positive. Among them, R1 has the highest average value, indicating that the sample generally believes that brand behavior is consistent with its promises and statements. brand trust (T): From T1 to T5, the average value ranges from 4.864 to 5.658, indicating that the sample has a higher perception of brand trust, especially T5, indicating that the sample has a higher evaluation of the brand's ability to protect personal information security. customer value co creation (C): From C1 to C7, the average value ranges from 3.837 to 5.364, indicating that the sample's participation in value co creation behaviour varies. Among them, C3 has the lowest average value, which may indicate that the sample has less behaviour in recommending brands to friends and family. perceived behavioural control (P): From P1 to P6, the average values range from 4.185 to 5.288, indicating that there are certain differences in the sense of control and autonomy of the samples in brand interaction. Among them, P2 has the highest average value, demonstrating that the samples typically experience a high level of autonomy when engaging in brand-related activities.

Results of the descriptive statistical analysis show that the sample's perception of brand authenticity, brand trust, and customer value co creation has an average value higher than the median of 4 for each variable, indicating that the sample's overall perception of the brand is relatively positive. And the data distribution is close to a normal distribution, providing a good foundation for subsequent statistical analysis. The sample's level of heterogeneity in perceiving various brand qualities is revealed by the mean and standard deviation of each variable, while the skewness and kurtosis results validate the normality of the data, providing necessary prerequisites for further hypothesis testing and model construction. Descriptive statistics are used in brand management research to reveal consumers' perception of brand attributes.

4.2. Reliability and validity analysis

Spearman initially used the term reliability in psychological measurement in 1904, referring to the degree of consistency or dependability of test outcomes. Validity analysis is a key step in evaluating whether a scale accurately measures its expected concepts. The validity analysis of this study includes two aspects: content validity and construct validity.

4.2.1. Reliability analysis

In 1904, Spearman initially proposed the idea of reliability in the context of psychological assessment, with the primary goal being to gauge the consistency and dependability of test findings. Specifically, reliability reflects the stability of measurement results. When the same measurement tool measures the same object multiple times at different times and the results are all relatively close, it can be considered that the measurement tool has high reliability. This feature establishes a strong basis for in-depth examination in later study by guaranteeing the legitimacy and authenticity of the data gathered. In this research, reliability analysis plays a crucial role in evaluating whether the survey questionnaire used can stably and accurately capture the true situation of the research subjects. Through repeated testing of sample data, reliability analysis can reveal the consistency of questionnaire performance in different contexts, thereby determining whether it is suitable as a research tool. A high reliability scale means that similar results can be obtained in multiple measurements, which is irreplaceable in ensuring the accuracy and reproducibility of research results.

Table 3. Consistency Coefficient

Dimension	Subject	Cronbacha
Customer value co-creation	C1	0.878
	C2	
	C3	
	C4	
	C5	
	C6	
	C7	
Perceived behavioral control	P1	0.889
	P2	
	P3	
	P4	
	P5	
	P6	
Brand authenticity	R1	0.891
	R2	
	R3	
	R4	
	R5	
	R6	
Brand trust	T1	0.846
	T2	
	T3	
	T4	
	T5	

For specific quantitative reliability, this study used Cronbach's alpha coefficient as the main evaluation metric. With values ranging from 0 to 1, the Cronbach alpha coefficient is a commonly used reliability assessment technique in social science and psychology research. According to general standards, a scale's very good dependability is indicated by an alpha coefficient of 0.9 or above; The range is 0.8 to 0.9, it indicates good reliability of the scale; Between 0.7 and 0.8 indicates acceptable reliability; Between 0.6 and 0.7 indicates average reliability; Reliability is deemed undesirable if it is less than 0.5; a value between 0.5 and 0.6 indicates less than perfect reliability. In practical operation, this study conducted a detailed reliability analysis of questionnaire items in various key dimensions. For example, for the dimension of "customer value co creation", by calculating the Cronbach alpha coefficient of all items included (such as C1 to C7), the result shows that the alpha coefficient of this dimension is 0.878, indicating that these items have high intrinsic consistency in measuring customer value co creation and the scale has a high degree of reliability. Similarly, for the dimension of "perceived behavioural control", its alpha coefficient is 0.889, further confirming the high reliability of this dimension in evaluating consumers' sense of control and autonomy in brand interaction. The alpha coefficients for other dimensions such as "brand authenticity" and "brand trust"

are 0.891 and 0.846, respectively, both within an acceptable range of reliability, ensuring the reliability and stability of the research data.

Reliability is a key concept in psychological measurement and research methods, used to evaluate the reliability and stability of measurement tools. Dependability can be separated into two groups based on various study focuses: intrinsic dependability and extrinsic reliability. Each has its own unique standards and evaluation techniques.

Intrinsic reliability: Intrinsic reliability mainly concerns whether the survey items are measuring a unified concept, emphasizing the consistency among them. High internal reliability indicates that all questions in the survey are closely related to the same theme and can effectively measure the target construct together. The evaluation of intrinsic reliability usually uses Cronbach's alpha coefficient and Split Half Reliability.

Based on the computation results shown in Table 3, the alpha coefficient of the customer value co creation dimension is 0.878, demonstrating the high level of intrinsic consistency and strong scale reliability of the questions in this dimension. The alpha coefficient of the perceived behavioural control dimension is 0.889, indicating that the questions in this dimension have high intrinsic consistency and excellent reliability of the scale. The alpha coefficient of the brand authenticity dimension is 0.891, indicating high consistency among the questions in this dimension and outstanding dependability of the scale. Indicating strong reliability, the brand trust dimension's alpha coefficient is 0.846, which is just below 0.9 but still falls between 0.8 and 0.9. The reliability of all dimensions ranges from 0.846 to 0.891, with reliability coefficients above 0.8, reflecting that the scale employed is internally consistent and provides trustworthy assessments.

The results of reliability analysis are crucial for ensuring the reliability of research findings. The reliability coefficients of all key dimensions in this study were higher than 0.8, demonstrating that the scale maintains high measurement reliability and produces replicable results. These high reliability scales provide a strong basis for subsequent data analysis, enabling accurate analysis and interpretation of the connection between brand authenticity, brand trust, and customer value co creation. A high reliability scale also means that the research results can be replicated, increasing the external validity of the study. High reliability is a key indicator of the reliability of a scale.

4.2.2. Validity analysis

Validity analysis is a key step in evaluating whether a scale accurately measures its expected concepts. Content validity and construct validity are two components of this study's validity analysis. The content validity in its entirety covers all relevant fields of the research variables. In this study, mature scales were adopted for the design of the scale, and experts in marketing, psychology, and sociology were requested to examine the scale. The items in the scale were developed through a comprehensive review of existing literature to guarantee that each item has theoretical support. The scale item design covers all key dimensions of brand authenticity, brand trust, customer value co creation, and perceived behavioral control.

The construct validity in this study was assessed using both exploratory and confirmatory factor analysis.

1. Exploratory Factor Analysis (EFA)

Exploratory factor analysis (EFA) is used to identify potential relationships between variables and determine whether the scale can be classified into the theoretically expected factor structure. Kaiser, Meyer, and Olkin conducted the KMO test and suggested the Measure of Sampling Adequacy. The relative magnitudes of the partial and simple correlation coefficients between the initial variables are examined in this test.

2. KMO and Bartlett sphericity test

By dividing the sum of squared partial correlation coefficients by the total of squared simple correlation coefficients between variables, the KMO value is determined. The KMO value approaches 1, signifying that the shared variance across variables is strong and appropriate for factor analysis, when the sum of the squares of the simple correlation coefficients between all variables is significantly larger than the sum of the squares of the partial correlation coefficients. A KMO value close to 1 suggests that factor analysis is appropriate, as it reflects a high degree of common variance among variables-evident when the total squared simple correlations notably surpass the squared partial correlations.

Bartlett's test of sphericity derives its statistical value from the determinant of the correlation matrix. A high test statistic with a p-value under 0.05 leads to rejecting the null hypothesis, suggesting notable inter-variable correlations and supporting factor analysis. Conversely, the null hypothesis is supported if the p-value exceeds the significance level, signifying that the data is unsuitable for factor analysis and that there is no significant association between the variables.

Table 4. KMO and Bartlett tests

KMO sampling suitability quantity		0.907
Bartlett sphericity test	Approximate chi square	4220.309
	Freedom	276
	Significance	0.000

The KMO value is 0.907, which is greater than 0.9, indicating that the data is very suitable for factor analysis; The Bartlett sphericity test showed a significance of <0.001, proving that factor analysis is appropriate for the data. The results of Table 4 demonstrate the high degree of correlation between the scale's elements, which qualifies it for factor analysis. KMO and Bartlett's test are necessary steps before factor analysis.

3. Explanation of Total Variance

Total variance interpretation is a commonly used data processing method in statistics that explains data variability by decomposing total variance. In data analysis, total variance interpretation can often be used to explain the degree of influence of different variables on overall variation, in order to help understand patterns and trends in data in practical research.

When evaluating the efficacy of principal component analysis, the total variance explanation is a crucial metric. Table 5 provides the total variance interpretation results of principal component analysis (PCA) in this study. In the PCA method, the eigenvalues at various stages are represented by the original eigenvalues, extracted sum of squared loadings, and rotated sum of squared loadings. The initial eigenvalue column presents the variance explained by each component before rotation, and the variance contribution of each factor is indicated in the extracted sum of squared loadings column. The rotated load sum of squares column displays the variance contribution of components optimized through rotation methods after factor analysis.

Table 5. Explanation of total variance

comp onent	Initial eigenvalue			Extract the sum of squared loads			Sum of squared rotational loads		
	Total	Variance percenta ge	Accumulate d%	Total	Variance percenta ge	Accumula ted%	Total	Variance percenta ge	Accumulate d%

1	6.459	26.912	26.912	6.459	26.912	26.912	4.102	17.090	17.090
2	3.897	16.238	43.150	3.897	16.238	43.150	3.903	16.263	33.353
3	2.567	10.697	53.847	2.567	10.697	53.847	3.891	16.213	49.566
4	2.107	8.779	62.627	2.107	8.779	62.627	3.135	13.061	62.627
5	0.685	2.855	65.482						
6	0.653	2.721	68.203						
7	0.596	2.485	70.688						
8	0.574	2.393	73.081						
9	0.553	2.304	75.385						
10	0.518	2.159	77.544						
11	0.493	2.055	79.600						
12	0.471	1.964	81.564						
13	0.463	1.927	83.491						
14	0.447	1.864	85.355						
15	0.421	1.754	87.108						
16	0.403	1.677	88.786						
17	0.396	1.651	90.436						
18	0.367	1.530	91.967						
19	0.363	1.513	93.480						
20	0.343	1.429	94.909						
21	0.331	1.378	96.286						
22	0.315	1.312	97.599						
23	0.296	1.234	98.832						
24	0.280	1.168	100.000						

This study employed principal component analysis for factor analysis, and the criterion for obtaining principal components was eigenvalues greater than 1. Eigenvalues above 1 suggest that a principal component explains more variance than a single original variable, whereas values below 1 indicate less explanatory power. This rate shows how much variance a principal component accounts for, indicating its role in aggregating item-level information. The cumulative variance contribution rate is the ratio of the variance of the top k principal components to the total variance. The data may be categorized into four dimensions, as shown by Table 5, which shows that four principal components were extracted using principal component analysis. Their cumulative variance contribution rates reached 62.627%, which is in line with theoretical expectations.

The total variance explanation results reinforce this study's theoretical framework, showing that the four dimensions of brand authenticity, brand trust, customer value co creation, and perceived behavioural control can be effectively extracted from the data. This outcome offers a strong basis for further structural equation modelling (SEM) analysis because PCA results show that the variables under study account for enough of the data's variability. The total variance explained in Table 5 provides strong statistical support for the study, indicating that the selected variables can effectively capture the main components of the data and provide a reliable basis for further analysis.

4. The rotated component matrix

The rotated component matrix is an important step in factor analysis, which helps simplify the data structure and reveal potential factor structures. In this study, the rotated component matrix is crucial for understanding the relationship between brand authenticity, brand trust, customer value co creation, and perceived behavioral control. To enhance interpretability, the varimax rotation method was applied to the initial factor loading matrix, redistributing factor-variable relationships and amplifying loadings toward 0 or 1. Loadings with absolute values below 0.4 were excluded from the analysis.

Table 6. Rotating Component Matrix

	Component			
	1	2	3	4
R1		0.752		
R2		0.755		
R3		0.810		
R4		0.772		
R5		0.775		
R6		0.789		
T1				0.747
T2				0.768
T3				0.755
T4				0.758
T5				0.789
C1	0.735			
C2	0.737			
C3	0.757			
C4	0.721			
C5	0.768			
C6	0.718			
C7	0.755			
P1			0.778	
P2			0.796	
P3			0.798	
P4			0.829	
P5			0.815	
P6			0.801	

The following is a detailed in-depth analysis based on the rotated component matrix in Table 6.

The significance of factor structure: It is evident from the rotated component matrix that the factor loadings of most variables are above 0.4, showing that these variables and the factors that correspond to them have a high association. This significance is a key indicator of the effectiveness of factor analysis, as it ensures the reliability and interpretability of the analysis results.

Brand authenticity (R) Dimension: All items related to brand authenticity (R1 to R6) exhibit strong loadings on the first factor indicating that these items collectively reflect a core dimension of brand

authenticity. Especially R3 and R6, whose load values exceed 0.78, demonstrate their importance in the dimension of brand authenticity.

Brand trust (T) dimension: The items of brand trust (T1 to T5) show stronger loadings on the second factor indicating that these items collectively constitute the dimension of brand trust. The load value of T5 is the highest, reaching 0.789, which may indicate that consumers have given a high evaluation of the brand's ability to protect personal information, which is an important aspect of brand trust.

The dimension of customer value co creation (C): The items of customer value co creation (C1 to C7) load heavily onto the third factor, reflecting the extent of customer involvement in brand value co-creation. The load values of C3 and C4 exceeded 0.75, indicating their importance in the dimension of customer value co creation.

Perceived behavioral control (P) dimension: The items of perceived behavioral control (P1 to P6) have a high load on the fourth factor, indicating that these items collectively constitute the dimension of perceived behavioral control. The load values of P4 and P5 exceeded 0.8, indicating their importance in the dimension of perceived behavioral control.

Explanation of factor loading: Loadings quantify the linkage between variables and latent components. A higher factor loading value means a closer relationship between the variable and its associated factor. All variables in this study exhibited factor loadings that were relatively high, providing a solid foundation for further analysis.

Selection of Rotation Method: This study used the Caesar Normalization Varimax rotation method for factor rotation. This method aims to differentiate factor loadings between 0 and 1, so that, using just one component, each variable has the highest loading achievable, making it easier to explain. Convergence of rotation: The rotation has converged after 5 iterations, indicating that the factor structure has stabilized and can be explained.

According to the data results in Table 6, the rotated component matrix shows that each variable has a high load on the corresponding factor. To make sure the factors were significant, factor loads with absolute values below 0.4 were eliminated. The data were grouped into four factors, in accordance with theoretical expectations. The rotated component matrix helps identify the structural relationships between variables.

2. Confirmatory Factor Analysis (CFA)

To determine whether the scale's structural model matches the actual responses, a multivariate statistical technique called confirmatory factor analysis (CFA) is utilized to evaluate the fit between a proposed measurement model and the observed data.

(1) CFA fitting index

CFA can help researchers validate the rationality of theoretical construction and ensure that the measurement structure of the scale is consistent with theoretical expectations. The following is a detailed in-depth analysis of the CFA fitting indicators in Table 4.7:

Table 7. CFA fitting indicators

	χ^2/df	RMSEA	SRMR	TLI	CFI
Suggested standard value	3	0.08	0.08	0.9	0.9

Fitted value 1.086 0.015 0.034 0.994 0.995

As shown in Table 7, the CFA model exhibits a good fit: $\chi^2/df = 1.086$ (below the threshold of 3), RMSEA = 0.015 and SRMR = 0.034 (both < 0.08), while TLI (0.994) and CFI (0.995) exceed the recommended value of 0.9, indicating strong model adequacy. These results indicate that the CFA model fits well. Fit indices in CFA serve as critical indicators of the model's agreement with empirical data. These results support the theoretical construction in the study that the structure of the four dimensions of brand authenticity, brand trust, customer value co creation, and perceived behavioural control is reasonable and can be supported by actual data.

(2) Combination reliability

For each dimension, Table 8 provides comprehensive data on composite reliability and average variance extracted (AVE), two critical metrics for evaluating the validity and reliability of the scale.

Table 8. Combination reliability and convergent validity of each dimension

Dimension	Item	Estimated value	Standard error	C.R.	P	Standardization factor load	Composite reliability	AVE
Customer value co-creation	C1	1.000	0.000			0.703		
	C2	0.881	0.073	12.060	0.000	0.684		
	C3	1.132	0.087	13.048	0.000	0.744		
	C4	0.954	0.079	12.081	0.000	0.685	0.880	0.513
	C5	1.079	0.082	13.180	0.000	0.753		
	C6	0.854	0.071	11.976	0.000	0.679		
	C7	0.940	0.072	13.095	0.000	0.747		
Perceived behavioral control	P1	1.000	0.000			0.725		
	P2	0.938	0.069	13.603	0.000	0.746		
	P3	1.039	0.076	13.665	0.000	0.750	0.890	0.574
	P4	1.127	0.078	14.479	0.000	0.795		
	P5	0.943	0.067	14.136	0.000	0.776		
	P6	1.076	0.078	13.746	0.000	0.754		
Brand authenticity	R1	1.000	0.000			0.733		
	R2	1.315	0.092	14.258	0.000	0.768		
	R3	1.239	0.086	14.382	0.000	0.775	0.892	0.581
	R4	1.203	0.086	14.055	0.000	0.758		
	R5	1.215	0.088	13.850	0.000	0.747		
	R6	1.176	0.081	14.551	0.000	0.784		
Brand trust	T1	1.000	0.000			0.706		
	T2	1.049	0.082	12.780	0.000	0.752		
	T3	0.974	0.082	11.858	0.000	0.691	0.847	0.527
	T4	1.036	0.083	12.477	0.000	0.731		
	T5	0.890	0.069	12.847	0.000	0.757		

As shown in Table 8, composite reliability values across dimensions range from 0.847 to 0.892, reflecting strong internal consistency. Each dimension's AVE falls within the range of 0.513 to 0.581, indicating that the ability of each dimension to simultaneously explain its corresponding item is quite strong. Combination reliability and AVE are important indicators for measuring construct validity.

(3) Differential validity

By comparing the absolute value of each dimension's correlation coefficient with the square root of AVE across those dimensions, differential validity is assessed. The results in Table 4.9 indicate the data has discriminant validity as the square roots of AVE for each dimension are higher than the absolute values of their correlation coefficients with other dimensions.

Table 9. Differential validity

	Brand authenticity	Brand trust	Customer value co-creation	Customer value co-creation
Brand authenticity	0.762			
Brand trust	0.455	0.726		
Customer value co-creation	0.444	0.355	0.716	
Perceived behavioral control	0.011	-0.005	-0.023	0.758

In Table 9, the AVE square roots of brand authenticity (R), brand trust (T), customer value co creation (C), and perceived behavioral control (P) are 0.762, 0.726, 0.716, and 0.758, respectively. All of these AVE square root values are higher than the correlation coefficients' absolute values with other dimensions. The correlation between brand authenticity and brand trust is 0.455, notably lower than the square root of brand authenticity's AVE (0.762).

Analysis of correlation coefficients between various dimensions: The correlation between brand trust and customer value co-creation is 0.355, while its correlation with perceived behavioral control is -0.005. Additionally, customer value co-creation and perceived behavioral control show a weak negative correlation of -0.023. Each of these association coefficients' absolute values is less than the square root of their respective AVEs, indicating statistical discrimination between the dimensions.

Differential validity is the key to ensuring that different constructs can be distinguished. The differential validity analysis results of this investigation lend credence to each scale dimension's autonomy.

4.3. Correlation analysis

When assessing the direction and strength of correlations between variables, correlation analysis is a crucial first step. Within this research, the Pearson correlation coefficients between various variables were calculated to explore the interrelationships between perceived behaviour control, brand authenticity, brand trust, and customer value co creation. It is possible to assess how strongly and in which direction certain variables are related. Table 4.10 shows the correlation coefficients between perceived behavioural control, brand authenticity, brand trust, and customer value co creation:

Table 10. Correlation

	Perceived behavioral control	Brand authenticity	Brand trust	Customer value co-creation
Perceived behavioral control	1			
Brand authenticity	0.008	1		
Brand trust	0	.393**	1	
Customer value co-creation	-0.018	.392**	.311**	1

Table 10. (Continued)

According to Table 10, a correlation coefficient of 0.393 was observed between brand trust and brand authenticity, and the correlation coefficients between customer value co creation and brand authenticity and brand trust are 0.392 and 0.311, respectively, both of which are significant at the 0.01 level.

4.4. Process regulates mediating effects

In this study, perceived behavioural control was examined as a moderator influencing the relationships between brand authenticity and customer value co-creation, as well as between brand trust and customer value co-creation, using the PROCESS macro.

4.4.1. Analysis of regulatory effects

Table 11. Moderation mediation effect test

	Brand trust				Customer value co-creation			
	coeff	se	t	p	coeff	se	t	p
constant	0.000	0.061	0.000	1.000	4.882	0.060	81.632	0.000
Brand authenticity	0.339	0.042	8.165	0.000	0.279	0.045	6.203	0.000
Brand trust					0.189	0.052	3.636	0.000
Perceived behavioral control					-0.018	0.042	-0.436	0.663
Int_1					0.072	0.032	2.261	0.024
Int_2					0.089	0.036	2.449	0.015
F		66.663					20.869	
R-sq		0.154					0.224	

The mediation analysis examines the role of perceived behavioural control in the relationship among brand authenticity, brand trust, and customer value co-creation. This study uses the PROCESS macro to test the moderating mediation effect, in order to reveal how perceived behavioural control affects the indirect effects of brand trust and brand authenticity on customer value co creation. The mediation analysis results highlight the pivotal role of perceived behavioural control in the co-creation process linking brand authenticity, brand trust, and customer value, offering new insights and strategic implications for brand management.

4.4.2. Indirect effect analysis

The moderating effect of perceived behavioural control is identified through an analysis of how it alters the indirect links between brand authenticity, brand trust, and customer value co-creation.

1. Indirect effects under different levels of perceived behavioural control

Table 12. Indirect effect analysis

	Perceived behavioral control	Effect	se	BootLLCI	BootULCI
Indirect effect	M-SD	0.021	0.024	-0.028	0.068
	M	0.064	0.020	0.029	0.106
	M+SD	0.108	0.027	0.059	0.164
	(M)-(M-SD)	0.044	0.017	0.012	0.079
Indirect effect differences	(M+SD)-(M-SD)	0.087	0.034	0.024	0.158
	(M+SD)-(M)	0.044	0.017	0.012	0.079

Table 12. (Continued)

When perceived behavioural control is one standard deviation below the mean (M-SD), the 95% confidence interval for the indirect effect is $[-0.028, 0.068]$, which includes zero, suggesting the mediating effect is not significant at this level. This means that in situations where perceived behavioural control is low, the impact of brand trust and brand authenticity on customer value co creation does not act through mediating variables, or the effect is weak.

At the mean level of perceived behavioural control (M), the 95% confidence interval for the indirect effect is $[0.029, 0.106]$, excluding zero, which indicates a significant mediating effect. This indicates that under moderate levels of perceived behavioural control, brand trust and brand authenticity have a significant positive impact on customer value co creation through mediating variables.

At one standard deviation above the mean (M+SD) of perceived behavioural control, the 95% confidence interval for the indirect effect is $[0.059, 0.164]$, which excludes zero, indicating a significant mediating effect. This indicates that under high levels of perceived behavioural control, brand trust and brand authenticity have a more significant positive impact on customer value co creation.

2. Comparison of indirect effects

Comparing the mediating effects of M-SD, M, and M+SD on perceived behavioural control pairwise, the results showed that the 95% confidence intervals of their differences did not include 0, indicating that these differences were statistically significant. This indicates that perceived behavioural control significantly moderates the mediating effects of brand trust and brand authenticity on customer value co-creation. Specifically, the indirect effect increased by 0.044 from M-SD to M, 0.044 from M to M+SD, and 0.087 from M-SD to M+SD. As perceived behavioural control increases, the indirect influence of brand trust and brand authenticity on customer value co-creation becomes more pronounced.

4.5. MPLUS structural equation modeling

This study used MPLUS software for structural equation modelling analysis to evaluate the impact of brand authenticity, brand trust, and perceived behavioural control on customer value co creation, as well as the moderating role of perceived behavioural control in this process.

4.5.1. Path analysis

Path analysis, within the framework of structural equation modelling (SEM), is used to assess both direct and indirect relationships among variables. In this study, the results of path analysis provide quantitative evidence of the impact of brand authenticity, brand trust, and perceived behavioural control on customer value co creation, as well as the moderating role of perceived behavioural control in these relationships. This study used MPLUS software for structural equation modelling analysis. The following are detailed path analysis results.

Table 13. Path Analysis

	Estimate	S.E.	Est./S.E.	P-Value
Brand authenticity→Brand trust	0.459	0.065	7.095	0.000
Brand trust→Customer value co-creation	0.203	0.069	2.936	0.003
Brand trust X Perceived behavioral control→Customer value co-creation	0.169	0.072	2.351	0.019

Brand authenticity→Customer value co-creation	0.383	0.067	5.672	0.000
Perceived behavioral control→Customer value co-creation	-0.035	0.063	-0.556	0.578
Brand authenticity X Perceived behavioral control→Customer value co-creation	0.140	0.065	2.164	0.030

1. The impact of brand authenticity on brand trust

According to the results in Table 13, the estimated value of brand authenticity on brand trust is 0.459, with a standard error of 0.065. The ratio of estimated value to standard error (Est./S.E.) is 7.095, and the P-value is close to 0, suggesting that brand authenticity exerts a significant positive influence on brand trust. This result implies that the improvement of brand authenticity can significantly increase consumers' trust in the brand, which supports hypothesis H1 that the higher the brand authenticity, the greater the level of brand trust among consumers.

2. The impact of brand authenticity on customer value co creation

Based on the findings in Table 13, it was found that the estimated value of brand authenticity on customer value co creation is 0.383, with a standard error of 0.067 and an Est./S.E. of 5.672. The P-value is close to 0, indicating that brand authenticity shows a significant positive association with customer value co-creation. This supports the hypothesis H2 that brand authenticity may directly affect customer value co creation. The significant positive impact of brand authenticity on customer value co creation has been supported by empirical research.

3. The impact of brand trust on customer value co creation

Based on the results in Table 13, it was found that brand trust has a noteworthy favourable effect on customer value co creation, with an estimated value of 0.203, a standard error of 0.069, an Est./S.E. of 2.936, and a P-value of 0.003. This supports hypothesis H3, which suggests that brand trust plays a mediating role between brand authenticity and co creation of customer value.

4. The impact of the interaction between brand trust and perceived behavioural control on customer value co creation

Table 13 reports that the estimated interaction effect of brand trust and perceived behavioural control on customer value co-creation is 0.169, with a standard error of 0.072, an Est./S.E. of 2.351, and a P-value of 0.019, indicating that the interaction term between brand trust and perceived behavioural control has a major beneficial effect on customer value co creation. This supports hypothesis H4, which suggests that perceived behavioural control positively moderates the relationship between brand trust and customer value co-creation. The significant positive impact of the interaction between brand trust and perceived behavioural control on customer value co creation has been supported by research.

5. The impact of perceived behavioural control on customer value co creation

According to the results in Table 13, it was found that the estimated value of perceived behavioural control on customer value co creation is -0.035, with a standard error of 0.063, an Est./S.E. of -0.556, and a P-value of 0.578, suggesting that customer value co-creation is not much impacted by perceived behavioral control.

6. The impact of the interaction between brand authenticity and perceived behavioral control on customer value co creation

According to the results in Table 13, it was found that the estimated value of the interaction between brand authenticity and perceived behavioural control on customer value co creation is 0.140, with a standard

error of 0.065, an Est./S.E. of 2.164, and a P-value of 0.030. It shows that brand authenticity and perceived behavioural control interact to enhance customer value co-creation significantly. These results validate H5, suggesting that perceived behavioural control strengthens the relationship between brand authenticity and customer value co-creation.

4.5.2. Analysis of direct and indirect effects

Further analysis was conducted on the direct and indirect effects of different levels of perceived behavioural control on brand trust and brand authenticity on customer value co creation:

Table 14. Direct and indirect effects

	Estimate	S.E.	BootLLCI	BootULCI
IND_LOWV	0.016	0.043	-0.068	0.105
IND_MEDV	0.093	0.033	0.036	0.168
IND_HIV	0.171	0.050	0.085	0.287
DIR_LOWV	0.243	0.102	0.040	0.442
DIR_MEDV	0.383	0.067	0.254	0.519
DIR_HIV	0.523	0.084	0.360	0.691

1. Indirect effects under low-level perceived behavioural control

In Table 14, when the estimated value is 0.016 and the 95% confidence interval is [-0.068, 0.105], that is, when the moderating variable perceived behaviour control is taken as a low value, the mediating effect is not important [B=0.016, 95% CI=[-0.068, 0.105]], indicating that under low-level perceived behaviour control, the mediating effect of brand trust on customer value co creation is not important; When the perceived behavioural control of the moderating variable is set to a low value, the mediating effect is significant [B=0.243, 95% CI=[0.04, 0.442]]. Under low-level perceived behavioural control, the mediating effect of brand trust on customer value co creation is not significant.

2. Indirect effects under moderate level perceived behavioural control

In Table 14, when perceived behavioural control is at the median level, the indirect effect is significant (B = 0.093, 95% CI [0.036, 0.168]), indicating that brand trust significantly mediates the relationship with customer value co-creation under this condition. When adjusting for the median of perceived behavioural control variables, the mediating effect is significant [B=0.383, 95% CI = [0.254, 0.519]]. Under moderate levels of perceived behavioural control, brand trust has a significant mediating effect on customer value co creation.

3. Indirect effects under high-level perceived behavioural control

In Table 14, the estimated value of 0.171 with a 95% confidence interval of [0.085, 0.287] suggests that brand trust significantly mediates the relationship between perceived behavioural control and customer value co creation when perceived behavioural control is high. When the perceived behavioural control of the moderating variable is set to a high value, the mediating effect is noteworthy [B=0.523, 95% CI = [0.36, 0.691]]. Under high-level perceived behavioural control, brand trust possesses a strong mediating influence on customer value co creation. Based on the above analysis, the following results can be obtained:

Brand authenticity has a noteworthy favourable effect on brand trust; [B=0.459,P=0], Assuming H1 holds true;

Brand authenticity has a significant positive impact on customer value co creation; [B=0.383,P=0], Assuming H2 holds true;

Brand trust has a significant positive impact on customer value co creation; [B=0.203, P=0.003], Assuming H3 holds true;

Brand trust X perception behaviour control has a significant positive impact on customer value co creation; [B=0.169, P=0.019], This suggests that perceived behavioural control has a favourable moderating influence on the effects of brand trust on customer value co creation, assuming H4 holds true;

There isn't any notable effect of perceived behavioural control on customer value co creation; [B=-0.035,P=0.578];

The perceived behavioural control of brand authenticity X has a noteworthy favourable effect on customer value co creation; [B=0.14, P=0.03], This implies that perceived behavioural control provides a beneficial moderating influence on the effects of brand authenticity on customer value co creation, assuming H5 holds true.

5. Conclusions

5.1. Research conclusions

The study concludes that brand authenticity favourably impacts brand trust and customer value co-creation. Brand trust mediates the connection between brand authenticity and customer value co-creation, while perceived behavioural control moderates these relationships. The results emphasize how crucial brand authenticity is for boosting customer confidence and value co-creation involvement.

5.2. Discussion and managerial implications

5.2.1. Theoretical contributions and future research directions

By thoroughly examining the moderating influence of perceived behavioural control and the mediating role of brand trust, the study advances brand management theory. Subsequent investigations may examine the enduring effects of digital transformation on brand authenticity and its implementation across various sectors.

5.2.2. Managerial practice strategy suggestions

Building brand authenticity and trust is one way that brand managers may improve customer value co-creation. High-quality goods and services, delivering consistent brand messaging, and involving customers in brand activities are some strategies.

5.2.3. Role and impact of policy makers

Policy makers can support brand authenticity and trust building through legislation and policy guidance, promoting sustainable brand development.

5.2.4. Impact of cultural differences on brand management

Cultural differences significantly impact brand authenticity, trust, and value co-creation. Brand managers need to adapt strategies to different cultural contexts to enhance brand performance.

5.3. Management suggestions

5.3.1. Brand authenticity strategic planning

Brand managers should incorporate brand authenticity into long-term strategic planning, ensuring consistency in brand messages and reflecting core values in products and services.

5.3.2. Brand trust building and management

Brand trust can be built through consistent product and service quality, transparent communication, and positive customer service. Engaging in social responsibility activities can also enhance brand trust.

5.3.3. Customer value co-creation incentive mechanisms

Brand managers can design incentive mechanisms to encourage customer participation in value co-creation, such as feedback channels, product design involvement, and social media sharing.

5.3.4. Application strategies for perceived behavioral control

Brand managers can enhance perceived behavioural control by providing more choices, enhancing customer participation, and offering transparent information and feedback mechanisms.

Conflict of interest

The authors declare no conflict of interest

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