Developing and Validating Scales for City Brand Image from the Perspective of International Communication

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Abstract: This article sorts out the core concepts of city brand image, national image, regional image, brand image, etc., and generalizes the dimensions of city brand image. Based on the current international communication capacities of China's megacities, represented by Beijing, qualitative research methods such as in-depth interviews and content analysis are used to determine the dimensional model of city brand image from the perspective of international communication. Finally, a questionnaire is developed for empirical research of foreigners, and a city brand image scale from the perspective of international communication is written through exploratory and confirmatory factors, including 6 dimensions of Economy, Politics, Industry, Nature, Culture and Public welfare, with a total of 17 items, aiming to provide an effective measurement tool for the evaluation of the international communication effect of city brands.

1. Raising the question

City brand is the most symbolic characterization of a city. The international communication of city brand uses the city as a medium to realize the connection between the city and the global network at all levels [1]. The "Hexagon" framework proposed by Simon Anholt in 2006 was the earliest model to evaluate the effectiveness of city branding activities [2], and then Chinese scholar Yuming Lian pioneered the five-dimensional model of the "China City Brand Value Index"[3]. As the globalization continues to deepen, research on international communication capacity building in megacities will play an important supportive role in achieving high-quality development, fueling regional coordinated innovation, and building world-class megalopolis. Developing a city brand image scale from the perspective of international communication has become critical.

2. Theoretical review and dimension construction

2.1. Definition of city brand image connotation

City brand is the product of continuous brand development and application in urban research. It is a comprehensive reflection of the city's own cultural heritage and external image. This article introduces theoretical perspectives such as national image, regional image, and brand image into the

research of "city brand image". Wenhu Guan and others believed that national image was the overall evaluation and certification of the country itself, its behavior, its activities and achievements by the external public and the internal public[4]. Youfu Wu divided the national image into five dimensions: Economy, Security, Culture, Government, and Residents[5]. Regional image was the reflection of people's sensory and memory impressions of a region as a whole, and it was also the focus and assumption of all information about the region[6]. Lianxiong Jiang and others subdivided regional image into natural resources, humanistic spirit, policy systems, industry, scientific and technological innovation capabilities, and product image[7]. Among them, the industry and product in the regional image were not included in the international image dimensions. Brand image was a collection of brand associations and attributes linked to the brand name, reflecting consumers' beliefs and internal impressions of a specific brand[8]. Hui Guan and Dahai Dong suggested that consumers' perception of product image and corporate image was the prominent focus of brand image[9].

2.2. Construction of city brand image dimensions

Based on the basic structure of national image, regional image and brand image, this article proposes that the city brand image is composed of nine dimensions: City Economy, Politics, Security, Nature, Culture, Industry, Corporate, Product and Consumer. Among them, **Economy, Politics, Security, Nature and Culture** come from the dimensions of national image division, reflecting the comprehensive strength and cultural advantages of the city brand; **Industry and Product** come from the constituent dimensions of regional image, reflecting the industry characteristics and structural scale of the city brand; **Corporate and Consumer** come from the constituent dimensions of brand image, reflecting the corporate popularity and consumer perception of the city brand.

3. Development of the scale

3.1. Generation of initial items

3.1.1. Interview research design

This article selects Beijing as a representative city and uses interviews to initially test the dimensions and test items of the city brand image mentioned above from a qualitative perspective. The interviews were conducted in June 2023, and 19 foreigners who had lived in Beijing were chose as respondents, and the original interview report was coded and analyzed through content analysis.

3.1.2. Analysis and extraction of interview content

The results show that the division of existing dimensions suffers from duplication of concepts, incomplete coverage, and scattered respondents. Therefore, this article re-divides the dimensions of city brand image, merging Product into Corporate, Security into Politics, and changing Consumer to Resident. The interview data are re-coded by reclassifying the coding sheet according to the newly created dimensions. Finally, the content validity of the coded results is determined using the "content validity ratio", resulting in a question bank of 29 items in 7 dimensions.

3.2. Testing and modification of the original scale

The study invited three marketing professors and six graduate students to review and supplement the calibration of 29 city brand image indicators, which were expanded to 33 after repeated discussions. After completing the preparation of the original questionnaire, five foreign personnel were invited to evaluate the initial questionnaire. Finally, a city brand image scale with 33 items in 7

dimensions was formed, show in table 1.

Table 1: Initial question bank of city brand image scale

Dimensions	Test items	Question items
Economy	Test item 1	Economically developed
	Test item 2	Good potential for economic development
	Test item 3	Strong scientific and technological innovation capacity
	Test item 4	Close cooperation with foreign countries
	Test item 5	Residents have high standards of living
	Test item 6	Well-developed infrastructure
Politics	Test item 7	Improved laws and regulations
	Test item 8	Government efficiency is high
	Test item 9	Good public security
Industry	Test item 10	Unique industrial resources
	Test item 11	Large industrial scale
	Test item 12	Advanced industrial production technology
	Test item 13	Strong influence of industrial culture
Corporate	Test item 14	The corporate is powerful
	Test item 15	The corporate has advanced technology
	Test item 16	The corporate has high popularity
	Test item 17	The corporate has good reputation
	Test item 18	Strong sense of corporate social responsibility
Nature	Test item 19	Strategic location
	Test item 20	Rich in natural resources
	Test item 21	Natural resources are suitable for industrial development
	Test item 22	Good ecological environment
	Test item 23	Convenient transportation
Culture	Test item 24	Full of history
	Test item 25	Rich tourism resources
	Test item 26	Strong educational strength
	Test item 27	Events and exhibitions have wide scope of coverage
	Test item 28	Food culture is unique
	Test item 29	Strong cultural international influence
Residents	Test item 30	Residents are of high quality
	Test item 31	Residents are warm and friendly
	Test item 32	Residents are down-to-earth and hard-working
	Test item 33	Residents are honest and trustworthy

4. Empirical testing

4.1. Questionnaire distribution and data collection

This study developed a questionnaire based on the scale, which included two parts. The first part was the city brand image scale, using a 5-point Likert scale (where "1" represents completely disagree

and "5" represents completely agree); the second part was the collection of demographic information.

Sample collection was divided into two stages. The first stage was pre-investigation. 20 questionnaires were distributed through snowballing, and 20 were recovered. The recovery efficiency was 100.00 %. This stage was used for preliminary item analysis and reliability testing. After testing, all test items were retained. The second stage was the large-scale survey stage. The research team first randomly distributed questionnaires to foreigners, and then used a snowballing method to invite participants to introduce more foreigners who had visited Beijing. In this stage, 270 questionnaires were distributed and 256 valid questionnaires were recovered, with a recovery rate of 94.81%.

4.2. Validation of the scale

4.2.1. Exploratory factor analysis

In this study, SPSS24.0 software was used to analyze the exploratory factor of the questionnaire data. Firstly, the 34 items of the city brand image scale were purified by the Corrected Item-Total Correlation (CITC), and 8 items with the Corrected Item-Total Correlation less than 0.4 were deleted, and the Cronbach's α coefficient of the remaining 26 items was between 0.910 and 0.914, indicating that the internal consistency of each item was acceptable.

The KMO and Barlett tests showed that the KMO value was 0.723, and the Barlett spherical test was significant ($p<0.001$), indicating that there was a significant correlation between the variables. The Principal Component Analysis method was used to extract the factors, and with an eigenvalue greater than 1 as the criterion, the variance was maximized for rotation to test the construct validity of the scale. After orthogonal rotation, the factor loadings of 3 of the 26 test items were less than 0.5, and the loadings of 2 test items on one principal component were both greater than 0.5. After deleting the above 5 test items, a city brand image scale with 6 factors and 20 items was obtained. These 6 factors were renamed according to the specific meaning of the test items, and the results of exploratory factor analysis were shown in Table 2.

Table 2: Exploratory factor analysis results of city brand image scale

Dimensions	Test items	Factor loadings	Explained variation
Industry	Test item 12: Advanced industrial production technology	.808	17.535
	Test item 32: Residents are down-to-earth and hard-working	.758	
	Test item 11: Large industrial scale	.758	
	Test item 15: The corporate has advanced technology	.691	
	Test item 14: The corporate is powerful	.541	
Politics	Test item 23: Convenient transportation	.797	10.528
	Test item 8: Government efficiency is high	.728	
	Test item 7: Improved laws and regulations	.634	
Culture	Test item 13: Strong influence of industrial culture	.723	9.854
	Test item 4: Close cooperation with foreign countries	.659	
	Test item 24: Full of history	.585	
	Test item 29: Strong cultural international influence	.583	
Nature	Test item 20: Rich in natural resources	.813	9.786

	Test item 21: Natural resources are suitable for industrial development	.665	
	Test item 19: Strategic location	.507	
Public welfare	Test item 33: Residents are honest and trustworthy	.690	9.340
	Test item 17: The corporate has good reputation	.634	
	Test item 18: Strong sense of corporate social responsibility	.611	
Economy	Test item 2: Good potential for economic development	.854	9.134
	Test item 5: Residents have high standards of living	.543	
	Test item 1: Economically developed	.514	

4.2.2. Confirmatory factor analysis

Table 3: The model fit metrics

Overall fit coefficient table						
$\chi 2$ /df	RMSEA	GFI	AGFI	CFI	IFI	TLI
5,320	0.159	0.753	0.637	0.726	0.731	0.641

Table 4: Confirmatory factor analysis results of city brand image scale

Path			Estimate	AVE	CR
Test item 15	<---	Industry	.750	0.6164	0.8645
Test item 11	<---	Industry	.798		
Test item 32	<---	Industry	.700		
Test item 12	<---	Industry	.881		
Test item 7	<---	Politics	.744	0.6908	0.8156
Test item 8	<---	Politics	.910		
Test item 29	<---	Culture	.760	0.4927	0.7438
Test item 4	<---	Culture	.670		
Test item 13	<---	Culture	.672		
Test item 19	<---	Nature	.608	0.4587	0.7147
Test item 20	<---	Nature	.621		
Test item 21	<---	Nature	.788		
Test item 18	<---	Public welfare	.898	0.6112	0.7538
Test item 17	<---	Public welfare	.645		
Test item 1	<---	Economy	.809	0.5298	0.7705
Test item 5	<---	Economy	.668		
Test item 2	<---	Economy	.699		

In this study, SPSS Amos 28 software was used to perform confirmatory factor analysis on 20 items, using the six-factor model obtained by exploratory factor analysis as the original model. The model fitting results were not satisfactory, so the test items with factor loading less than 0.6 were deleted. The results showed that the ratio of chi-square to degree of freedom χ^2 / df is close to 5, and

the root mean square error of approximation RMSEA is close to 0.1, and the values of important indicators such as GFI, AGFI, CFI, IFI and TLI are close to the threshold, as shown in Table 3. The fit is generally acceptable.

According to the method proposed by Fornell and Larcker[10], the average variance extracted (AVE) of each factor was tested for convergent validity analysis. As seen from Table 4, the composite reliability (CR) of each factor is greater than 0.7, and the average variance extracted (AVE) is slightly lower than 0.5 except for Culture (AVE=0.4927) and Nature (AVE=0.4587). The convergent validity of other factors is good, and the overall convergent validity of the scale is ideal.

The revised six-factor model is shown in Figure 1. Finally, this study obtained a city brand image scale with 6 factors and 17 items, see Table 5.
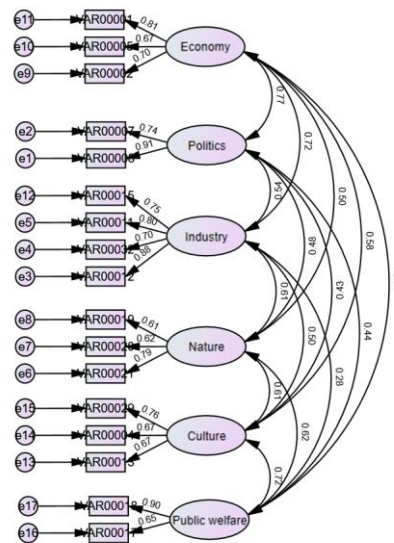

Figure 1: Six-factor model of city brand image

Table 5: City brand image scale from the perspective of international communication

	Dimensions	Question items
City brand image	Economy	T1: Economically developed
		T2: Good potential for economic development
		T3: Residents have high standards of living
	Politics	T4: Government efficiency is high
		T5: Improved laws and regulations
	Industry	T6: Advanced industrial production technology
		T7: Residents are down-to-earth and hard-working
		T8: Large industrial scale
		T9: The corporate has advanced technology
	Nature	T10: Rich in natural resources
		T11: Strategic location
		T12: Natural resources are suitable for industrial development
	Culture	T13: Strong influence of industrial culture
		T14: Close cooperation with foreign countries
		T15: Strong cultural international influence
	Public welfare	T16: The corporate has good reputation
		T17: Strong sense of corporate social responsibility

4.2.3. Discriminant validity analysis

As shown in Table 6, the pairwise correlation coefficients between Economy, Politics, Industry, Nature, Culture, and Public welfare are all smaller than the corresponding square root AVE, indicating that each factor has good discriminant validity.

Table 6: Discriminant validity analysis results of a city brand image scale

Discriminant validity						
	Industry	Politics	Culture	Nature	Public welfare	Economy
Industry	0.6164					
Politics	0.545	0.6908				
Culture	0.496	0.432	0.4927			
Nature	0.609	0.479	0.607	0.4587		
Public welfare	0.278	0.443	0.716	0.624	0.6112	
Economy	0.721	0.768	0.583	0.504	0.306	0.5298
Square root AVE	0.7851	0.8311	0.7019	0.6773	0.7818	0.7279
Note: The diagonal line is the average variance extraction AVE						

5. Conclusion

This study synthesizes the basic characteristics of national image, regional image and brand image, and theoretically explores the connotation of city brand image, and divides the dimensions of city brand image based on existing researches. It conducts rigorous argumentation through qualitative investigation and quantitative researches, and finally gets a city brand image measurement tool with relatively good reliability and validity. It improves the current research on city brand image from the perspective of international communication and provides a research basis for the actual development and construction of the city.

Acknowledgement

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