URBAN SCULPTURE CAPACITY MANAGEMENT INDICATOR SYSTEM

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Abstract

The reason for this study is that, before the global epidemic, the urban economy in Shaanxi Province of China developed rapidly, and the quantity of urban public sculptures gradually increased while the quality lagged behind. It aims to establish the establishment of the index management system of urban public sculpture in Shaanxi Province to establish a foundation for the management optimization of urban public sculpture. This study adopts the methods of field investigation, expert consultation and comprehensive analysis to collect data, systematically deals with the natural and humanistic influences on urban public sculpture management, establishes a mathematical model, determines the urban public sculpture capacity threshold, and analyzes the relationship between urban public sculpture capacity and environmental carrying capacity. It provides theoretical and practical significance for the sustainable development of urban public sculpture management. This study conducted a quantitative empirical analysis

Keywords: Urban Sculpture; Capacity management; Indicator system

Introduction

Yangzhiheng (2003) The concept of urban sculptural capacity is based on the concept of regional environmental capacity. Regional environmental capacity is an embodiment of the internal structural characteristics of the regional system, is expressed in a certain period of time, a certain environment, a piece of the region for which human activities can provide the ability to

support the threshold, also known as the regional environmental carrying capacity. Urban sculpture capacity is a kind of performance of the internal structural characteristics of the landscape environment, according to the landscape area volume rate state, a certain area of the landscape environment on the sculpture device to support the ability of the maximum load value, also for the urban sculpture carrying capacity. This is a new concept based on the law of effective limit of environmental resources. Urban sculpture capacity is affected by two kinds of variables: dynamic variables and limiting variables, dynamic variables refer to people's preference for park activity space and sculpture landscape; limiting variables are a kind of performance inherent in the environment and space, which refers to the performance of the landscape environment on the limiting effect of sculpture devices (Liudongwu, 2011). We can use the capacity of urban sculpture as a criterion to measure the coordination of regional landscape environment and the freedom of human activities or not.

The characteristics of the capacity of urban sculpture are: objectivity, uncertainty, variability and interdisciplinarity, respectively, as an objective quantity, the capacity of urban sculpture significantly exists in a region. In a region with a certain functional structure of the environment, its open system has the ability to support the landscape, architecture, and the free space of the crowd, and in order to maintain its relative stability, it needs to exchange with the outside world of different information, material and energy. Therefore, as long as the structure of the environmental system on which it is based does not change significantly, its structure and function will remain stable, and the capacity of urban sculpture is objective and stable in terms of quality and quantity. Due to the crowd involved in measuring the capacity of urban sculpture in the environmental indicators and other evaluation of the value of the determination of a greater degree of subjective thinking, not be able to achieve sufficiently objective and accurate, which results in the capacity of urban sculpture uncertainty; at the same time, the capacity of the urban sculpture of the influence of the factors can always be years of the surrounding environment, the facilities of the change and the change of depreciation caused by the capacity of the urban sculpture with the sculpture of the change of the space and the function of the change and the change of the urban sculpture capacity. The capacity of urban sculpture is not a constant, but a variable that can be changed under external action. Certain landscape environment design can change and control it so that it can be changed according to human arrangement. So, the

designer of the sculpture can change a kind of limiting factor of sculpture capacity through the change of some factors, so as to change the sculpture capacity. As the design and construction of urban sculpture requires participants from different fields, the citizens involved in the evaluation of indicators also have different knowledge backgrounds. Therefore, there exists a large number of structural networks with different knowledge from different disciplines in the capacity of urban sculpture, so that single-discipline knowledge and approach cannot correctly but scientifically reflect the connotation of sculpture capacity. In the process of research, the adopted disciplines also need to be closely related to each other and exchange information.

Xi'an Urban Sculpture Indicator Management System Screening Principles

Xi'an urban sculpture indicator management system screening principlesPrinciples of scientificity, dynamism and operationalization, respectively. Any system of indicators must be based on a scientific and rigorous foundation, and be able to objectively reflect the correlation between sculpture capacity and the environmental system as well as the various indicators. At the same time, the concept and connotation of each indicator must be clear, and the research and calculation methods must be standardized. Data collection and statistical methods must be standardized. In this way, the characteristics of sculpture capacity can be accurately measured, and the scientific nature of the study, the objectivity and authenticity of the results can be guaranteed. Since some of the indicators affecting the capacity of urban sculpture are in real-time change, the selected indicators need to be stabilized accordingly. At the same time, the indicators used in the study need to comprehensively reflect the development trend of sculpture capacity, so the construction of the indicator system needs to show the combination of dynamism and stability. Due to the availability of research data and the quantification of indicators, each data is easy to measure, and should be combined with the characteristics of the complexity of the data, not only to reflect the connotation and characteristics of the urban sculpture capacity, but also measurable and easy to grasp the characteristics, so as to facilitate the quantitative processing in the process of data utilization.

Construction Process of Urban Sculpture Indicator Management System in Xi'an

Design of Capacity Indicator System: The capacity of urban sculpture affects the index construction factors from two aspects respectively: the quantitative conditions of environment and space on the one hand, and the conditions of humanistic evaluation mechanism on the other. The purpose of this paper is to follow the principles of scientific, subjective change and regionality in the construction of indicators through the connotation and characteristics of urban sculpture capacity, combined with the allocation of environmental resources for urban sculpture, the spatial type of urban sculpture volume and the subjective evaluation mechanism of the general public.

According to the guidelines for the construction of urban sculpture capacity, two secondary indicators are established through the connotation and characteristics of the primary indicators to construct the urban sculpture capacity indicator system. The block diagram of the general idea of evaluation is shown in Figure 1.

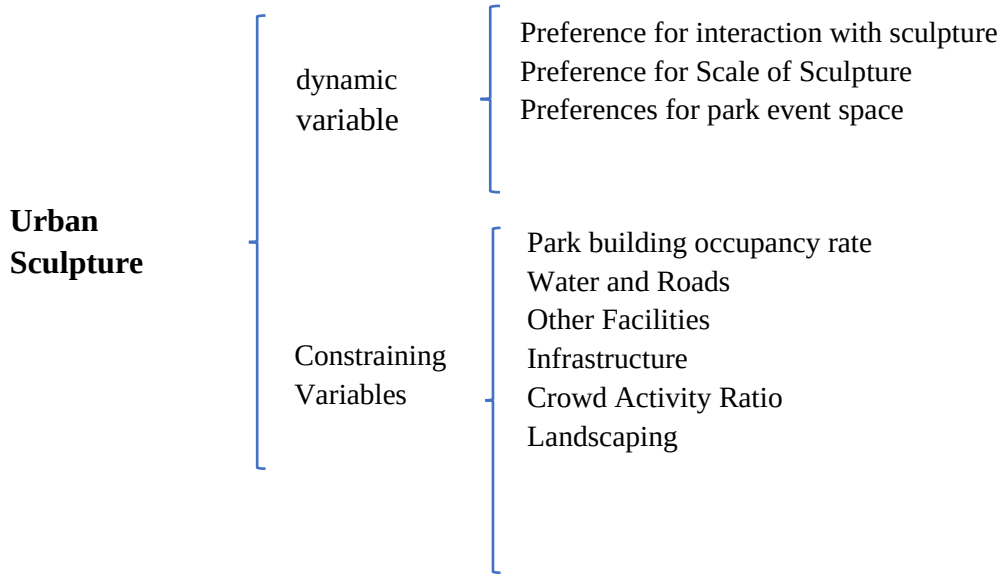

Figure 1: Urban sculpture capacity indicator system.

Determination of the weights of indicators: In this paper, the qualitative and quantitative analysis will be carried out using the hierarchical analysis method (AHP) proposed by American operations researcher Saaty, whose main method is to decompose the decision-making related elements into an ordered recursive hierarchical system composed of the target layer, the criterion layer, and the indicator layer, and to make the decision-making process mathematical by utilizing less quantitative information quantitative information, and meanwhile, combining the qualitative analysis with the quantitative analysis to assign the value to each indicator applying the simplified Hierarchical analysis method (IAHP) and combined with expert opinion, the weight of each indicator is calculated and its corresponding meaning is shown in Table 1.

Table 1: Scales 1-9 in two-by-two judgment matrix construction

scale	a_{ij} /Importance of factor i relative to factor j
1	equal importance
3	Slightly important
5	More important
7	Very important
9	Absolutely important
2、4、6、8、10	Neighborhood median

Adopt Delphi method (Delphi) to construct judgment matrix. Ten urban sculpture researchers were invited to judge the relative importance between indicators at all levels, and the judgment matrix was constructed as A. The number of indicators at the same level was n, then A= $(a_{ij})_{n\times n}$ 。Of these a_{ij} denotes the importance of indicators i and j at the same level relative to the criterion level. The relative weights of the indicators at each level are calculated and tested for consistency. Finally, the combination weights are calculated to obtain the weight assignment values of the first-level indicators relative to the higher-level overall indicators. Similarly, the local relative weight vector of the second-level indicators is obtained, and finally the weights of the indicators at each level are obtained. As Table 2:

Table 2: Weights of urban sculpture capacity indicators

standardized level	weights	indicator level	weights
dynamic variable	0.50	Preference for interaction with sculpture	0.037
		Preference for Scale of Sculpture	0.141
		Preferences for park event space	0.322
Constraining Variables	0.50	Park building footprint	0.062
		Occupancy rate of water area and road	0.033
		Occupancy rate of other facilities	0.018
		Infrastructure occupancy rate	0.034
		Occupancy rate of crowd activities	0.180
		Landscaping	0.173
add up the total			1.000

Quantitative Description of the Capacity of Urban Sculpture in Xi'an: Due to the different platforms of indicators characterizing the capacity of urban sculpture in the park area, the indicators are first normalized, and this paper stipulates that when positively correlated with the capacity of urban sculpture, i.e., the indicator that plays a role in promoting the total score is a positive indicator, and when negatively correlated with the capacity of urban sculpture, i.e., the one that plays the opposite role in the total score is a negative indicator, and in order to make the normalization have the same direction, when the X_{ij} they are positive and negative indicators, respectively:

$$X_{ij} = \begin{cases} 100 \times x_{ij} / x_{i\max}, & \text{When X is a negative action indicator} \\ 100 \times x_{ij} / x_{i\min}, & \text{When X is a positive action indicator} \end{cases} \quad (1)$$

（Zhangjiali,2008）Calculation of urban sculpture capacity is also the dynamic variables in the guideline layer and the limiting variables according to the corresponding weighting of the value obtained by the synthesis, taking into

account the irreplaceability of the indicators at the low level and the relative complementarity at the high level, it is proposed to use the method of weighted summation of the different areas of the area of urban sculpture capacity of the mathematical formula is expressed as follows:

$$SC = 2 * \sum_{i,j=1}^{n} X_{ij} W_i \quad (2)$$

SC is the size of the city's sculpture capacity (Sculpture capacity), and in this equation W_i means X_{ij} weights.

Due to the actual carrying rate of urban sculpture and the designer's subjective judgment of the number of urban sculpture there is a certain deviation, according to the geometric theorem in the cosine theorem on both sides of the relationship between a pinched angle, the same amount of conversion, the actual urban sculpture capacity and the ideal urban sculpture capacity of the $\cos\theta$ value to determine the capacity of the urban sculpture is in an overloaded state, this paper introduces the reality of the city's capacity of urban sculpture calculation formula is as follows:

$$RSC = SC \times \cos\theta \quad (3)$$

RSC refers to Real-Sculpture capacity (RSC), and θ is the angle between the actual urban sculpture capacity and the urban sculpture capacity in the designer's subjective state.

$$\cos\theta = \frac{\sqrt{\sum_{i=1}^{n} X_{i\max}^2 \times \sum_{i=1}^{n} X_{i\min}^2}}{\sum_{i=1}^{n} X_{i\min} X_{i\max}} \quad (4)$$

Formulas: $X_{i\max}$、$X_{i\min}$ delegates X_{ij} vertex coordinates in the ideal state.

The guidelines for determining whether the capacity of an urban sculpture is overloaded are, if the:

$$\theta \begin{cases} >0, \text{if } RSC>SC & \text{Overloading} \\ =0, \text{if } RSC=SC & \text{Adequate} \\ <0, \text{if } RSC<SC & \text{Inadequate} \end{cases} \quad (5)$$

Empirical Evidence for the Xi'an Park Sculpture Indicator

Subjects of the study and main methodology: The empirical phase of this paper adopts on-site questionnaire survey and interview method to collect information, based on the three most representative parks in Xi'an, including Daming Palace Ruins Park (Figure 3), Datang Furong Park (Figure 4) and Urban Sports Park (Figure: 5) three different types of parks for the questionnaire survey, the questionnaire design has an open-ended and closed-

ended questions in the open-ended questions in which the main purpose is to validate the subjective factor In the open-ended items, the main purpose is to verify the indicators of the influence of subjective factors; in the closed-ended items, the form of Likert scale is used, and each question is set up with five options (strongly disagree, relatively disagree, generally, relatively agree, strongly agree), and the score items 1, 2, 3, 4, and 5 are assigned respectively.

The survey respondents were citizens and tourists of Daming Palace Ruins Park, Datang Hibiscus Park, and the Urban Sports Park, respectively. To avoid sample bias, only one person in the peer group was selected for the survey. According to the requirements of the sample mean distance from the overall mean of the best not more than 0.1 points, the overall standard deviation is about 0.3, and the credibility of 95%, the number of samples of each landscape is not less than 40, so the overall sample size of at least 160, due to the consideration of the validity of the questionnaire of the research process, the questionnaire is designed to total 200 copies, which were distributed in the region.

New Knowledges

Analysis of the results: The questionnaire survey for the three parks of Daming Palace Ruins Park, Datang Hibiscus Garden and Urban Sports Park respectively, a total of 200 questionnaires were sent out, a total of 200 questionnaires were collected, and 183 valid questionnaires were obtained. Among them, the sample sizes of Daming Palace Ruins Park, Datang Hibiscus Garden and City Sports Park were 62, 61 and 60 respectively. Among the valid interviewed samples, 53.2% were female and 46.8% were male; 68.5% were local citizens of Xi'an and 31.5% were tourists.

Through the data statistics and processing of the questionnaire, this paper mainly uses SPSS to process and analyze the data, and derives the evaluation score table of urban sculpture capacity indicators in Xi'an (Table 6).

Table 6: Xi'an Park Urban Sculpture Capacity Indicator Evaluation Table

No.	Name of park	weights	Evaluation indicators	Indicator stratum mean $\bar{x}$	aggregate score
1	Daming Palace Ruins Park	0.037	Interaction preference with sculptures	3.124	0.116
			Preference for scale		
		0.141	Preferences for event space	3.000	0.423
		0.322		4.333	1.395
2	Tang Paradise in Xi'an	0.037	Interaction preference with sculptures	4.333	0.160
		0.141		2.000	0.423
		0.322	Preference for scale	4.000	1.288
			Preferences for event space		
3	City Sports Park	0.037	Interaction preference with sculptures	4.000	0.148
		0.141	Preference for scale	3.000	0.423

		0.322	Preferences for event space	4.000	1.288

Through the research data on the subjective factors of the three parks, it can be seen that: tourists are satisfied with the activity space in the three unique parks, while the scale preference evaluation scores for the Daming Palace Ruins Park, Datang Hibiscus Garden and the Urban Sports Park are 0.423, 0.282 and 0.423 respectively. The comprehensive score is slightly lower, during the visit through the interview method, we learned that the sculpture group of Datang Hibiscus Garden is large in scale and huge, which gives people a feeling of seriousness and majesty, and lacks the fun of interaction.

Table 7: Status of sculpture capacity in the 3 parks

NO.	Name of park	Actual number of sculptures (RSC)	Ideal number of
1	Daming Palace Ruins Park	41	78. 85
2	Tang Paradise in Xi'an	70	134. 62
3	City Sports Park	15	41

After the information is fully collected, integrate the relevant data, use Excel to count the average value of each index factor score, multiply it with the weight index, and finally obtain the final score of the index factor.

According to the above formula, the sculpture indexes of Daming Palace Ruins Park, Datang Furong Park and Urban Sports Park are calculated and analyzed as follows:

(1) Daming Palace Ruins Park. Daming Palace Ruins Park covers an area of about 3.2 square kilometers, the sculpture is mostly based on Tang Dynasty historical themes, and the expression form is dominated by round sculpture and relief sculpture, and the quantity statistics in this paper mainly counts the number of round sculptures. Sculptures are located on both sides of the road, and in terms of scale, most of them are small and medium-sized sculptures, which is convenient for crowd interaction. The study shows that the average

value of the indicator layer of the Daming Palace Ruins Park is relatively high, in which the average value of the crowd's preference for the activity space indicator is the highest, with a composite score of 1.395, while the interaction with the sculpture and the preference for the scale of the composite score of 0.116 and 0.423, respectively. In the field observation and interviews, the tourists generally believe that the sculpture group has a strong historical and cultural background, and the sculpture shape is smaller, which is convenient for taking pictures and interaction, increasing the activity space, and added interest in the tour. The preference for the scale of the second, in determining the number of sculptures focus on the sculpture scale, in order to determine the best viewing angle, so as to determine the capacity of the sculpture in a limited range, the smaller the number of smaller scales, the smaller the number of larger the number of larger, follow the negative correlation between the scale and the number of rules. By counting the number of sculptures in Daming Palace Ruins Park and the rate of land area of each functional area in the park, the capacity of urban sculpture is calculated, and according to the formula, $\cos\theta$ is 0.520, and RSC<SC, which is within the threshold range. The above analysis shows that the capacity of urban sculpture in Daming Palace Ruins Park is moderate, and the number of sculptures can be increased on this basis.

(2) Datang Hibiscus Garden. Datang Hibiscus Garden to all-round display of the culture of the Tang Dynasty, the Royal Garden is the main park. There are about 70 groups of sculptures in the park, and the sculptures are mostly based on the culture of the Tang Dynasty Sculptures with the terrain, landscape, and various areas of the park are arranged with different landscape sculptures, and in terms of scale, the park adopts a one-to-one restoration, and the shallow relief sculptures and murals in the park are usually appeared in the panoramic effect of the whole pair and the whole wall, which brings a sense of shock to the people. The study shows that the indicator layer of the Datang Furong Garden and sculpture interaction preference mean score is relatively high, in which the crowd of activity space preference indicator mean value is the highest, the comprehensive score of 1.288, while the interaction with the sculpture and the scale of the preference of the comprehensive score of 0.160 and 0.423, respectively, in the field observation and visit, visitors generally believe that the sculpture group of history and culture, sculpture volume is huge, the overall grandeur, but lack of interactivity and only satisfy visual enjoyment during the tour. Satisfaction in the interaction with the sculpture is the lowest,

the Datang Hibiscus Garden is mostly dominated by large sculptures and reliefs, and tourists can only meet the visual appreciation within a moderate range, but lack of interactive fun, through the statistics of the number of sculptures in the Datang Hibiscus Garden, as well as the rate of the park's various functional areas, the calculation of the city's capacity of the sculpture, according to the formula can be obtained cos θ is 0.99, and the RSC < SC, within the threshold range. The above analysis shows that the urban sculpture capacity of Datang Furongyuan Ruins Park is moderate.

(3) Urban Sports Park. Xi'an City Sports Park is located in the center of Xi'an Beicheng Economic Development Zone, covers an area of about 800 acres, is a set of various sports-based sports theme park, in the sculpture selection is also the main pursuit of sports and living content, but the entire park sculpture is not a lot of sculpture, found during the research period of the city sports park is mainly based on the round sculpture, two or three characters to form a group of sculpture form. In the research results of the data concluded that people have higher requirements for activity space, followed by better satisfaction with the sculpture scale, urban sports park sculpture is mostly small sculpture display, adding the fun of the park and the interactivity of the humanities exchanges, so the reduction in scale can indirectly affect the variable relationship, according to the current incomplete statistics on the number of sculptures is 15 compared to the sculpture cannot be very comprehensive performance of the charm of the city's sculpture and the pleasure of the sculpture.

Conclusions

The author constructs urban sculpture capacity influencing factors through the concept and characteristics of urban sculpture capacity. Determine the influencing variables from the two secondary indicators of dynamic variables and limiting variables respectively, use expert consultation and follow the principle of indicator screening to construct the indicator system of urban sculpture capacity, and determine the weights of indicators at all levels through hierarchical analysis, establish the quantitative assessment model of urban sculpture capacity, and calculate the threshold of sculpture capacity through the subjective and objective bi-directional indicators. Based on the construction of the calculation formula, the article selects three representative parks in Xi'an for empirical research to enhance the scientific and objectivity of the calculation

model, and determines whether the capacity of urban sculpture in the region is overloaded or not through the value of sinusoidal angle of the capacity of urban sculpture in the real city and in the ideal state, with a view to providing a scientific bas

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