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Research Article

Research on the Hybrid ANP-FCE Approach of Urban Community Sustainable Construction Problem

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As an important component of urban construction, the development of the community is of great significance to the sustainable construction of the entire society. The previous studies mainly focused on quantitative research and were limited by the data collectability, affecting the scientificity of the index system. Therefore, based on the theory of sustainable development, through the review of previous literature, combined with relevant experts' opinions and community development goals and other factors, a qualitative evaluation index system for community sustainable development capacity was established. The ANP (analytic network process) method is mainly used to determine the weight of each indicator, and FCE (fuzzy comprehensive evaluation) is proposed to determine every indicator's membership. Then the hybrid fuzzy evaluation is promoted to evaluate the selected community as the empirical study. In this paper, the indicator selection is not limited by objective factors, and the evaluation system is more accurate; the application of ANP method makes the results of weight more scientific; meanwhile, fuzzy comprehensive evaluation can be suitable for solving various nondeterministic problems. This study transforms qualitative research into quantitative research; it provides an effective evaluation method for local managers and decision makers to carry out community sustainable construction.

1. Introduction

Sustainable development has now been recognized as a priority by most countries[1, 2]. About 65% of the world's population is expected to live in urban areas by the year 2025. Due to the rapid pace of urbanization, natural ecosystems are increasingly replaced by cities[3], followed by many problems such as traffic jams, housing shortages, resource shortages, noise, and air and water pollution, people are becoming increasingly aware of the importance of improving living standards[4]. As a regional society, the community is a community of people's social life in a certain geographical area, and it is also the first social space to meet the needs of residents[5]. Therefore, to realize the healthy and orderly development of the city, the first step is to conduct the community sustainable construction[6]. The goal of making cities and human settlements inclusive, safe, resilient, and sustainable has been proposed by world leaders who attended a special summit held at the United Nations in New York and adopted the "2030 Agenda" in September 2015[7]. Based on social development and living demands, regardless of decision makers or researchers, the problem of the community sustainable construction has become a necessary agenda.

In order to pursue social sustainable development, the assessment work of community sustainable construction problem is very important[8–10]. The existing indicator system does provide valuable guidance for helping the community move toward sustainable development. However, most of the previous studies are based on studies of special regions or special forms of communities, such as rural community[11–13], or focus on sustainable development in certain areas of the community, such as community resources supply

and public health [14, 15]; it is relatively rare to conduct sustainable development research from the perspective of the whole community. Some studies have proposed an evaluation index system and consider that the importance of each indicator is consistent or even ignore the weight of indicator; this method does not meet the actual situation[16]. Meanwhile, most of the previous index systems use quantifiable indicators as the evaluation criteria and use the relatively macroscopic panel data for evaluation [17, 18]. The data, namely, population growth rate and average annual growth rate of GDP, are relatively easy to obtain, but they are too macro and cannot be used as a typical indicator to measure sustainable development of the community. Therefore, this method of selecting indicators that are limited by data cannot fully reflect the comprehensiveness of community sustainable development.

To solve the problem of the commonality of indicators and calculation methods, this study proposes a systematic evaluation system from the perspective of qualitative analysis; the system does not consider the limitations of data collection factors, and it provides a more scientific indicator system. Combining previous research results, practical experience, and experts' opinions, from the perspective of the fundamental factors and development goals that influence the sustainable construction of the community, the study builds a community sustainable development evaluation system and develops a hybrid ANP-FCE evaluation method that transforms qualitative research into quantitative research. This method not only can consider the mutual influence between indicators, but also better solves the problem that the indicator is difficult to quantify, which provides good guidance for decision makers and managers in the sustainable development of the community.

2. An Overview of the Critical Factors for Urban Community Sustainable Construction

2.1. Analysis of Urban Community Construction. Cities are important space carriers for regional economic development and social progress. With the development of social economy, the world's population is increasingly concentrated in cities. The level of urbanization is widely considered to be an important symbol of economic development and social progress in a country or region. The community is a product of the process of urbanization. It is a miniature unit of the city and integrates society, space, organization, life, and history[34]. The community refers to the social life community formed by people gathered in a certain geographical area[16]; they are social groups with similar cultural characteristics and have a common organization and common living space[34]. With the improvement of living standards, people's requirements for residential area standards have been continuously improved, and the continuous progress of urbanization processes and other factors require the transformation and upgrading of traditional communities. The function of the community should not only be to solve the problem of people's residence. Under the basic conditions of providing safe buildings for residents, it should also create a clean and comfortable living environment for residents and provide convenient and good community services and a variety of cultural life[10]. Therefore, the issue of community construction problem has become an important issue that people cannot ignore.

2.2. Factors Analysis for Urban Community Sustainable Construction. Sustainable development is an important issue in the world care; as an important product of urbanization, the community is the important base for the country to implement the strategy of sustainable development[35]. And the sustainable development of the community is a critical keyword to improving the quality of life[36]. Based on the concept of the community, it combines a variety of social, economic, environmental, and cultural conflicts, thus forming a kind of social-economic-natural complex ecosystem[37]. Because community sustainable development is of great importance to the harmonious development of a society and people, the indicators and assessment models are needed to set criterion, and some research and exploration on evaluation of community sustainable construction have already been concerned.

Chandra (1974) had conducted the evaluation of urban community development problem in 1974 and proposed that area development is the main factor to influence the community sustainable construction[13]. After that, many researchers improve this point of view and put forward some specific indicators, such as the elements of socioeconomic and demographic factors[20], community economic development, labour market programmes[21], and outdoor and indoor environment[28]. These influencing factors are basically studied from economic and environmental indicators. With the deepening of research, people pay more attention to the humanistic environment of the community, and along with the proposal of green communities and ecological communities, the standards for the buildings have also changed. Some research findings indicate that community sustainable development is correlated with improvements in elite participation[38], social services, community life, cultural identity[29], and community participation[31, 32, 39]. The building standard needs to meet the requirements of green building[28], especially the aspects of energy efficient and building function [40].

In order to understand the factors needed for the sustainable development of the community, this study first collected some relevant factors from the literature. And then the current direction of sustainable community construction also was obtained from the interviews of five university professors with relevant research experience. According to the results of the literature review, 12 primary indicators were obtained, including economic development, resource consumption, energy use, urban demand, residents' needs, resources and environment, social development, ecological architecture, infrastructure construction, cultural environment, community security, and community management. At the same time, 53 secondary indicators also have been acquired, such as per capita GDP, per capita living area, per capita possession of road area, green space rate, building density, unemployment

Table 1: Critical factors of community sustainable development.

Factor	Indicator	Explanation of the indicators	References
C1: Economic potential	C11: Housing price	Reasonable housing prices can increase community purchase rate	[19]
	C12: Regional advantage	Regional advantages increase community purchasing rate	[20, 21]
	C13: Employment opportunity	Employment opportunity reduces community unemployment	[21]
	C14: Economic vitality	Great economic potential guarantees the future development of the community	[22]
	C15: Governance mode	Diversification of governance models to ensure that communities can co-ordinate multiple social resources and stimulate diversity in society	[23, 24]
C2: Environmental construction	C21: Natural environment	Beautiful natural environment improves comfort	[25, 26]
	C22: Living conditions	Living conditions will affect residents' living comfort	[27]
	C23: Public traffic	Reasonable traffic planning improves the convenience of residents' travel	[22, 28]
	C24: Resource consumption	Clean water resources and Energy saving are beneficial to the health of residents and economic development	[18, 28]
	C25: Solid waste management	Effective management of wastes to improve environmental cleanliness	[16, 18]
C3: Social development	C31: Culture life	The diversity of cultural life enhances the life fun of residents	[27]
	C32: Supporting facility	Improvement of supporting facilities to improve the convenience of residents	[27, 29]
	C33: Supporting service	Humanization of supporting services to meet the needs of residents	[22, 27]
	C34: Informatization degree	Higher degree of informatization improves residents' information reception speed	[27, 30]
	C35: Community security	Community safety can effectively protect residents' safety	[18, 27]
	C36: Community participation	Extensive community involvement can improve community governance	[31, 32]
C4: Building performance	C41: Building structural	Building structure design is beautiful and reasonable to enhance the beauty of buildings	[22]
	C42: Building function	Perfect building function can protect residents' needs	[22, 28]
	C43: Building quality	The quality of the building is intact to ensure the safety of residents	[16, 22]
	C44: Floor area ratio	A small volume ratio means fewer floors and better indoor lighting.	[27, 33]
	C45: Building density	Small building density ensures that the building spacing is large, resulting in a higher greening rate	[27, 30]

rate, community residents crime level, public participation, and the number of higher education students. According to the interviews of five experts, we deleted some overlapping and cross-over indicators and over-macro-indicators and retained some indicators that were most relevant to the sustainable development of the community. Finally, four primary indicators and 21 secondary indicators were determined, as shown in Table 1.

3. Research Methodology

According to previous studies, it can be found that there are currently many methods for evaluation, such as Delphi method, entropy method, factor analysis method, and analytic hierarchy process. These methods have the advantages of convenient application, but there are also some inevitable problems [41]. The implementation of the Delphi method is

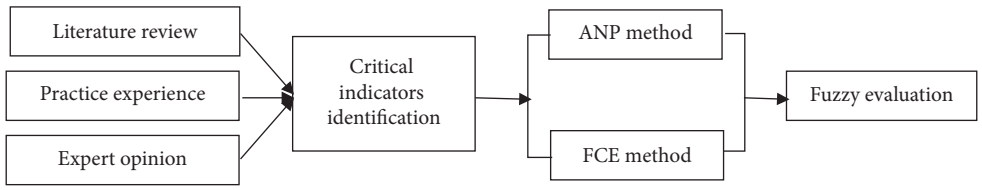

Figure 1: The flowchart of the research method.

complicated and takes a long time. Entropy strictly enforces mathematical laws, ignoring the subjective intentions of decision makers. The factor analysis method has strict requirements on the objective data collected, and the analytic hierarchy process ignores the influence relationship between the indicators [42].

However, in the process of studying the community sustainable development indicators, it is found that the indicators are not mutually independent; they interacted with each other. For example, in the factor of C1 (economic potential), the indicator of C11 (housing price) is related to the indicator of C12 (regional advantage), the good community location leads to higher housing prices, and this mutual influence and interaction constitute a new feature of community sustainable development that cannot be ignored. Therefore, in the weight distribution of the index system, the ANP (Analytic Network Process) is used to assign weights to each indicator. ANP not only considers the correlation between various factors, but also can give feedback to the entire model, form a network relationship, and be more in line with the actual situation of the decision-making process [42, 43].

At the same time, we found that there are still some uncertainties and ambiguities in the evaluation indicators. For example, C41 (building structural), is not suitable for evaluation with accurate numerical value. Even if some indicators can be input with accurate numerical values, if there is no comparison, it is impossible to determine whether the status of the target of the research object is good or bad. Based on this, this study uses FCE (Fuzzy Comprehensive Evaluation) to evaluate the factors' membership. FCE is a comprehensive evaluation method based on fuzzy mathematics. It uses the principle of fuzzy relation synthesis to quantify some factors that have unclear boundaries and are difficult to quantify.

Therefore, the research methods used in this paper are briefly introduced in Figure 1. According to the literature review, practical experience, and expert opinion, the study identifies the key factors of the community sustainable development and then combines the research object of this paper and establishes an ANP-FCE based assessment model for community sustainable development, where ANP is used to determine the weight of indicators, and FCE is to determine the factors' membership. FCE is based on ANP, and they work together to make the evaluation result more clear and effective[44]. This section studies the related calculation principles of ANP-FCE and then gives the hybrid evaluation step of the community sustainable construction.

The basic calculation steps of ANP are as follows.

Step 1 (construct the ANP structure). ANP divides the entire system element into two major parts[45]. According to the research content of this paper, ANP network structure is shown in Figure 2. The first part is called the control hierarchy, including the decision goals and criteria. All the criteria are considered independent of each other and only subject to the goal. The community sustainable development is the decision goal in the control hierarchy. The second part is called the network hierarchy. It is composed of element groups, such as C1-C4 proposed by this study. These element groups are controlled by the control hierarchy. The system internals are similar to the mutual influence of the network system.

Step 2 (survey of the relevance of indicators). The second phase is to investigate how critical factors of the community sustainable development interact. The list of critical factors to the community sustainable development (see in Table 1) is already drawn from the extensive literature review, practical experience, and expert opinion. It is based on the complex relationships between indicators and the ANP model that have already been built. Experts fill in the pairwise comparison matrix of the correlation index. The degree of dominance indicated by the scale method used is shown in Table 2. The range of score changes is 1-9.

Step 3 (construct an unweighted supermatrix). The supermatrix constructs the degree of interaction between elements. Supermatrix presents this degree in the form of a block matrix. The elements in the constructed matrix represent the degree of influence of the underlying element on the elements above it[46], such as W_{C15}^{C13}; this formula represents the impact of the indicator C15 (governance mode) on the indicator C13 (employment opportunity); this judgment process is completed by experts. The element-level supermatrix construction of this study is shown in formula (1). The result can indicate the local dominance of this element in its element group.

$$\mathrm{W} = \begin{bmatrix} W_{C11}^{C11} & W_{C11}^{C12} & \dots & W_{C11}^{C45} \\ W_{C12}^{C11} & W_{C12}^{C12} & \dots & W_{C12}^{C45} \\ W_{C13}^{C11} & W_{C13}^{C12} & \dots & W_{C13}^{C45} \\ \dots & \dots & \dots & \dots \\ W_{C43}^{C11} & W_{C43}^{C12} & \dots & W_{C43}^{C45} \\ W_{C44}^{C11} & W_{C44}^{C12} & \dots & W_{C44}^{C45} \\ W_{C45}^{C11} & W_{C45}^{C12} & \dots & W_{C45}^{C45} \end{bmatrix} \quad (1)$$

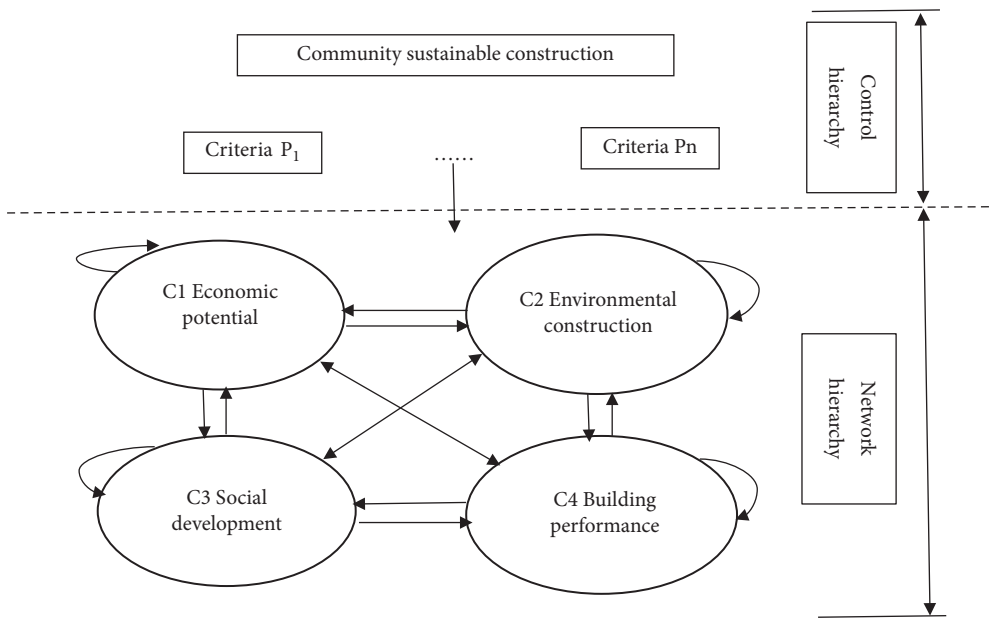

Figure 2: The basic structure of ANP.

Table 2: The value of scale and explanation (parts).

No.	The degree of dominance indicated	Score range	Final store
1	C13: Employment opportunity is moderately to strongly more important than C12 Regional Advantage	1-9	4
2	C22: Living conditions are moderately more important than C24 Energy uses	1-9	3
3	C33: Supporting service is equally to moderately more important than C32 Supporting facility	1-9	2
4	C45: Building density is equally to moderately more important than (C44) Floor area ratio	1-9	1

Step 4 (construct a weighted supermatrix). According to the principle of ANP calculation, there is also a mutual influence between element groups. Formula (2) represents an element group level supermatrix. The formula of w_{c1}^{c2} indicates the impact of the indicator C1 (economic potential) on the indicator C2 (environmental construction). Meanwhile, by comparing different element groups, a normalized sorting vector can be obtained, followed by a weighted matrix A which consisted of every normalized sorting vector, as shown in formula (3). Multiply the matrix A and W to get the weighted supermatrix (see formula (4)). Then we can get the global dominance of the element.

$$\mathrm{w} = \begin{bmatrix} w_{c1}^{c1} & w_{c1}^{c2} & w_{c1}^{c3} & w_{c1}^{c4} \\ w_{c2}^{c1} & w_{c2}^{c2} & w_{c2}^{c3} & w_{c2}^{c4} \\ w_{c3}^{c1} & w_{c3}^{c2} & w_{c3}^{c3} & w_{c3}^{c4} \\ w_{c4}^{c1} & w_{c4}^{c2} & w_{c4}^{c3} & w_{c4}^{c4} \end{bmatrix} \tag{2}$$

$$\mathrm{A} = \begin{bmatrix} a_{11} & a_{12} & a_{13} & a_{14} \\ a_{21} & a_{22} & 2_{23} & a_{24} \\ a_{31} & a_{32} & a_{33} & a_{34} \\ a_{41} & a_{42} & a_{43} & a_{44} \end{bmatrix} \tag{3}$$

$$\overline{W} = \mathrm{W} \times \mathrm{A} \tag{4}$$

Step 5 (solve the limit supermatrix). In decision-making, in order to reflect the dependencies between elements, the weighted supermatrix $\overline{W}$ needs to be stabilized; by calculating the limit of the power of the weighted hypermatrix, we get the comprehensive ranking of the supermatrix[47].

$$\overline{W}' = \lim_{r \longrightarrow \infty} \overline{W}^{r} \tag{5}$$

The basic calculation steps of FCE are as follows.

Step 1 (determine the evaluation indicators). The evaluation indicators of the community sustainable development (see Table 1) are already drawn from the extensive literature review, practical experience, and expert opinion. $\mathrm{C} = \{C_1, C_2, C_3, C_4\}$, where C_1 represents economic potential, C_2 represents environmental construction, C_3 represents social development, and C_4 represents building performance.

Step 2 (construct an evaluation set). The evaluation set is a collection of various results that the evaluator may make on the evaluation object. The evaluation set of the indicator can be expressed as $\mathrm{F} = f_1, f_2, f_3, f_4, f_5$, where f_1 means very low; f_2 means lower; f_3 means general; f_4 means higher, and f_5 means very high.

Step 3 (construct the FCE matrix). If the membership of the first element in the factor set C_1 to the first element

Table 3: The membership of the indicator (R_1).

	f_1	f_2	f_3	f_4	f_5
C_{11}	r_{111}	r_{112}	r_{113}	r_{114}	r_{115}
C_{12}	r_{121}	r_{122}	r_{123}	r_{124}	r_{125}
C_{13}	r_{131}	r_{132}	r_{133}	r_{134}	r_{135}
C_{14}	r_{141}	r_{142}	r_{143}	r_{144}	r_{145}
C_{15}	r_{151}	r_{152}	r_{145}	r_{154}	r_{155}

Table 4: The information of selected community.

Community name	Year of completion	Number of households	Total surface area (m^2)	Floor Area Ratio	Greening rate
Min Xing Garden	June 2002	1006	165000	2.0	35%

in the evaluation set f_1 is r_{111}, the result of the single element evaluation can be expressed as a fuzzy set: $r_{11} = (r_{111}, r_{112}, r_{113}, r_{114}, r_{115})$, where normalized values need to be satisfied where $r_{111} + r_{112} + r_{113} + r_{114} + r_{115} = 1$, and the evaluation method of indicator membership which be proposed by experts can be described in Table 3. Taking the five single factor evaluation sets which consisted of $r_{11}, r_{12}, r_{13}, r_{14}, r_{15}$ as the rows, the matrix of $R_1 = r_{5\times5}$ can be called the FCE (Fuzzy Comprehensive Evaluation) matrix, as shown in formula (6), with the same method to calculate the membership of R_2, R_3, R_4. Therefore, final comprehensive evaluation matrix can be descripted by a set of four factors' matrix, as shown in formula (7).

$$R_1 = \begin{bmatrix} r_{111} & r_{112} & r_{113} & r_{114} & r_{115} \\ r_{121} & r_{122} & r_{123} & r_{124} & r_{125} \\ r_{131} & r_{132} & r_{133} & r_{134} & r_{135} \\ r_{141} & r_{142} & r_{143} & r_{144} & r_{145} \\ r_{151} & r_{152} & r_{153} & r_{154} & r_{155} \end{bmatrix} \tag{6}$$

$$\mathrm{R} = \begin{bmatrix} R_1 \\ R_2 \\ R_3 \\ R_4 \end{bmatrix} = \begin{bmatrix} r_{111} & r_{112} & r_{113} & r_{114} & r_{115} \\ & & \cdots & & \\ r_{211} & r_{212} & r_{213} & r_{214} & r_{215} \\ & & \cdots & & \\ r_{311} & r_{312} & r_{313} & r_{314} & r_{315} \\ & & \cdots & & \\ r_{411} & r_{412} & r_{413} & r_{414} & r_{415} \\ & & \cdots & & \\ r_{451} & r_{452} & r_{453} & r_{454} & r_{455} \end{bmatrix} \tag{7}$$

Step 4 (fuzzy synthesis and comprehensive evaluation). Based on the ANP calculation results, we can obtain the weight of each indicator and express the fuzzy set of indicator weight sets as $\mathrm{A}' = (A_1, A_2, A_3, A_4)$, after identifying the comprehensive evaluation matrix R and the factor weight vector A, by fuzzy change of the fuzzy vector A on F to the fuzzy vector B on F, as shown in in the following formula:

$$\begin{aligned} \mathrm{B} &= \mathrm{A}' \circ \mathrm{R} \\ &= \left(a'_{11}, \cdots, a'_{21}, \cdots, a'_{31}, \cdots, a'_{41}, \cdots, a'_{45}\right) \\ &\quad \times \begin{bmatrix} r_{111} & r_{112} & r_{113} & r_{114} & r_{115} \\ & & \cdots & & \\ r_{211} & r_{212} & r_{213} & r_{214} & r_{215} \\ & & \cdots & & \\ r_{311} & r_{312} & r_{313} & r_{314} & r_{315} \\ & & \cdots & & \\ r_{411} & r_{412} & r_{413} & r_{414} & r_{415} \\ & & \cdots & & \\ r_{451} & r_{452} & r_{453} & r_{454} & r_{455} \end{bmatrix} = (b_1, b_2, b_3, b_4, b_5) \end{aligned} \tag{8}$$

where $\circ$ is called synthesis evaluation synthesis operator, and it can be taken as general matrix multiplication. For the final result, it is processed according to maximum membership principle of FCE, and the evaluation result of the evaluated object can be obtained.

4. Empirical Study

In this section, the empirical evaluation study of the ANP-FCE method can be shown as follows. First, according to the evaluation system of the community sustainable development (see Table 1) which is already drawn from the extensive literature review, practical experience, and expert opinion, calculate the weight of every indicator with the help of ANP method. And then, based on the case community which has already been selected and the weights, FCE method conducts the comprehensive evaluation. The relevant judgments appearing in the above process are completed by selected experts (see in Table 5). The information of the selected community can be shown in Table 4.

The selected community in this empirical study is the Min Xing Garden in Dalian, Liaoning Province, China. The community was completed in 2002 and its development is

Table 5: The information of selected experts.

Expert	Working organization	Role in the organization
A	University	Professor
B	University	Professor
C	University	Professor
D	University	Professor
E	University	Professor
F	Contractor	Planner
G	Real estate company	Developer
I	Government	Governor
J	Community	Resident
H	Property department	Property manager

relatively mature. It has a mature social environment and construction level. At the same time, taking Dalian people's Square as the center, it is within 2km from the city center; therefore, it has good economic potential.

In this paper, ten experts who are familiar with community sustainable construction give the weights and memberships of each indicator through a questionnaire survey. Considering the stability of the results, this study will take the average of ten experts' results as the final outcomes. The experts are composed of five university professors with relevant research experience and the other five stakeholders. The collected data of ten questionnaires is valid.

Through the above detailed explanation of the research method and calculation principles, the study constructs a structural evaluation system of urban community sustainable development. And then, based on the average survey result from ten experts, this research can obtain every indicator weight (see in Table 6). The operation solving process where experts use ANP to analyze, evaluate, and construct the judgment matrix is very complicated; this study will not show further details in this article.

Then, based on the weights of indicators and the membership calculated by the experts, the fuzzy comprehensive evaluation can be described as

$$\begin{aligned} B &= (0.125, \cdots, 0.089, \cdots, 0.004, \cdots, 0.010, \cdots, 0.074) \\ &\times \begin{bmatrix} 0.25 & 0.30 & 0.10 & 0.25 & 0.10 \\ & & \cdots & & \\ 0.10 & 0.25 & 0.35 & 0.25 & 0.15 \\ & & \cdots & & \\ 0.05 & 0.25 & 0.15 & 0.35 & 0.20 \\ & & \cdots & & \\ 0.00 & 0.35 & 0.35 & 0.25 & 0.05 \\ & & \cdots & & \\ 0.10 & 0.25 & 0.25 & 0.25 & 0.20 \end{bmatrix} \\ &= (0.049, 0.151, 0.305, 0.342, 0.153) \end{aligned} \tag{9}$$

According to the results of fuzzy comprehensive evaluation, it is known that the membership of "very low" level of community sustainable construction is 0.049, the membership of the "below average" level of community sustainable construction is 0.151, the membership of the "average" level of community sustainable construction is 0.305, the membership of the "above average" level of community sustainable construction is 0.342, and the "very high" level of community sustainable construction is 0.153. Therefore, according to t maximum membership principle of FCE, the community sustainable construction of Min Xing Garden is "above average". It has not yet reached the standard of "very high" level and there is still room for improvement.

5. Discussion

In order to pursue sustainable development, appropriate sustainability measurement at the local scale is critical. However, few efforts have been made in this regard [18]. This study establishes the index system which is different from most other studies and uses ANP to assign weights to the selected indicators. By evaluating the evaluation results of the index system, we can identify the relative importance of the impact factors of community sustainable development. Meanwhile, combining evaluation of cases used FCE method, providing good guidelines for China's community sustainable construction and urban sustainable agenda.

Through the research results, similar to past research results, it is found that the community's environmental construction plays a very important role in the sustainable development of the community [25], including natural environment, living conditions, public traffic, resource consumption, and solid waste management. Relative to other indicators, natural environment and public traffic play important roles in the sustainability of the community. The wonderful community environment will help improve the quality of people's lives, and it will also promote the sustainable development of the community. Meanwhile, the community's good transportation facilities system will improve the convenience of people's lives. Therefore, environmental construction is still a very important part of the sustainable development of communities.

Second, economic factors neglected or underestimated in previous studies are important for community sustainability

Table 6: The weight of each indicator.

Factor	Factor weight	Indicator	Indicator weight	No.
C1: Economic potential	0.370	C11: Housing price	0.125	1
		C12: Regional advantage	0.047	11
		C13: Employment opportunity	0.039	13
		C14: Economic vitality	0.070	6
		C15: Governance mode	0.089	2
C2: Environmental construction	0.298	C21: Natural environment	0.089	3
		C22: Living conditions	0.058	8
		C23: Public traffic	0.077	4
		C24: Resource consumption	0.047	12
		C25: Solid waste management	0.023	16
C3: Social development	0.117	C31: Culture life	0.004	20
		C32: Supporting facility	0.027	14
		C33: Supporting service	0.014	17
		C34: Informatization degree	0.008	19
		C35: Community security	0.060	7
		C36: Community participation	0.004	21
C4: Building performance	0.220	C41: Building structural	0.010	18
		C42: Building function	0.057	9
		C43: Building quality	0.054	10
		C44: Floor area ratio	0.026	15
		C45: Building density	0.074	5

[25]. In this study, it is believed that economic factors are a very important part of sustainable community development. They not only involve the current housing price, regional advantage, and employment opportunity, but also involve the community's economic vitality and the governance mode of community operations. Judging from the weighted results of various indicators, the housing price and governance mode are the two most important indicators that affect community sustainable development. Reasonable housing prices can increase the access rate of the community, and the model of community governance affects the sustainability of community operations. Therefore, in the process of sustainable community construction, do not underestimate the important role of economic factors, and focus on factors such as housing prices, community geographical advantages, and providing good employment opportunities for residents in community construction.

Furthermore, the factor of building performance has become an important factor affecting the sustainable construction of the community. Building density and building function are relatively more important than other factors. For residents, they pay more attention to the comfort of the residence and the function of the buildings. However, the social development of community construction such as culture life, supporting facility, supporting service, informatization degree, community security, and community participation are less important than other factors, which is closely related to the current economic development mode in China. People's increasingly busy work makes residents often neglect the participation in community activities and the interaction of community residents. Nevertheless, from the long-term perspective, residents not only pay attention to living conditions, but also will be more and more satisfied with the harmonious and friendly community culture. Therefore, the social development aspect of future community construction will become a very important part of the community sustainable construction.

6. Conclusion

Study on the evaluation of community sustainable development mainly involves the evaluation of a single aspect or the special area. This paper establishes a "richness-fairness" indicator system. The system not only is concerned about the current factors, but also takes into account the future direction of the sustainable community. In addition, without being limited by the data, we have taken a more comprehensive consideration of various factors that affect the sustainable construction of communities and provided a theoretical basis for our country to carry out comprehensive community construction.

In this paper, a hybrid evaluation model is implemented to evaluate urban community sustainable construction. This hybrid evaluation model takes full advantages of ANP and FCE. ANP not only considers the correlation between various factors, but also can give feedback to the entire model, form a network relationship, and be more in line with the actual situation of the decision-making process. Meanwhile, FCE uses the principle of fuzzy relation synthesis to quantify some factors that have unclear boundaries and are difficult

to quantify, making the evaluation result more objective and in line with the actual situation. Therefore, in this study, the ANP-FCE comprehensive evaluation method can combine qualitative and quantitative factors, expand the amount of information, increase the number of evaluations, and make the evaluation conclusions credible.

However, community development is an ever-changing process. Standards of sustainable communities and people's needs for sustainable communities will change with time and the environment. Therefore, we need to continue to consider some other factors, such as residents' quality and value orientation and improve and optimize the evaluation system of urban community sustainable construction ability. Moreover, the ANP model's data inputs rely on expert scoring used in the traditional ANP method, which leads to the comparison results of the index factors being too subjective. In the future, we can also develop more advanced evaluation technology.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper. The mentioned received funding in the Acknowledgments did not lead to any conflicts of interest.

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