Research on Post-use Evaluation Methods and Applications of Urban Micro-agriculture: A Case Study of Guangzhou

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Abstract. The micro-agriculture labor experience carried out nearby in cities has gradually become popular among residents. By constructing a post-use evaluation system for urban micro-agriculture, necessary development strategies are provided for the construction and development of urban micro-agriculture. Based on the analytic hierarchy process, 5 criterion-level indicator factors and 20 standard-level indicator factors are selected to construct a hierarchical system model. The weight values of each indicator factor are calculated by constructing a judgment matrix and the consistency test is performed to obtain the weight results that meet the requirements; 5 urban micro-agricultures in Guangzhou are selected for post-use evaluation to obtain the post-use comprehensive rating. The post-use comprehensive rating results of the 5 urban micro-agricultures in Guangzhou are: Tianhe Children's Park Farm is "excellent", Urban Skyline Farm is "excellent", Taikoo Hui Rooftop Farm is "excellent", Hualin Street Love Farm is "good", and Lion King Beibei Rooftop Farm is "average". The establishment of the post-use evaluation system for urban micro-agriculture provides a scientific basis for the construction and development of urban micro-agriculture, accurately discovers the problems existing in the development of urban micro-agriculture and formulates effective solutions, which is conducive to the sustainable development of urban micro-agriculture and thus improves the life happiness of urban residents. With the continuous development of smart agriculture in cities, future research should focus on the changes and impacts that smart agriculture brings to the lives of urban residents based on existing traditional agricultural forms.

Keywords: Post-use Evaluation, Urban Micro-agriculture, Analytic Hierarchy Process, Labor Experience, Guangzhou

1 Introduction

Urban settlements have existed for thousands of years with the development of human civilization. These settlements initially relied mainly on agriculture, and later grew and became centers of merchants and trade[1]. In recent years, with the continuous expansion of urban areas, suburban areas around the world have developed rapidly,

X. Li et al. (eds.), *Proceedings of the 2025 International Conference on Agriculture and Resource Economy (ICARE 2025)*, Advances in Biological Sciences Research 46,
https://doi.org/10.2991/978-94-6463-746-5_5

occupying large areas of fertile land originally used for agriculture[2]. However, in some areas of cities, especially in communities, the number of people who carry out or intend to carry out micro-agricultural activities has gradually increased. These "small but fine" agricultural planting forms are reasonably distributed in urban residential areas. By introducing sustainable energy recycling facilities such as earthworm composting towers, composting barrels, and garbage sorting bins, small green spaces in cities can be turned into productive public spaces[3]. The rise of urban micro-agriculture is inevitable and plays a positive role in entrepreneurship, employment, nature education, social interaction, and spiritual relaxation[4, 5]. At the same time, the evolution and development of the relationship between urban agriculture and cities can further promote the high integration of urban economic and social development and the ecosystem[6], which is a sustainable development model for urban environment that integrates multiple functions[7].

Urban agriculture was first formally proposed by American economist Allen Ness in 1977[8]. It is mainly agriculture in cities or surrounding areas, serving the needs of residents in the entire urban area for agricultural products and leisure and entertainment. Urban micro-agriculture is a kind of micro-fine agriculture within the city[9].Its characteristics are small scale, natural ecology, strong functionality, high participation, low carbon and environmental protection. Urban micro-agriculture is a comprehensive consideration of agricultural production crops, planting techniques, etc. in the process of urban construction, and integrates them into urban space through landscape design methods to build an ecological agricultural landscape with popular science, naturalness, leisure and fun. Its main service population is residents living in the city. It is a breakthrough in the trend of urban landscape design being similar, allowing urban landscapes to return to a poetic living atmosphere[10]. Urban micro-agriculture plays a positive role in bringing residents closer to nature, enhancing residents' outdoor activity experience, and improving neighborhood relations[11].

Since ancient times, people's ideal paradise for life is a fertile land that is conducive to agricultural production. Similarly, the development of gardens is also constantly simulating nature, thereby generating agricultural landscapes[12].The upsurge of micro-agricultural activities in cities reflects the profound influence of traditional Chinese farming culture on people, and also reflects people's endless yearning for pastoral life[13]. Using abandoned vacant land, building roofs, facades of structures and other spaces in cities to carry out micro-agricultural activities, or transforming public green spaces in some residential spaces into small agricultural production green spaces, can greatly satisfy people's enjoyment and experience of the pastoral spirit[14, 15].

Unlike traditional agriculture, urban agriculture does not only focus on the economic function of agriculture, but also pays equal attention to multiple functions such as ecology, society, and culture. Its progress and development depends on the multifunctionality of agriculture[16]. Urban micro-agriculture should not only retain the production function of agriculture, but also allow residents to participate in the natural planting experience, and provide good natural education opportunities for all ages in the city[17]. It is the green starting point for micro-renewal of urban space. Urban agri-

culture needs to attract people's attention in order to cope with urbanization, rapid population growth, food crisis and climate change in a sustainable way[18, 19].

2 Study Area and Data Sources

2.1 Study Area Selection

This study selected Guangzhou as the research area for urban micro-agriculture. Guangzhou is located in the subtropical climate zone, with an average annual temperature between 20-22°C and abundant rainfall, which is conducive to the growth of crops in all seasons. On March 27, 2021, the "Guangzhou Urban Small Vegetable Garden" project jointly launched by multiple government units in Guangzhou was held in “Huacheng” Square, becoming the first urban agricultural action in China guided by the government to participate in "personal vegetable gardens". On December 18, 2021, the Guangzhou Municipal Agriculture and Rural Affairs Bureau and others hosted the "Small Vegetable Garden" Carnival, and selected 60 "Most Beautiful Guangzhou Urban Small Vegetable Gardens" such as "Baiyun Supply and Marketing Initial Garden". Guangzhou's urban micro-agriculture has been widely carried out in communities, streets, schools and other places, allowing citizens to enjoy the natural fun of green agriculture locally.

2.2 Data Source

2.2.1 Evaluation Weight Acquisition

The weight data of the evaluation system indicators were obtained by consulting 16 professionals, including experts, builders, and participants in urban micro-agriculture in the form of a questionnaire. Among them, 5 agriculture-related professors, 5 urban landscape designers, and 6 micro-agriculture activity organizers were included in the evaluation. The importance of the indicators was rated using a 1-9 scale (Table 1). A total of 16 questionnaires were distributed and collected in this survey. Through data processing, it was found that all questionnaire data were valid and usable.

Table 1. Judgment matrix importance scale and meaning.

Scale	Meaning
1	Factor i is as important as factor j
3	Factor i is slightly more important than factor j
5	Factor i and factor j are obviously important
7	Factors i and j are particularly important
9	Factor i and factor j are absolutely important
2,4,6,8	The compromise value of comparing two factors
Reciprocals	Comparison of two factors

2.2.2 Acquisition of Post-use Evaluation Data of Micro-agriculture

This study conducted a field survey of urban micro-agriculture in Guangzhou, and randomly selected 5 micro-agriculture sites within the research scope to conduct a questionnaire survey on the evaluation of the population after use. During the survey, a total of 450 questionnaires were distributed and 420 questionnaires were collected, with a questionnaire collection rate of 93.3%. After data sorting and integrity checking of the collected questionnaires, 412 useful questionnaires were obtained, with a questionnaire validity rate of 91.6%.

3 Evaluation Index Selection and Model Construction

The analytic hierarchy process is selected as the post-use evaluation method of urban micro-agriculture. This method can better solve complex decision-making problems in a quantitative way. The analytic hierarchy process divides the indicator factors related to the overall decision into multiple levels such as the target layer, the criterion layer, and the indicator layer. By comparing the importance of each of the interconnected indicator factors at each layer, the importance ranking of each indicator factor is obtained, providing a scientific basis for the development of urban micro-agriculture.

The development of urban micro-agriculture is related to multiple factors, not just the single field of traditional agriculture, but also involves multiple fields such as agricultural production, landscape aesthetics, modern agricultural technology and environmental psychology. By consulting relevant experts and professionals, we conducted a field survey of Guangzhou's urban micro-agriculture landscape and drew on the relevant evaluation index system construction method[20] to construct an evaluation system for Guangzhou's urban micro-agriculture. This evaluation system classifies the index factors into five categories: service, popular science, productivity, technology, and sociality as the criterion layer; and selects 20 index factors such as complete planting facilities, public participation experience, popular science of agricultural knowledge, rich crop varieties, green organic planting, advanced planting technology, rainwater collection system, improving residents' happiness, and promoting ecological protection as the standard layer (Table 2).

Table 2. Indicator selection and content description of the post-use evaluation system of urban micro-agriculture in Guangzhou

Target Layer	Criteria Layer	Standard Layer
Guangzhou Urban Micro-Agriculture Post-use Evaluation System A	Serviceability B1	Complete planting facilities C1
		Complete service facilities C2
		Convenient location C3
		Public Participation Experience C4
	Popular Science B2	Agricultural Knowledge Popularization C5
		Farming Culture Inheritance C6
		Nature Education Science C7

		Planting technology promotion C8
	Productivity B3	Rich variety of crops C9
		Green organic planting C10
		Sustainable crop production C11
		Professional planting and maintenance C12
	Technology B4	Smart Technology Planting C13
		Scientific Management Platform C14
		Rainwater collection system C15
		Energy Cycle Technology C16
	Social B5	Promoting Neighborhood Harmony C17
		Improving residents' happiness C18
		Innovative Economic Development C19
		Promote ecological and environmental protection C20

4 Research Methods

4.1 Construct a Judgment Matrix

Guangzhou's urban micro-agriculture evaluation system is divided into three levels, represented by the letters A, B, and C respectively. Each level of indicators has a corresponding indicator weight proportion to the previous level[21]. The data of indicator weights are obtained through questionnaires. Using the elements of the upper layer as the benchmark, any two indicators in the same layer are compared in pairs to construct a judgment matrix. According to the hierarchical relationship in the Guangzhou urban micro-agricultural landscape construction evaluation system, A-(B1~B5), B1-(C1~C4), B2-(C5~C8),B3-(C9~C12),B4-(C13~C16), B5-(C17~C20) 6 judgment matrices.

4.2 Indicator Weight Calculation and Consistency Check

The importance judgment matrix of each indicator factor is used to calculate the indicator weight using the geometric mean method. First, the product "Mi" of each row element in the judgment matrix and its nth root "$\overline{\omega i}$ "are calculated using formulas (1) and (2). Use formula (3) to normalize "$\overline{\omega i}$ " to obtain the corresponding eigenvector value "W_i ". "W_i " is the relative weight value of the index factor of this layer corresponding to the index factor of the previous layer. The weight value of the factor of this layer can be sorted.

Formula (4) is used to calculate the maximum eigenvalue "λ_{max} " of the judgment matrix, and a consistency test is performed. Introduce the consistency index calcula-

tion formula (5) “CI” and the average random consistency index “RI” of the judgment matrix (Table 3), and use formula (6) “CR = CI/RI”to perform consistency testing on the constructed judgment matrix. If “CR” < 0.1, the judgment matrix has acceptable consistency.

Table 3. Average random consistency index “RI” value

Degree	RI
1	0
2	0
3	0.58
4	0.90
5	1.12
6	1.24
7	1.32
8	1.41
9	1.45
10	1.49

$$\mathrm{M_i} = \prod_{j=1}^{\mathrm{n}} a_{ij} \quad (\mathrm{i}=1,\ 2,\ \ldots \mathrm{n}) \tag{1}$$

$$\varpi_{\mathrm{i}} = \sqrt[n]{\prod_{j=1}^{n} a_{ij}} \tag{2}$$

$$W_{\mathrm{i}} = \frac{\varpi_i}{\sum_{i=1}^{n} \varpi_i} \tag{3}$$

$$\lambda_{\max} = \frac{1}{n} \sum_{i=1}^{n} \frac{(AW)_i}{W_i} \tag{4}$$

(“ A ” is the judgment matrix, “ W ” is the weight vector)

$$\mathrm{CI} = \frac{\lambda_{\max} - \mathrm{n}}{n-i} \tag{5}$$

$$\mathrm{CR} = \frac{\mathrm{CI}}{\mathrm{RI}} \tag{6}$$

Table 4. Post-use evaluation system of urban micro-agriculture in Guangzhou

Target Layer	Criteria Layer	Criteria layer weight	Standard Layer	Standard layer weight value	Comprehensive weight value	Sorting
A	B1	0.3441	C1	0.2844	0.0980	2
			C2	0.1196	0.0411	10
			C3	0.1817	0.0625	6
			C4	0.4143	0.1425	1
	B2	0.2404	C5	0.3903	0.0938	3
			C6	0.2036	0.0490	8
			C7	0.1094	0.0263	16
			C8	0.2966	0.0713	4
	B3	0.1332	C9	0.1493	0.0197	19
			C10	0.3075	0.0407	11
			C11	0.3657	0.0483	9
			C12	0.1775	0.0235	17
	B4	0.1001	C13	0.2157	0.0216	18
			C14	0.1526	0.0153	20
			C15	0.2839	0.0284	14
			C16	0.3478	0.0348	13
	B5	0.1822	C17	0.1986	0.0362	12
			C18	0.3696	0.0673	5
			C19	0.1509	0.0275	15
			C20	0.2809	0.0512	7

4.3 Study on Post-use Evaluation Method of Urban Micro-agriculture

Five urban micro-agriculture sites in Guangzhou were selected to conduct a post-use evaluation questionnaire survey. 90 questionnaires were distributed to each micro-agriculture landscape, and the valid questionnaires for the post-use evaluation of the micro-agriculture were obtained by removing the questionnaires that did not meet the requirements. In order to evaluate each indicator in the evaluation index system, five levels of V1 (excellent), V2 (good), V3 (average), V4 (poor), and V5 (poor) were selected to form the comment set V = {V1, V2, V3, V4, V5}, as shown in Table 5.

Table 5. Comprehensive rating table of micro-agriculture on the rooftop vegetable garden of Taikoo Hui in Guangzhou

Target Layer	Criteria Layer	Standard Layer	Evaluation level (V)				
			V 1	V 2	V 3	V 4	V 5
A	B1	C1	0.53	0.31	0.16	0.00	0.00
		C2	0.41	0.33	0.18	0.08	0.00
		C3	0.58	0.31	0.11	0.00	0.00
		C4	0.78	0.21	0.01	0.00	0.00
	B2	C5	0.53	0.28	0.10	0.08	0.01

		C6	0.11	0.23	0.47	0.19	0.00
		C7	0.49	0.31	0.18	0.02	0.00
		C8	0.21	0.47	0.21	0.11	0.00
	B3	C9	0.13	0.28	0.47	0.12	0.00
		C10	0.58	0.31	0.10	0.01	0.00
		C11	0.61	0.28	0.11	0.00	0.00
		C12	0.21	0.31	0.33	0.10	0.05
	B4	C13	0.81	0.18	0.01	0.00	0.00
		C14	0.22	0.48	0.21	0.09	0.00
		C15	0.48	0.21	0.19	0.12	0.00
		C16	0.31	0.49	0.12	0.08	0.00
	B5	C17	0.33	0.42	0.18	0.07	0.00
		C18	0.58	0.31	0.02	0.09	0.00
		C19	0.55	0.29	0.10	0.06	0.00
		C20	0.61	0.31	0.05	0.03	0.00

The membership degree of each indicator was obtained by the fuzzy statistical experimental method, and the fuzzy relation ℝ (m = 1, 2, 3⋯k) was constructed to obtain the evaluation matrix(7):

$$\mathrm{R}_m = (r_{ij})_{p \times n} = \begin{pmatrix} r_{11} & r_{12} & \cdots & r_{1n} \\ r_{21} & r_{22} & \cdots & r_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ r_{p1} & r_{p2} & \cdots & r_{pn} \end{pmatrix} \tag{7}$$

Wherein,“r_{ij}”refers to the membership function of the i-th indicator in the secondary indicator layer to the j level in the comment set; the ratio of the j-level evaluation frequency of the i-th indicator to the total evaluation frequency is used as the membership frequency of the i-th indicator to the comment set V. “r_{ij}”(the number of occurrences of the i-th indicator in the secondary indicator layer to the j-level in the comment set) / total evaluation frequency;

Performing a first-level fuzzy operation on the second-level indicator weight vector set and the corresponding evaluation matrix can obtain the first-level comprehensive evaluation of the first-level indicator layer(8):

$$\mathrm{A}_m = W_m \text{ x } R_m \tag{8}$$

From Table 4, we can conclude that the secondary indicator weight vector sets are:
= (0.2844,0.1196,0.1817,0.4143),
= (0.3903,0.2036,0.1094,0.2966),
= (0.1493,0.3075,0.3657,0.1775),
= (0.2157,0.1526,0.2839,0.3478),
= (0.1986,0.3696,0.1509,0.2809),

According to the questionnaire survey data, we can get the corresponding evaluation matrix R_1, R_2, R_3, R_4, R_5. After the first-level comprehensive evaluation of the secondary indicator factors, we can get:

A_1=(0.6283, 0.2710, 0.0912, 0.0096, 0.0000)

A_2=(0.2983, 0.3763, 0.2167, 0.1047, 0.0039)

A_3=(0.4543, 0.2946, 0.1997, 0.0343, 0.0085)

A_4=(0.4524, 0.3421, 0.1299, 0.0756, 0.0000)

A_5=(0.5342, 0.3288, 0.0723, 0.0646, 0.0000)

Through the first-level evaluation, we can get the evaluation matrix R= (A_1, A_2, $\cdots A_5$) ^{T} of the criterion layer for the target layer. From Table 4, we can get the weight vector of the first-level index W= (0.3441, 0.2404, 0.1332, 0.1001, 0.1822). The first-level index weight vector "W" and the evaluation matrix "R" are fuzzy operated to complete the final second-level comprehensive evaluation: A=W×R= (0.4911, 0.3171, 0.1362, 0.0524, 0.0021)

According to the principle of maximum membership, the evaluation result of the micro-agriculture of the rooftop vegetable garden of Taikoo Hui after use is determined to be "excellent".

Table 6. Guangzhou Urban Micro-Agriculture Post-use Evaluation Rating Table

Micro-agriculture name	Overall Rating	B_1	B2	B3	B4	B5
Taikoo Hui rooftop vegetable garden	Y+	Y+	Y	Y+	Y+	Y+
Tianhe Children's Park Farm	Y+	Y+	Y+	Y	Y	Y
Financial Building Urban Skyline Farm	Y	Y+	Y	Y+	Y-	Y
Hualin Street Love Vegetable Garden	Y	Y-	Y-	Y	Y-	Y+
Xia Liang Chuxin Farm	Y+	Y	Y+	Y+	Y-	Y-

"Y+" stands for "Excellent": "Y" stands for "good": "Y-" stands for "General"

5 Results and Analysis

5.1 Analysis of Post-use Evaluation System of Urban Micro-agriculture

5.1.1 Ranking Analysis of Index Factors at the Criterion Level

From Fig. 1, it can be seen that the weight values of the indicator factors at the criterion level are ranked as service B1 (0.3441) > popular science B2 (0.2404) > sociality B5 (0.1822) > productivity B3 (0.1322) > technology B4 (0.1001). It can be seen from the importance ranking of each indicator factor that in the process of urban micro-agriculture, urban residents pay the highest attention to the service of micro-

agriculture activities, which also reflects that high-quality service functions are very important for urban residents to participate in urban micro-agriculture activities. The popular science factors and social factors of urban micro-agriculture activities are also highly concerned by residents. The popular science function is one of the important purposes of urban micro-agriculture activities. The development of agricultural activities can enable residents to learn agricultural knowledge and understand farming culture in the city, and let residents contact and understand nature in the process of agricultural production experience, which plays a good natural education function; the sociality of micro-agriculture to urban residents cannot be ignored. It can mobilize all positive forces in the city to participate in agricultural activities, jointly formulate a sound management model, and provide support for the sustainable development of micro-agriculture. At the same time, residents' joint participation in agricultural activities can greatly promote neighborhood relations and promote unity and harmony among residents of the entire community. Productive factors are more important for the development of urban micro-agricultural activities. Urban residents' participation in agricultural production activities and harvesting the fruits of their labor can satisfy their yearning for rural life and allow them to feel a sense of achievement and joy from the harvest[22]. Micro-agricultural production should also focus on the integration of new technologies, which can be more conducive to the development of micro-agricultural activities. At the same time, it can also allow agricultural activities to continue to develop in the direction of intelligence and digitization, and improve the scientific and technological content of urban micro-agriculture.

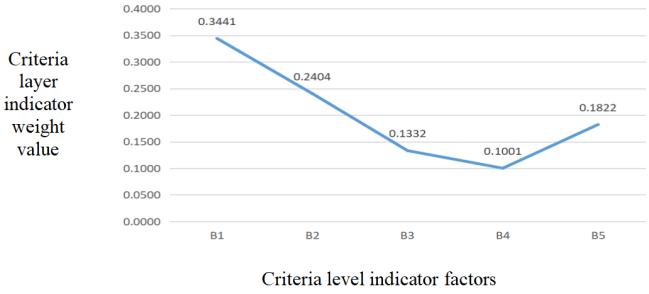

Fig. 1. Distribution of weight values of indicator factors at the criterion level.

5.1.2 Comprehensive Ranking Analysis of Standard Layer Index Factors

From Fig. 2, it can be seen that the comprehensive ranking of secondary indicator factors, the weight values of six indicator factors, including public participation experience C4 (0.1425), complete planting facilities C1 (0.0979), popularization of agricultural knowledge C5 (0.0938), promotion of planting technology C8 (0.0713), improving residents' happiness C18 (0.0673), and convenient site location (0.0625), ranked highest, indicating that in the process of urban micro-agriculture activities, these six indicator factors play a very important role in the normal development of urban micro-agriculture. Residents are most concerned about the public participation

in micro-agriculture. Every urban resident should have the right and opportunity to participate in micro-agriculture activities and hope to enjoy better micro-agriculture activities. Perfect planting facilities and popularization of agricultural knowledge are also key factors that residents pay attention to. Perfect planting facilities and popularization of rich agricultural knowledge are more conducive to attracting more people in the city to participate in agricultural production activities. In a city full of reinforced concrete, it is also important to participate in urban micro-agricultural activities to highlight the value of labor and thus enhance the happiness of residents. At the same time, the location of the micro-agricultural site is also crucial. The convenient accessibility of the site can bring great convenience to urban residents in participating in agricultural production activities.

Among the index factors of the standard layer, the weight values of seven index factors, such as promoting ecological environmental protection C20(0.0512), inheriting farming culture C6(0.0490), sustainable crop production C11 (0.0483), complete service facilities C2 (0.0411), green organic planting C10(0.0407), promoting neighborhood harmony C17 (0.0362), and energy recycling technology C16 (0.0348), are ranked high, which have a great impact on the development of urban micro-agriculture and are also the value of urban micro-agriculture activities. The weight values of five index factors, such as rainwater collection system C15 (0.0284), innovative economic development C19 (0.0275), natural education and popular science C7 (0.0263), professional planting and maintenance C12 (0.0235), and smart technology planting C13 (0.0216), are ranked generally, indicating that the importance of this index in the development of urban micro-agriculture activities is relatively low. The demand for urban micro-agriculture is not high due to factors such as the difficulty in building rainwater collection systems, the lack of outstanding innovative economic development effects, the lack of outstanding natural education and popular science, and the difficulty of professional planting and maintenance and smart technology planting. The weight values of the two indicator factors C9 (0.0197) and C14 (0.0153) with rich crop varieties ranked the lowest, indicating that the number of urban micro-agricultural crop varieties and whether there is a scientific management platform have little impact on the development of agricultural activities.

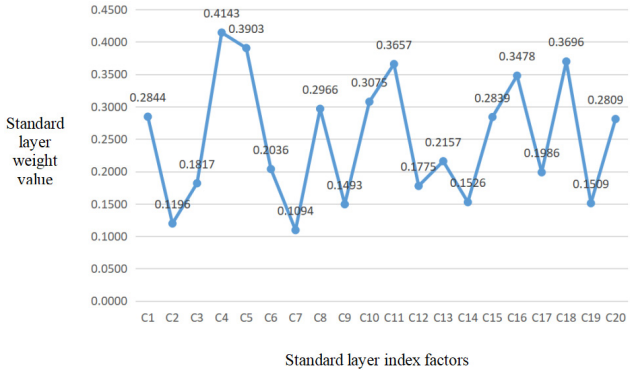

Fig. 2. Distribution of comprehensive weight values of standard layer indicator factors

5.2 Analysis of the Results of Post-use Evaluation of Urban Micro-agriculture

The evaluation results of micro agriculture in five cities of Guangzhou are shown in Table 6: Tianhe Children's Park Farm, Xia Liang Chuxin Farm and Taikoo Hui Rooftop Farm were rated as "excellent", Financial Building Urban Skyline Farm was rated as "good", and Hualin Street Love Vegetable Garden was rated as "average".

The three urban micro-agricultures of Tianhe Children's Park Farm, Xia Liang Chuxin Farm and Taikoo Hui Rooftop Farm mainly serve the public, and urban residents have a high degree of participation in micro-agriculture, so their service is good. At the same time, the urban micro-agriculture also has professional management personnel to operate and maintain it. The operation and management of the professional team can ensure that it is well evaluated in terms of sociality, popular science and productivity. The Urban Skyline Farm of the Financial Building is a rooftop farm located on the roof of the Financial Building. Its users are mainly residents of the building. It is not open to the public and does not allow urban residents to participate widely, so its service and sociality are average. Since the farm is located on the roof of the building, it is also difficult to promote agricultural activities and update planting facilities, but it can regularly carry out certain agricultural knowledge popularization activities for residents in the building, so it is evaluated well in terms of popularization. The organization and management of the professional team can ensure that the Urban Skyline Farm of the Financial Building has a rich variety of crops and continuous production throughout the year, so it is evaluated as excellent in terms of productivity. Hualin Street Love Farm is a community farm in the old city. Its service targets are the needy residents in the community. The operation team is composed of community love volunteers. Therefore, the micro-agriculture participation group is relatively single. Although the vegetables produced can be provided free of charge to the elderly and families in need in the community, which is of great help to improve neighborhood harmony and residents' happiness, it has a greater guarantee in terms of productivity and sociality, but it is relatively lacking in service, popularization and technology, resulting in a low overall post-use evaluation.

6 Conclusion

Urban micro-agriculture, as a form of urban green space, is gradually gaining attention from urban residents. It improves the urban ecological environment, enhances the internal energy cycle of the city, effectively reduces negative environmental impacts, and re-establishes the dynamic balance between people's aesthetic needs and natural ecology within the urban space [23]. Urban micro-agriculture can meet the participation needs of residents of different age groups in agricultural activities, meet the demand for farming experience of residents, enhance communication and interaction among residents, and effectively promote the physical and mental health of urban residents. Therefore, the construction of urban micro-agriculture can integrate agricultural landscapes into people's daily lives, improve people's quality of life, promote communication between people and nature, and improve the ecological environment of people's living spaces [24]. This study uses the method of hierarchical analysis to

conduct a post-use evaluation of urban micro-agriculture, analyzing it from the three layers of the target layer, criterion layer, and standard layer, and determining the post-use evaluation indicators that meet the development of urban micro-agriculture in Guangzhou. It establishes a reasonable post-use evaluation system for urban micro-agriculture and conducts a post-use evaluation of five urban micro-agriculture projects in Guangzhou. The results show that the urban micro-agriculture with the function of education and popularization and the urban micro-agriculture with improved service performance have better post-use evaluation performance. This study can use the quantitative processing method of hierarchical analysis to solve complex qualitative problems, which has certain scientific value. However, in the questionnaire survey process, the investigation was not carried out according to age groups, and the post-use evaluation of urban micro-agriculture for different age groups of urban residents was not specific enough. Further research on the post-use evaluation of urban micro-agriculture by age group is needed. At the same time, with the continuous development of smart agriculture, more attention should be paid to the impact of urban smart agriculture development on the happiness of urban residents' lives in the future.

Acknowledgments

This article is a school level project titled "Research on the Construction and Development Strategy of Agricultural Park Landscape Evaluation System Based on Ecotourism" (ky202117); One of the phased achievements of the research on teaching reform of "Architectural Modeling Technology" based on enhancing design thinking ability (JYJG202213).

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